

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Spiers End/Semi				Issued on Date	15/12/2022
Assessment Reference	Spiers End/Semi		Prop Type Ref	Spiers		
Property	4 Bed, WC, B, 2 Storey					
SAP Rating	87 B	DER	12.92	TER	16.77	
Environmental	89 B	% DER<TER	22.98			
CO ₂ Emissions (t/year)	1.14	DFEE	38.69	TFEE	50.44	
General Requirements Compliance	Pass	% DFEE<TFEE	23.31			
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 107 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.77 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 38.7 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	1.21 (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 35

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): Slight OK

Based on:

Overshading: Average

Windows facing North East: 9.04 m², No overhang

Windows facing South West: 5.44 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Window U-value	0.90 W/m ² K
Thermal bridging y-value	0.023 W/m ² K

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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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6124		(33)					
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)					
Timber GF			24.8400			9.0000	223.5600 (32c)					
Timber 1F			120.9700			9.0000	1088.7300 (32c)					
AAC GF			53.9000			39.0000	2102.1000 (32c)					
Internal Floor			53.5900			12.6000	675.2340 (32d)					
Internal Ceiling			53.5900			9.0000	482.3100 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15622.3440 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.7580 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)					
Total fabric heat loss						(33) + (36) =	56.4030 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5044	Feb 43.5044	Mar 43.5044	Apr 43.5044	May 43.5044	Jun 43.5044	Jul 43.5044	Aug 43.5044	Sep 43.5044	Oct 43.5044	Nov 43.5044	Dec 43.5044 (38)
Heat transfer coeff	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074 (39)
Average = Sum(39)m / 12 =												99.9074 (39)
HLP	Jan 0.9321	Feb 0.9321	Mar 0.9321	Apr 0.9321	May 0.9321	Jun 0.9321	Jul 0.9321	Aug 0.9321	Sep 0.9321	Oct 0.9321	Nov 0.9321	Dec 0.9321 (40)
HLP (average)												0.9321 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7968 (42)
Average daily hot water use (litres/day)	100.6239 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863	(44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653	(45)
Energy content (annual)										Total =	Sum (45)m =	1583.2061	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448	(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	14.1505	12.7698	14.1121	13.6185	14.0379	13.5452	13.9719	14.0147	13.5851	14.0784	13.6641	14.1381	(61)
Total heat required for water heating calculated for each month	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(62)
WWHRS	-55.2584	-48.6213	-49.6238	-40.8223	-37.9009	-31.2639	-26.4552	-32.0327	-32.9691	-40.7611	-47.2228	-53.4112	eq. (G10)
Total of WWHRS savings												-496.3429	
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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Heat gains from water heating, kWh/month	58.1157	50.9268	52.7856	46.3486	44.7152	38.9437	36.4422	41.3133	41.6575	48.1094	52.0892	56.3905	(65)
										Total per year (kWh/year) =	Sum (64)m =	1252.5496	(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	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7788	22.8965	18.6207	14.0971	10.5377	8.8964	9.6129	12.4952	16.7710	21.2946	24.8540	26.4953	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.4404	270.2156	263.2222	248.3341	229.5405	211.8772	200.0770	197.3018	204.2952	219.1833	237.9769	255.6402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	78.1125	75.7839	70.9484	64.3730	60.1011	54.0885	48.9814	55.5287	57.8576	64.6631	72.3462	75.7937	(72)
Total internal gains	439.2837	436.8480	420.7432	394.7561	368.1313	342.8140	326.6232	333.2776	346.8758	373.0930	403.1290	425.8812	(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					5.7100	11.2829	0.4600	0.0000	0.7700		22.8195	(75)	
Southwest					5.4400	36.7938	0.4600	0.0000	0.7700		70.8961	(79)	
Northeast					3.3300	11.2829	0.4300	0.0000	0.7700		12.4402	(75)	
Solar gains	106.1558	192.5345	294.5428	417.0959	514.7759	531.9882	504.1813	428.1070	336.4786	221.1793	129.2830	89.4672	(83)
Total gains	545.4395	629.3825	715.2861	811.8520	882.9072	874.8023	830.8045	761.3846	683.3544	594.2724	532.4121	515.3483	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356
alpha	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957
util living area	0.9913	0.9841	0.9666	0.9188	0.8155	0.6570	0.5073	0.5670	0.7992	0.9481	0.9851	0.9930 (86)
MIT	19.4332	19.6258	19.9479	20.3568	20.7095	20.9101	20.9748	20.9613	20.8010	20.3392	19.7993	19.3791 (87)
Th 2	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403 (88)
util rest of house	0.9896	0.9810	0.9597	0.9016	0.7771	0.5890	0.4168	0.4747	0.7436	0.9337	0.9817	0.9916 (89)
MIT 2	18.0183	18.2983	18.7641	19.3446	19.8204	20.0624	20.1252	20.1153	19.9463	19.3298	18.5527	17.9395 (90)
Living area fraction	18.2361	18.5026	18.9463	19.5004	19.9573	20.1929	20.2560	20.2455	20.0778	19.4852	18.7446	18.1611 (91)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	18.0861	18.3526	18.7963	19.3504	19.8073	20.0429	20.1060	20.0955	19.9278	19.3352	18.5946	18.0111 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9835	0.9716	0.9453	0.8821	0.7601	0.5807	0.4131	0.4696	0.7277	0.9158	0.9725	0.9864	(94)
Useful gains	536.4188	611.5294	676.1825	716.1583	671.0976	508.0171	343.1653	357.5341	497.2807	544.2089	517.7780	508.3297	(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	1377.3342	1344.0155	1228.4925	1044.0751	809.9787	543.7898	350.2735	369.2118	582.2448	872.7083	1148.3963	1379.8307	(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	625.6411	492.2307	410.9186	236.1001	103.3275	0.0000	0.0000	0.0000	0.0000	244.4036	454.0452	648.3967	(98)

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Space heating
Space heating per m2 (98) / (4) = 3215.0636 (98)
29.9969 (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													3552.5565 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	625.6411	492.2307	410.9186	236.1001	103.3275	0.0000	0.0000	0.0000	0.0000	244.4036	454.0452	648.3967	(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)	691.3162	543.9013	454.0537	260.8841	114.1741	0.0000	0.0000	0.0000	0.0000	270.0592	501.7074	716.4605	(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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Efficiency of water heater	89.9581	89.9083	89.7919	89.5105	88.8969	87.3000	87.3000	87.3000	87.3000	89.4983	89.8445	89.9860	(216)
Fuel for water heating, kWh/month	136.7711	119.8003	125.4359	113.8982	112.5619	102.2003	99.2118	109.6166	109.6075	120.0266	125.5802	133.0119	(217)
Water heating fuel used												1407.7223	(219)
Annual totals kWh/year													
Space heating fuel - main system												3552.5565	(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)												73.3959	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												148.3959	(231)
Electricity for lighting (calculated in Appendix L)												455.2624	(232)
Total delivered energy for all uses												5563.9371	(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	3552.5565	0.2160	767.3522	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1407.7223	0.2160	304.0680	(264)
Space and water heating			1071.4202	(265)
Pumps and fans	148.3959	0.5190	77.0175	(267)
Energy for lighting	455.2624	0.5190	236.2812	(268)
Total CO2, kg/year			1384.7189	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9200	(273)

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

DER		12.9200	ZC1
Total Floor Area	TFA	107.1800	
Assumed number of occupants	N	2.7968	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.7863	ZC2
CO2 emissions from cooking, equation (L16)		1.7365	ZC3
Total CO2 emissions		29.4428	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		29.4428	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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1517 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4017 (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) =					0.3716 (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	0.4738	0.4645	0.4552	0.4087	0.3994	0.3530	0.3530	0.3437	0.3716	0.3994	0.4180	0.4366	(22b)				
Effective ac	0.6122	0.6079	0.6036	0.5835	0.5798	0.5623	0.5623	0.5591	0.5690	0.5798	0.5874	0.5953	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			14.4800	1.3258	19.1970		(27)					
FP McCann System			53.5900	0.1300	6.9667		(28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.1800	15.5250		(29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.1300	6.9667		(30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.8054		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0697 (36)					
Total fabric heat loss						(33) + (36) =	60.8751 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.2691	Feb 52.8899	Mar 52.5182	Apr 50.7725	May 50.4459	Jun 48.9254	Jul 48.9254	Aug 48.6439	Sep 49.5111	Oct 50.4459	Nov 51.1066	Dec 51.7974 (38)
Heat transfer coeff	114.1441	113.7650	113.3933	111.6476	111.3210	109.8005	109.8005	109.5190	110.3862	111.3210	111.9817	112.6725 (39)
Average = Sum(39)m / 12 =												111.6460 (39)
HLP	Jan 1.0650	Feb 1.0614	Mar 1.0580	Apr 1.0417	May 1.0386	Jun 1.0244	Jul 1.0244	Aug 1.0218	Sep 1.0299	Oct 1.0386	Nov 1.0448	Dec 1.0512 (40)
HLP (average)												1.0417 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7968 (42)
Average daily hot water use (litres/day)												100.6239 (43)
Daily hot water use	Jan 110.6863	Feb 106.6614	Mar 102.6364	Apr 98.6114	May 94.5865	Jun 90.5615	Jul 90.5615	Aug 94.5865	Sep 98.6114	Oct 102.6364	Nov 106.6614	Dec 110.6863 (44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653 (45)
Energy content (annual)										Total = Sum(45)m =		1583.2061 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448 (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												

Combi loss	50.9589	46.0274	50.9589	48.6303	48.2002	44.6605	46.1492	48.2002	48.6303	50.9589	49.3151	50.9589	(57)
Total heat required for water heating calculated for each month	215.1035	189.5893	199.1019	177.7850	172.1272	151.6001	145.2444	161.9135	163.7016	185.0635	195.7007	209.9242	(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	215.1035	189.5893	199.1019	177.7850	172.1272	151.6001	145.2444	Solar input (sum of months) = Sum (63)m =					0.0000 (63)
Heat gains from water heating, kWh/month	67.3178	59.2412	61.9973	55.1015	53.2558	46.7225	44.4865	49.8597	50.4188	57.3295	61.0020	65.5957	(65)
								Total per year (kWh/year) = Sum (64)m =					2166.8549 (64)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													4501.8999 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	811.3863	649.2758	556.1129	321.4692	136.9870	0.0000	0.0000	0.0000	0.0000	322.9983	583.1674	823.3776	(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)	868.7219	695.1561	595.4100	344.1854	146.6670	0.0000	0.0000	0.0000	0.0000	345.8226	624.3762	881.5606	(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	215.1035	189.5893	199.1019	177.7850	172.1272	151.6001	145.2444	161.9135	163.7016	185.0635	195.7007	209.9242	(64)
Efficiency of water heater (217)m	88.0785	87.9013	87.4986	86.5246	84.4829	80.3000	80.3000	80.3000	80.3000	86.4397	87.6306	88.1476	(217)
Fuel for water heating, kWh/month	244.2180	215.6844	227.5488	205.4734	203.7420	188.7921	180.8772	201.6357	203.8626	214.0953	223.3246	238.1509	(219)
Water heating fuel used												2547.4050	(219)
Annual totals kWh/year													
Space heating fuel - main system													4501.8999 (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)													455.2624 (232)
Total delivered energy for all uses													7579.5673 (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	4501.8999	0.2160	972.4104 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2547.4050	0.2160	550.2395 (264)
Space and water heating			1522.6499 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.2624	0.5190	236.2812 (268)
Total CO2, kg/m2/year			1797.8561 (272)
Emissions per m2 for space and water heating			14.2065 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2045 (272b)
Emissions per m2 for pumps and fans			0.3632 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2065 * 1.00) + 2.2045 + 0.3632, rounded to 2 d.p.			16.7700 (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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1517 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3522 (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) =	0.3258 (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	0.4154	0.4072	0.3991	0.3584	0.3502	0.3095	0.3095	0.3014	0.3258	0.3502	0.3665	0.3828 (22b)
Effective ac	0.5863	0.5829	0.5796	0.5642	0.5613	0.5479	0.5479	0.5454	0.5531	0.5613	0.5672	0.5733 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)
Total net area of external elements Aum(A, m ²)			210.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.6124		(33)
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)
Timber GF			24.8400			9.0000	223.5600 (32c)
Timber 1F			120.9700			9.0000	1088.7300 (32c)
AAC GF			53.9000			39.0000	2102.1000 (32c)
Internal Floor			53.5900			12.6000	675.2340 (32d)
Internal Ceiling			53.5900			9.0000	482.3100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15622.3440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.7580 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)
Total fabric heat loss						(33) + (36) =	56.4030 (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	51.0109	50.7194	50.4337	49.0917	48.8406	47.6718	47.6718	47.4553	48.1220	48.8406	49.3485	49.8795 (38)
Heat transfer coeff	107.4138	107.1224	106.8366	105.4947	105.2436	104.0747	104.0747	103.8583	104.5250	105.2436	105.7515	106.2825 (39)
Average = Sum(39)m / 12 =												105.4935 (39)
HLP	1.0022	0.9995	0.9968	0.9843	0.9819	0.9710	0.9710	0.9690	0.9752	0.9819	0.9867	0.9916 (40)
HLP (average)												0.9843 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7968 (42)
Average daily hot water use (litres/day)												100.6239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653 (45)
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	1583.2061 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
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	34.8807	30.5069	31.4804	27.4454	26.3345	22.7247	21.0577	24.1641	24.4527	28.4972	31.1069	33.7801 (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	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7788	22.8965	18.6207	14.0971	10.5377	8.8964	9.6129	12.4952	16.7710	21.2946	24.8540	26.4953 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.4404	270.2156	263.2222	248.3341	229.5405	211.8772	200.0770	197.3018	204.2952	219.1833	237.9769	255.6402 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840 (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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719 (71)
Water heating gains (Table 5)	46.8827	45.3972	42.3124	38.1186	35.3958	31.5620	28.3034	32.4786	33.9620	38.3027	43.2041	45.4034 (72)
Total internal gains	405.0539	403.4613	389.1072	365.5017	340.4260	317.2876	302.9452	307.2275	319.9802	343.7326	370.9869	392.4909 (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	5.7100	11.2829	0.4600	0.0000	0.7700	22.8195 (75)
Southwest	5.4400	36.7938	0.4600	0.0000	0.7700	70.8961 (79)
Northeast	3.3300	11.2829	0.4300	0.0000	0.7700	12.4402 (75)

Solar gains	106.1558	192.5345	294.5428	417.0959	514.7759	531.9882	504.1813	428.1070	336.4786	221.1793	129.2830	89.4672 (83)
Total gains	511.2097	595.9958	683.6501	782.5976	855.2019	849.2758	807.1265	735.3345	656.4588	564.9120	500.2700	481.9580 (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	40.4002	40.5101	40.6185	41.1352	41.2333	41.6964	41.6964	41.7833	41.5168	41.2333	41.0353	40.8302
alpha	3.6933	3.7007	3.7079	3.7423	3.7489	3.7798	3.7798	3.7856	3.7678	3.7489	3.7357	3.7220
util living area	0.9930	0.9871	0.9725	0.9312	0.8391	0.6860	0.5365	0.5988	0.8257	0.9576	0.9882	0.9944 (86)
MIT	19.2485	19.4513	19.7940	20.2503	20.6423	20.8853	20.9658	20.9485	20.7541	20.2418	19.6656	19.2158 (87)
Th 2	20.0815	20.0838	20.0860	20.0965	20.0984	20.1075	20.1075	20.1092	20.1040	20.0984	20.0945	20.0903 (88)
util rest of house	0.9916	0.9844	0.9666	0.9157	0.8022	0.6163	0.4397	0.5013	0.7721	0.9452	0.9853	0.9933 (89)
MIT 2	18.4634	18.6667	19.0076	19.4607	19.8275	20.0392	20.0935	20.0864	19.9384	19.4606	18.8890	18.4374 (90)
Living area fraction	18.5843	18.7875	19.1287	19.5822	19.9529	20.1694	20.2278	20.2191	20.0640	19.5808	19.0086	18.5572 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5843	18.7875	19.1287	19.5822	19.9529	20.1694	20.2278	20.2191	20.0640	19.5808	19.0086	18.5572 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	505.2913	583.7286	655.3838	708.3260	680.3149	527.8600	365.8801	378.0192	505.0546	528.7719	490.5633	477.4177 (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	1534.3273	1487.6592	1349.2058	1126.9177	868.5689	579.6377	377.5642	396.6457	623.3835	945.1744	1259.3512	1525.9222 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	765.6028	607.4413	516.2035	301.3860	140.0610	0.0000	0.0000	0.0000	0.0000	309.8035	553.5273	780.0874 (98)
Space heating												3974.1128 (98)
Space heating per m2										(98) / (4) =		37.0789 (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	978.3026	770.1531	789.3230	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8352	0.8933	0.8636	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	817.0669	687.9833	681.6501	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1102.3556	1050.7743	969.0952	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	205.4079	269.9165	213.8591	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			689.1835 (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	51.3520	67.4791	53.4648	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												172.2959 (107)
Energy for space heating												1.6075 (108)
Energy for space cooling												37.0789 (99)
Total												1.6075 (108)
Dwelling Fabric Energy Efficiency (DFEE)												38.6864 (109)
												38.7 (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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1517 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4017 (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) =					0.3716 (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	0.4738	0.4645	0.4552	0.4087	0.3994	0.3530	0.3530	0.3437	0.3716	0.3994	0.4180	0.4366	(22b)				
Effective ac	0.6122	0.6079	0.6036	0.5835	0.5798	0.5623	0.5623	0.5591	0.5690	0.5798	0.5874	0.5953	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			14.4800	1.3258	19.1970		(27)					
FP McCann System			53.5900	0.1300	6.9667		(28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.1800	15.5250		(29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.1300	6.9667		(30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	50.8054		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0697 (36)					
Total fabric heat loss						(33) + (36) =	60.8751 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.2691	Feb 52.8899	Mar 52.5182	Apr 50.7725	May 50.4459	Jun 48.9254	Jul 48.9254	Aug 48.6439	Sep 49.5111	Oct 50.4459	Nov 51.1066	Dec 51.7974 (38)
Heat transfer coeff	114.1441	113.7650	113.3933	111.6476	111.3210	109.8005	109.8005	109.5190	110.3862	111.3210	111.9817	112.6725 (39)
Average = Sum(39)m / 12 =												111.6460 (39)
HLP	Jan 1.0650	Feb 1.0614	Mar 1.0580	Apr 1.0417	May 1.0386	Jun 1.0244	Jul 1.0244	Aug 1.0218	Sep 1.0299	Oct 1.0386	Nov 1.0448	Dec 1.0512 (40)
HLP (average)												1.0417 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7968 (42)
Average daily hot water use (litres/day)												100.6239 (43)
Daily hot water use	Jan 110.6863	Feb 106.6614	Mar 102.6364	Apr 98.6114	May 94.5865	Jun 90.5615	Jul 90.5615	Aug 94.5865	Sep 98.6114	Oct 102.6364	Nov 106.6614	Dec 110.6863 (44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653 (45)
Energy content (annual)										Total = Sum(45)m =		1583.2061 (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	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	0.0000 (59)
	34.8807	30.5069	31.4804	27.4454	26.3345	22.7247	21.0577	24.1641	24.4527	28.4972	31.1069	33.7801	(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	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	139.8398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7788	22.8965	18.6207	14.0971	10.5377	8.8964	9.6129	12.4952	16.7710	21.2946	24.8540	26.4953	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.4404	270.2156	263.2222	248.3341	229.5405	211.8772	200.0770	197.3018	204.2952	219.1833	237.9769	255.6402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	36.9840	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	46.8827	45.3972	42.3124	38.1186	35.3958	31.5620	28.3034	32.4786	33.9620	38.3027	43.2041	45.4034	(72)
Total internal gains	405.0539	403.4613	389.1072	365.5017	340.4260	317.2876	302.9452	307.2275	319.9802	343.7326	370.9869	392.4909	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Northeast				9.0400	11.2829			0.6300	0.7000	0.7700		31.1719 (75)
Southwest				5.4400	36.7938			0.6300	0.7000	0.7700		61.1710 (79)

Solar gains	92.3429	167.6481	256.8856	364.3915	450.2248	465.4768	441.0672	374.2022	293.6690	192.7022	112.4910	77.8062 (83)
Total gains	497.3968	571.1094	645.9928	729.8932	790.6508	782.7644	744.0125	681.4298	613.6492	536.4348	483.4780	470.2970 (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	65.2075	65.4248	65.6393	66.6656	66.8612	67.7871	67.7871	67.9613	67.4274	66.8612	66.4667	66.0592	
alpha	5.3472	5.3617	5.3760	5.4444	5.4574	5.5191	5.5191	5.5308	5.4952	5.4574	5.4311	5.4039	
util living area	0.9994	0.9987	0.9960	0.9836	0.9342	0.7975	0.6270	0.6972	0.9214	0.9919	0.9988	0.9996	(86)
MIT	19.7459	19.8767	20.1081	20.4342	20.7347	20.9296	20.9851	20.9742	20.8242	20.4404	20.0408	19.7304	(87)
Th 2	20.0295	20.0324	20.0353	20.0487	20.0513	20.0630	20.0630	20.0652	20.0585	20.0513	20.0462	20.0408	(88)
util rest of house	0.9992	0.9982	0.9945	0.9766	0.9048	0.7163	0.5048	0.5757	0.8738	0.9874	0.9983	0.9995	(89)
MIT 2	18.8739	19.0069	19.2400	19.5733	19.8596	20.0279	20.0589	20.0570	19.9496	19.5840	19.1822	18.8677	(90)
Living area fraction	19.0081	19.1408	19.3736	19.7058	19.9943	20.1667	20.2014	20.1982	20.0843	19.7158	19.3144	19.0005	(91)
MIT	19.0081	19.1408	19.3736	19.7058	19.9943	20.1667	20.2014	20.1982	20.0843	19.7158	19.3144	19.0005	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0081	19.1408	19.3736	19.7058	19.9943	20.1667	20.2014	20.1982	20.0843	19.7158	19.3144	19.0005	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9989	0.9976	0.9930	0.9733	0.9026	0.7263	0.5238	0.5943	0.8754	0.9852	0.9977	0.9992	(94)
Ext temp.	496.8728	569.7270	641.4697	710.4389	713.6464	568.5117	389.6874	404.9669	537.2030	528.5079	482.3750	469.9357	(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	1678.8489	1620.1086	1459.7856	1206.4437	923.3283	611.2272	395.4405	415.9759	660.5788	1014.7849	1367.7886	1667.6082	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	879.3903	705.8565	608.8270	357.1234	156.0034	0.0000	0.0000	0.0000	0.0000	361.7901	637.4978	891.0684	(98)
												4597.5569	(98)
												42.8957	(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	1032.1249	812.5238	832.3440	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8435	0.9130	0.8804	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	870.5945	741.8106	732.8110	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1024.6150	977.0047	906.0896	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	110.8947	174.9844	128.9193	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												414.7984	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	27.7237	43.7461	32.2298	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											103.6996 (107)
Space cooling per m2											0.9675 (108)
Energy for space heating											42.8957 (99)
Energy for space cooling											0.9675 (108)
Total											43.8632 (109)
Target Fabric Energy Efficiency (TFEE)											50.4 (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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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					
Wind factor	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)					
Adj infilt rate	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)					
	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			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6124		(33)					
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)					
Timber GF			24.8400			9.0000	223.5600 (32c)					
Timber 1F			120.9700			9.0000	1088.7300 (32c)					
AAC GF			53.9000			39.0000	2102.1000 (32c)					
Internal Floor			53.5900			12.6000	675.2340 (32d)					
Internal Ceiling			53.5900			9.0000	482.3100 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15622.3440 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.7580 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)					
Total fabric heat loss						(33) + (36) =	56.4030 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5044	Feb 43.5044	Mar 43.5044	Apr 43.5044	May 43.5044	Jun 43.5044	Jul 43.5044	Aug 43.5044	Sep 43.5044	Oct 43.5044	Nov 43.5044	Dec 43.5044 (38)
Heat transfer coeff	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074 (39)
Average = Sum(39)m / 12 =												99.9074 (39)
HLP	Jan 0.9321	Feb 0.9321	Mar 0.9321	Apr 0.9321	May 0.9321	Jun 0.9321	Jul 0.9321	Aug 0.9321	Sep 0.9321	Oct 0.9321	Nov 0.9321	Dec 0.9321 (40)
HLP (average)												0.9321 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7968 (42)
Average daily hot water use (litres/day)	100.6239 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863	(44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653	(45)
Energy content (annual)										Total = Sum	(45)m =	1583.2061	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448	(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	14.1505	12.7698	14.1121	13.6185	14.0379	13.5452	13.9719	14.0147	13.5851	14.0784	13.6641	14.1381	(61)
Total heat required for water heating calculated for each month	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(64)
Total per year (kWh/year) = Sum(64)m =												1748.8925	(64)
RHI water heating demand												1749	(64)
Heat gains from water heating, kWh/month	58.1157	50.9268	52.7856	46.3486	44.7152	38.9437	36.4422	41.3133	41.6575	48.1094	52.0892	56.3905	(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	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4471	57.2413	46.5518	35.2427	26.3443	22.2410	24.0322	31.2379	41.9275	53.2366	62.1350	66.2383	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	399.1648	403.3069	392.8690	370.6479	342.5978	316.2346	298.6224	294.4803	304.9182	327.1393	355.1894	381.5526	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	78.1125	75.7839	70.9484	64.3730	60.1011	54.0885	48.9814	55.5287	57.8576	64.6631	72.3462	75.7937	(72)
Total internal gains	655.2379	649.8457	623.8826	583.7771	542.5567	506.0776	485.1495	494.7604	518.2169	558.5525	603.1841	637.0980	(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					5.7100	12.9236		0.4600	0.0000	0.7700		26.1377 (75)				
Southwest					5.4400	40.4699		0.4600	0.0000	0.7700		77.9794 (79)				
Northeast					3.3300	12.9236		0.4300	0.0000	0.7700		14.2490 (75)				
Solar gains					118.3661	193.8553	294.5911	432.0851	520.6638	576.0385	539.9681	468.2763	365.6126	238.2622	147.8205	98.7095 (83)
Total gains					773.6040	843.7010	918.4737	1015.8622	1063.2205	1082.1162	1025.1175	963.0367	883.8295	796.8148	751.0046	735.8075 (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	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356		
alpha	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957		
util living area	0.9680	0.9541	0.9174	0.8291	0.6702	0.4491	0.3001	0.3289	0.6057	0.8555	0.9464	0.9726	(86)	
MIT	19.8333	19.9808	20.2829	20.6294	20.8795	20.9812	20.9972	20.9959	20.9387	20.6423	20.1830	19.7873	(87)	
Th 2	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	(88)	
util rest of house	0.9620	0.9457	0.9021	0.7985	0.6166	0.3766	0.2179	0.2420	0.5314	0.8220	0.9349	0.9674	(89)	
MIT	18.5969	18.8079	19.2361	19.7091	20.0227	20.1279	20.1393	20.1388	20.0916	19.7369	19.1009	18.5310	(90)	
Living area fraction									fLA = Living area / (4) =			0.1539	(91)	
MIT	18.7873	18.9884	19.3973	19.8508	20.1546	20.2592	20.2714	20.2708	20.2220	19.8763	19.2675	18.7244	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.6373	18.8384	19.2473	19.7008	20.0046	20.1092	20.1214	20.1208	20.0720	19.7263	19.1175	18.5744	(93)	

8. Space heating requirement

Utilisation	0.9481	0.9293	0.8827	0.7809	0.6076	0.3739	0.2161	0.2400	0.5251	0.8031	0.9173	0.9545	(94)	
Useful gains	733.4273	784.0876	810.7506	793.2368	645.9670	404.6521	221.4835	231.1744	464.1229	639.9378	688.9136	702.3558	(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	1352.4741	1322.6172	1183.6315	979.1729	699.8097	410.5434	221.9318	231.8612	486.7514	811.8724	1110.7196	1346.1949	(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	460.5708	361.8919	277.4233	133.8740	40.0590	0.0000	0.0000	0.0000	0.0000	127.9194	303.7004	479.0163	(98)	
Space heating												2184.4550	(98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

2184 (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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6124		(33)					
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)					
Timber GF			24.8400			9.0000	223.5600 (32c)					
Timber 1F			120.9700			9.0000	1088.7300 (32c)					
AAC GF			53.9000			39.0000	2102.1000 (32c)					
Internal Floor			53.5900			12.6000	675.2340 (32d)					
Internal Ceiling			53.5900			9.0000	482.3100 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15622.3440 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.7580 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)					
Total fabric heat loss						(33) + (36) =	56.4030 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5044	Feb 43.5044	Mar 43.5044	Apr 43.5044	May 43.5044	Jun 43.5044	Jul 43.5044	Aug 43.5044	Sep 43.5044	Oct 43.5044	Nov 43.5044	Dec 43.5044 (38)
Heat transfer coeff	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074 (39)
Average = Sum(39)m / 12 =												99.9074 (39)
HLP	Jan 0.9321	Feb 0.9321	Mar 0.9321	Apr 0.9321	May 0.9321	Jun 0.9321	Jul 0.9321	Aug 0.9321	Sep 0.9321	Oct 0.9321	Nov 0.9321	Dec 0.9321 (40)
HLP (average)												0.9321 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7968 (42)
Average daily hot water use (litres/day)	100.6239 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863	(44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653	(45)
Energy content (annual)										Total =	Sum (45)m =	1583.2061	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448	(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	14.1505	12.7698	14.1121	13.6185	14.0379	13.5452	13.9719	14.0147	13.5851	14.0784	13.6641	14.1381	(61)
Total heat required for water heating calculated for each month	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(62)
WWHRS	-55.2584	-48.6213	-49.6238	-40.8223	-37.9009	-31.2639	-26.4552	-32.0327	-32.9691	-40.7611	-47.2228	-53.4112	eq. (G10)
Total of WWHRS savings												-496.3429	
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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Heat gains from water heating, kWh/month	58.1157	50.9268	52.7856	46.3486	44.7152	38.9437	36.4422	41.3133	41.6575	48.1094	52.0892	56.3905	(65)
Total per year (kWh/year) =										Sum (64)m =		1252.5496	(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	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4471	57.2413	46.5518	35.2427	26.3443	22.2410	24.0322	31.2379	41.9275	53.2366	62.1350	66.2383	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	399.1648	403.3069	392.8690	370.6479	342.5978	316.2346	298.6224	294.4803	304.9182	327.1393	355.1894	381.5526	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	78.1125	75.7839	70.9484	64.3730	60.1011	54.0885	48.9814	55.5287	57.8576	64.6631	72.3462	75.7937	(72)
Total internal gains	655.2379	649.8457	623.8826	583.7771	542.5567	506.0776	485.1495	494.7604	518.2169	558.5525	603.1841	637.0980	(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					5.7100	11.2829		0.4600	0.0000	0.7700		22.8195 (75)				
Southwest					5.4400	36.7938		0.4600	0.0000	0.7700		70.8961 (79)				
Northeast					3.3300	11.2829		0.4300	0.0000	0.7700		12.4402 (75)				
Solar gains					106.1558	192.5345	294.5428	417.0959	514.7759	531.9882	504.1813	428.1070	336.4786	221.1793	129.2830	89.4672 (83)
Total gains					761.3937	842.3801	918.4255	1000.8730	1057.3326	1038.0658	989.3308	922.8675	854.6954	779.7319	732.4671	726.5652 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356
alpha	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957
util living area	0.9739	0.9600	0.9305	0.8633	0.7414	0.5765	0.4337	0.4809	0.7028	0.8919	0.9591	0.9779 (86)
MIT	19.7121	19.8888	20.1747	20.5209	20.7982	20.9430	20.9853	20.9781	20.8768	20.5227	20.0466	19.6552 (87)
Th 2	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403 (88)
util rest of house	0.9691	0.9529	0.9180	0.8388	0.6976	0.5107	0.3533	0.3977	0.6407	0.8671	0.9506	0.9739 (89)
MIT 2	18.4215	18.6753	19.0829	19.5635	19.9254	20.0927	20.1318	20.1267	20.0265	19.5764	18.9060	18.3394 (90)
Living area fraction	18.6202	18.8621	19.2510	19.7109	20.0597	20.2236	20.2632	20.2578	20.1574	19.7221	19.0816	18.5420 (91)
MIT	18.6202	18.8621	19.2510	19.7109	20.0597	20.2236	20.2632	20.2578	20.1574	19.7221	19.0816	18.5420 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4702	18.7121	19.1010	19.5609	19.9097	20.0736	20.1132	20.1078	20.0074	19.5721	18.9316	18.3920 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9375	0.8993	0.8197	0.6848	0.5053	0.3507	0.3945	0.6302	0.8472	0.9348	0.9625	(94)
Useful gains	728.4004	789.7021	825.9672	820.4298	724.0872	524.5793	346.9715	364.0314	538.6153	660.5673	684.7054	699.3444	(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	1415.7021	1379.9302	1258.9299	1065.1023	820.2134	546.8527	350.9941	370.4361	590.1972	896.3801	1182.0668	1417.8853	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	511.3525	396.6333	322.1242	176.1642	71.5180	0.0000	0.0000	0.0000	0.0000	175.4448	358.1002	534.5945	(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) = 2545.9316 (98)
23.7538 (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													2813.1841 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	511.3525	396.6333	322.1242	176.1642	71.5180	0.0000	0.0000	0.0000	0.0000	175.4448	358.1002	534.5945	(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)	565.0304	438.2688	355.9384	194.6566	79.0254	0.0000	0.0000	0.0000	0.0000	193.8616	395.6908	590.7121	(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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Efficiency of water heater (217)m	89.8612	89.7970	89.6487	89.3001	88.6059	87.3000	87.3000	87.3000	87.3000	89.2575	89.7121	89.8972	(216)
Fuel for water heating, kWh/month	136.9187	119.9488	125.6364	114.1666	112.9315	102.2003	99.2118	109.6166	109.6075	120.3504	125.7655	133.1433	(217)
Water heating fuel used												1409.4974	(219)
Annual totals kWh/year													
Space heating fuel - main system												2813.1841	(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)												73.3959	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												148.3959	(231)
Electricity for lighting (calculated in Appendix L)												455.2624	(232)
Total delivered energy for all uses												4826.3398	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2813.1841	3.4800	97.8988	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1409.4974	3.4800	49.0505	(247)
Mechanical ventilation fans	73.3959	13.1900	9.6809	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	455.2624	13.1900	60.0491	(250)
Additional standing charges			120.0000	(251)
Total energy cost			346.5718	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	0.9565	(257)
SAP value	86.6568	
SAP rating (Section 12)	87	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2813.1841	0.2160	607.6478	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1409.4974	0.2160	304.4514	(264)
Space and water heating			912.0992	(265)
Pumps and fans	148.3959	0.5190	77.0175	(267)
Energy for lighting	455.2624	0.5190	236.2812	(268)
Total kg/year			1225.3979	(272)
CO2 emissions per m2			11.4300	(273)
EI value			89.2099	
EI rating			89	(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	$3.48 / 0.8877 = 3.920$, stars = 5
Water heating environmental impact	$0.216 / 0.8877 = 0.2433$, 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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6124		(33)					
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)					
Timber GF			24.8400			9.0000	223.5600 (32c)					
Timber 1F			120.9700			9.0000	1088.7300 (32c)					
AAC GF			53.9000			39.0000	2102.1000 (32c)					
Internal Floor			53.5900			12.6000	675.2340 (32d)					
Internal Ceiling			53.5900			9.0000	482.3100 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15622.3440 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.7580 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)					
Total fabric heat loss						(33) + (36) =	56.4030 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5044	Feb 43.5044	Mar 43.5044	Apr 43.5044	May 43.5044	Jun 43.5044	Jul 43.5044	Aug 43.5044	Sep 43.5044	Oct 43.5044	Nov 43.5044	Dec 43.5044 (38)
Heat transfer coeff	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074 (39)
Average = Sum(39)m / 12 =												99.9074 (39)
HLP	Jan 0.9321	Feb 0.9321	Mar 0.9321	Apr 0.9321	May 0.9321	Jun 0.9321	Jul 0.9321	Aug 0.9321	Sep 0.9321	Oct 0.9321	Nov 0.9321	Dec 0.9321 (40)
HLP (average)												0.9321 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7968 (42)
Average daily hot water use (litres/day)	100.6239 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863	(44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653	(45)
Energy content (annual)										Total =	Sum (45)m =	1583.2061	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448	(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	14.1505	12.7698	14.1121	13.6185	14.0379	13.5452	13.9719	14.0147	13.5851	14.0784	13.6641	14.1381	(61)
Total heat required for water heating calculated for each month	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(62)
WWHRS	-55.2584	-48.6213	-49.6238	-40.8223	-37.9009	-31.2639	-26.4552	-32.0327	-32.9691	-40.7611	-47.2228	-53.4112	eq. (G10)
Total of WWHRS savings												-496.3429	
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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Heat gains from water heating, kWh/month	58.1157	50.9268	52.7856	46.3486	44.7152	38.9437	36.4422	41.3133	41.6575	48.1094	52.0892	56.3905	(65)
										Total per year (kWh/year) =	Sum (64)m =	1252.5496	(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	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4471	57.2413	46.5518	35.2427	26.3443	22.2410	24.0322	31.2379	41.9275	53.2366	62.1350	66.2383	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	399.1648	403.3069	392.8690	370.6479	342.5978	316.2346	298.6224	294.4803	304.9182	327.1393	355.1894	381.5526	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	78.1125	75.7839	70.9484	64.3730	60.1011	54.0885	48.9814	55.5287	57.8576	64.6631	72.3462	75.7937	(72)
Total internal gains	655.2379	649.8457	623.8826	583.7771	542.5567	506.0776	485.1495	494.7604	518.2169	558.5525	603.1841	637.0980	(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				5.7100	12.9236	0.4600	0.0000	0.7700	26.1377 (75)			
Southwest				5.4400	40.4699	0.4600	0.0000	0.7700	77.9794 (79)			
Northeast				3.3300	12.9236	0.4300	0.0000	0.7700	14.2490 (75)			
Solar gains	118.3661	193.8553	294.5911	432.0851	520.6638	576.0385	539.9681	468.2763	365.6126	238.2622	147.8205	98.7095 (83)
Total gains	773.6040	843.7010	918.4737	1015.8622	1063.2205	1082.1162	1025.1175	963.0367	883.8295	796.8148	751.0046	735.8075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	
alpha	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	
util living area	0.9680	0.9541	0.9174	0.8291	0.6702	0.4491	0.3001	0.3289	0.6057	0.8555	0.9464	0.9726 (86)	
MIT	19.8333	19.9808	20.2829	20.6294	20.8795	20.9812	20.9972	20.9959	20.9387	20.6423	20.1830	19.7873 (87)	
Th 2	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403 (88)	
util rest of house	0.9620	0.9457	0.9021	0.7985	0.6166	0.3766	0.2179	0.2420	0.5314	0.8220	0.9349	0.9674 (89)	
MIT 2	18.5969	18.8079	19.2361	19.7091	20.0227	20.1279	20.1393	20.1388	20.0916	19.7369	19.1009	18.5310 (90)	
Living area fraction	18.7873	18.9884	19.3973	19.8508	20.1546	20.2592	20.2714	20.2708	fLA = Living area / (4) =				0.1539 (91)
MIT	18.7873	18.9884	19.3973	19.8508	20.1546	20.2592	20.2714	20.2708	20.2220	19.8763	19.2675	18.7244 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.6373	18.8384	19.2473	19.7008	20.0046	20.1092	20.1214	20.1208	20.0720	19.7263	19.1175	18.5744 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9481	0.9293	0.8827	0.7809	0.6076	0.3739	0.2161	0.2400	0.5251	0.8031	0.9173	0.9545	(94)
Useful gains	733.4273	784.0876	810.7506	793.2368	645.9670	404.6521	221.4835	231.1744	464.1229	639.9378	688.9136	702.3558	(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	1352.4741	1322.6172	1183.6315	979.1729	699.8097	410.5434	221.9318	231.8612	486.7514	811.8724	1110.7196	1346.1949	(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	460.5708	361.8919	277.4233	133.8740	40.0590	0.0000	0.0000	0.0000	0.0000	127.9194	303.7004	479.0163	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating
Space heating per m2 (98) / (4) = 2184.4550 (98)
20.3812 (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													2413.7624 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.5708	361.8919	277.4233	133.8740	40.0590	0.0000	0.0000	0.0000	0.0000	127.9194	303.7004	479.0163	(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)	508.9180	399.8805	306.5451	147.9271	44.2641	0.0000	0.0000	0.0000	0.0000	141.3474	335.5805	529.2997	(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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Efficiency of water heater	89.8060	89.7455	89.5521	89.0883	88.1915	87.3000	87.3000	87.3000	87.3000	89.0107	89.6103	89.8416	(216)
Fuel for water heating, kWh/month	137.0028	120.0177	125.7718	114.4380	113.4622	102.2003	99.2118	109.6166	109.6075	120.6841	125.9085	133.2257	(219)
Water heating fuel used												1411.1469	(219)
Annual totals kWh/year													
Space heating fuel - main system												2413.7624	(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)												73.3959	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												148.3959	(231)
Electricity for lighting (calculated in Appendix L)												455.2624	(232)
Total delivered energy for all uses												4428.5677	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2413.7624	3.9200	94.6195 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.1469	3.9200	55.3170 (247)
Mechanical ventilation fans	73.3959	16.9600	12.4479 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	455.2624	16.9600	77.2125 (250)
Additional standing charges			88.0000 (251)
Total energy cost			340.3169 (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	2413.7624	0.2160	521.3727 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.1469	0.2160	304.8077 (264)
Space and water heating			826.1804 (265)
Pumps and fans	148.3959	0.5190	77.0175 (267)
Energy for lighting	455.2624	0.5190	236.2812 (268)
Total kg/year			1139.4791 (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	2413.7624	1.2200	2944.7902 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.1469	1.2200	1721.5993 (264)
Space and water heating			4666.3894 (265)
Pumps and fans	148.3959	3.0700	455.5754 (267)
Energy for lighting	455.2624	3.0700	1397.6556 (268)
Primary energy kWh/year			6519.6204 (272)
Primary energy kWh/m2/year			60.8287 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):		
A	Not considered	
B	Not considered	
C	Not considered	
D	Not considered	
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
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
U Solar photovoltaic panels	+ 8.8	-£ 309	-947 kg (83.1%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 22	-140 kg (12.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	8.83 kg/m²	A 95
Total Savings	£309	8.83 kg/m²	A 97
Potential energy efficiency rating:			A 95
Potential environmental impact rating:			A 97

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	£102	£102	£0
Mains gas	£238	£238	£0
Space heating	£208	£208	£0
Water heating	£55	£55	£0
Lighting	£77	£77	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£340	£31	£309
Total cost of uses	£340	£31	£309
Delivered energy	41 kWh/m²	24 kWh/m²	17 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.2 tonnes	0.9 tonnes
CO2 emissions per m²	11 kg/m²	2 kg/m²	9 kg/m²
Primary energy	61 kWh/m²	9 kWh/m²	52 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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6124		(33)					
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)					
Timber GF			24.8400			9.0000	223.5600 (32c)					
Timber 1F			120.9700			9.0000	1088.7300 (32c)					
AAC GF			53.9000			39.0000	2102.1000 (32c)					
Internal Floor			53.5900			12.6000	675.2340 (32d)					
Internal Ceiling			53.5900			9.0000	482.3100 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15622.3440 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.7580 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)					
Total fabric heat loss						(33) + (36) =	56.4030 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5044	Feb 43.5044	Mar 43.5044	Apr 43.5044	May 43.5044	Jun 43.5044	Jul 43.5044	Aug 43.5044	Sep 43.5044	Oct 43.5044	Nov 43.5044	Dec 43.5044 (38)
Heat transfer coeff	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074 (39)
Average = Sum(39)m / 12 =												99.9074 (39)
HLP	Jan 0.9321	Feb 0.9321	Mar 0.9321	Apr 0.9321	May 0.9321	Jun 0.9321	Jul 0.9321	Aug 0.9321	Sep 0.9321	Oct 0.9321	Nov 0.9321	Dec 0.9321 (40)
HLP (average)												0.9321 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7968 (42)
Average daily hot water use (litres/day)	100.6239 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863	(44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653	(45)
Energy content (annual)										Total =	Sum (45)m =	1583.2061	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448	(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	14.1505	12.7698	14.1121	13.6185	14.0379	13.5452	13.9719	14.0147	13.5851	14.0784	13.6641	14.1381	(61)
Total heat required for water heating calculated for each month	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(62)
WWHRS	-55.2584	-48.6213	-49.6238	-40.8223	-37.9009	-31.2639	-26.4552	-32.0327	-32.9691	-40.7611	-47.2228	-53.4112	eq. (G10)
Total of WWHRS savings												-496.3429	
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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Heat gains from water heating, kWh/month	58.1157	50.9268	52.7856	46.3486	44.7152	38.9437	36.4422	41.3133	41.6575	48.1094	52.0892	56.3905	(65)
										Total per year (kWh/year) =	Sum (64)m =	1252.5496	(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	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4471	57.2413	46.5518	35.2427	26.3443	22.2410	24.0322	31.2379	41.9275	53.2366	62.1350	66.2383	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	399.1648	403.3069	392.8690	370.6479	342.5978	316.2346	298.6224	294.4803	304.9182	327.1393	355.1894	381.5526	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	78.1125	75.7839	70.9484	64.3730	60.1011	54.0885	48.9814	55.5287	57.8576	64.6631	72.3462	75.7937	(72)
Total internal gains	655.2379	649.8457	623.8826	583.7771	542.5567	506.0776	485.1495	494.7604	518.2169	558.5525	603.1841	637.0980	(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					5.7100	11.2829		0.4600	0.0000	0.7700		22.8195 (75)				
Southwest					5.4400	36.7938		0.4600	0.0000	0.7700		70.8961 (79)				
Northeast					3.3300	11.2829		0.4300	0.0000	0.7700		12.4402 (75)				
Solar gains					106.1558	192.5345	294.5428	417.0959	514.7759	531.9882	504.1813	428.1070	336.4786	221.1793	129.2830	89.4672 (83)
Total gains					761.3937	842.3801	918.4255	1000.8730	1057.3326	1038.0658	989.3308	922.8675	854.6954	779.7319	732.4671	726.5652 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356
alpha	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957
util living area	0.9739	0.9600	0.9305	0.8633	0.7414	0.5765	0.4337	0.4809	0.7028	0.8919	0.9591	0.9779 (86)
MIT	19.7121	19.8888	20.1747	20.5209	20.7982	20.9430	20.9853	20.9781	20.8768	20.5227	20.0466	19.6552 (87)
Th 2	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403 (88)
util rest of house	0.9691	0.9529	0.9180	0.8388	0.6976	0.5107	0.3533	0.3977	0.6407	0.8671	0.9506	0.9739 (89)
MIT 2	18.4215	18.6753	19.0829	19.5635	19.9254	20.0927	20.1318	20.1267	20.0265	19.5764	18.9060	18.3394 (90)
Living area fraction	18.6202	18.8621	19.2510	19.7109	20.0597	20.2236	20.2632	20.2578	20.1574	19.7221	19.0816	18.5420 (91)
MIT	18.6202	18.8621	19.2510	19.7109	20.0597	20.2236	20.2632	20.2578	20.1574	19.7221	19.0816	18.5420 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4702	18.7121	19.1010	19.5609	19.9097	20.0736	20.1132	20.1078	20.0074	19.5721	18.9316	18.3920 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9375	0.8993	0.8197	0.6848	0.5053	0.3507	0.3945	0.6302	0.8472	0.9348	0.9625	(94)
Useful gains	728.4004	789.7021	825.9672	820.4298	724.0872	524.5793	346.9715	364.0314	538.6153	660.5673	684.7054	699.3444	(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	1415.7021	1379.9302	1258.9299	1065.1023	820.2134	546.8527	350.9941	370.4361	590.1972	896.3801	1182.0668	1417.8853	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	511.3525	396.6333	322.1242	176.1642	71.5180	0.0000	0.0000	0.0000	0.0000	175.4448	358.1002	534.5945	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 2545.9316 (98)
23.7538 (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													2813.1841 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	511.3525	396.6333	322.1242	176.1642	71.5180	0.0000	0.0000	0.0000	0.0000	175.4448	358.1002	534.5945	(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)	565.0304	438.2688	355.9384	194.6566	79.0254	0.0000	0.0000	0.0000	0.0000	193.8616	395.6908	590.7121	(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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Efficiency of water heater (217)m	89.8612	89.7970	89.6487	89.3001	88.6059	87.3000	87.3000	87.3000	87.3000	89.2575	89.7121	89.8972	(216)
Fuel for water heating, kWh/month	136.9187	119.9488	125.6364	114.1666	112.9315	102.2003	99.2118	109.6166	109.6075	120.3504	125.7655	133.1433	(219)
Water heating fuel used												1409.4974	(219)
Annual totals kWh/year													
Space heating fuel - main system												2813.1841	(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)												73.3959	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												148.3959	(231)
Electricity for lighting (calculated in Appendix L)												455.2624	(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												3099.1004	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2813.1841	3.4800	97.8988	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1409.4974	3.4800	49.0505	(247)
Mechanical ventilation fans	73.3959	13.1900	9.6809	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	455.2624	13.1900	60.0491	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			118.7490	(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] =		0.3277	(257)
SAP value			95.4281	
SAP rating (Section 12)			95	(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	2813.1841	0.2160	607.6478	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1409.4974	0.2160	304.4514	(264)
Space and water heating			912.0992	(265)
Pumps and fans	148.3959	0.5190	77.0175	(267)
Energy for lighting	455.2624	0.5190	236.2812	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			328.9606	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

CO2 emissions per m2	3.0700 (273)
EI value	97.1034
EI rating	97 (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	53.5900 (1b)	x 2.3100 (2b)	= 123.7929 (1b) - (3b)
First floor	53.5900 (1c)	x 2.6100 (2c)	= 139.8699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.6628 (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			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			11.1500	1.1450	12.7672		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			53.5900	0.1100	5.8949	75.0000	4019.2500 (28a)					
100mm Knauf Supafil 34	102.8800	16.6300	86.2500	0.2500	21.5625	52.8000	4554.0000 (29a)					
Plane Ceiling-500mm Loft Roll	53.5900		53.5900	0.0900	4.8231	9.0000	482.3100 (30)					
Total net area of external elements Aum(A, m2)			210.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6124		(33)					
E-WM-30			44.3300	0.0000	0.0000	45.0000	1994.8500 (32)					
Timber GF			24.8400			9.0000	223.5600 (32c)					
Timber 1F			120.9700			9.0000	1088.7300 (32c)					
AAC GF			53.9000			39.0000	2102.1000 (32c)					
Internal Floor			53.5900			12.6000	675.2340 (32d)					
Internal Ceiling			53.5900			9.0000	482.3100 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15622.3440 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.7580 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7905 (36)					
Total fabric heat loss						(33) + (36) =	56.4030 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5044	Feb 43.5044	Mar 43.5044	Apr 43.5044	May 43.5044	Jun 43.5044	Jul 43.5044	Aug 43.5044	Sep 43.5044	Oct 43.5044	Nov 43.5044	Dec 43.5044 (38)
Heat transfer coeff	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074	99.9074 (39)
Average = Sum(39)m / 12 =												99.9074 (39)
HLP	Jan 0.9321	Feb 0.9321	Mar 0.9321	Apr 0.9321	May 0.9321	Jun 0.9321	Jul 0.9321	Aug 0.9321	Sep 0.9321	Oct 0.9321	Nov 0.9321	Dec 0.9321 (40)
HLP (average)												0.9321 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7968 (42)
Average daily hot water use (litres/day)	100.6239 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.6863	106.6614	102.6364	98.6114	94.5865	90.5615	90.5615	94.5865	98.6114	102.6364	106.6614	110.6863	(44)
Energy conte	164.1446	143.5619	148.1430	129.1547	123.9270	106.9396	99.0952	113.7132	115.0713	134.1045	146.3856	158.9653	(45)
Energy content (annual)										Total =	Sum (45)m =	1583.2061	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6217	21.5343	22.2215	19.3732	18.5891	16.0409	14.8643	17.0570	17.2607	20.1157	21.9578	23.8448	(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	14.1505	12.7698	14.1121	13.6185	14.0379	13.5452	13.9719	14.0147	13.5851	14.0784	13.6641	14.1381	(61)
Total heat required for water heating calculated for each month	178.2951	156.3317	162.2551	142.7732	137.9649	120.4848	113.0672	127.7279	128.6565	148.1830	160.0497	173.1034	(62)
WWHRS	-55.2584	-48.6213	-49.6238	-40.8223	-37.9009	-31.2639	-26.4552	-32.0327	-32.9691	-40.7611	-47.2228	-53.4112	eq. (G10)
Total of WWHRS savings												-496.3429	
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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Heat gains from water heating, kWh/month	58.1157	50.9268	52.7856	46.3486	44.7152	38.9437	36.4422	41.3133	41.6575	48.1094	52.0892	56.3905	(65)
Total per year (kWh/year) = Sum (64)m =												1252.5496	(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	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	167.8078	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4471	57.2413	46.5518	35.2427	26.3443	22.2410	24.0322	31.2379	41.9275	53.2366	62.1350	66.2383	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	399.1648	403.3069	392.8690	370.6479	342.5978	316.2346	298.6224	294.4803	304.9182	327.1393	355.1894	381.5526	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	54.5776	(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)	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	-111.8719	(71)
Water heating gains (Table 5)	78.1125	75.7839	70.9484	64.3730	60.1011	54.0885	48.9814	55.5287	57.8576	64.6631	72.3462	75.7937	(72)
Total internal gains	655.2379	649.8457	623.8826	583.7771	542.5567	506.0776	485.1495	494.7604	518.2169	558.5525	603.1841	637.0980	(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				5.7100	12.9236	0.4600	0.0000		0.7700		26.1377 (75)	
Southwest				5.4400	40.4699	0.4600	0.0000		0.7700		77.9794 (79)	
Northeast				3.3300	12.9236	0.4300	0.0000		0.7700		14.2490 (75)	
Solar gains	118.3661	193.8553	294.5911	432.0851	520.6638	576.0385	539.9681	468.2763	365.6126	238.2622	147.8205	98.7095 (83)
Total gains	773.6040	843.7010	918.4737	1015.8622	1063.2205	1082.1162	1025.1175	963.0367	883.8295	796.8148	751.0046	735.8075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356	43.4356
alpha	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957	3.8957
util living area	0.9680	0.9541	0.9174	0.8291	0.6702	0.4491	0.3001	0.3289	0.6057	0.8555	0.9464	0.9726 (86)
MIT	19.8333	19.9808	20.2829	20.6294	20.8795	20.9812	20.9972	20.9959	20.9387	20.6423	20.1830	19.7873 (87)
Th 2	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403 (88)
util rest of house	0.9620	0.9457	0.9021	0.7985	0.6166	0.3766	0.2179	0.2420	0.5314	0.8220	0.9349	0.9674 (89)
MIT 2	18.5969	18.8079	19.2361	19.7091	20.0227	20.1279	20.1393	20.1388	20.0916	19.7369	19.1009	18.5310 (90)
Living area fraction	18.7873	18.9884	19.3973	19.8508	20.1546	20.2592	20.2714	20.2708	fLA = Living area / (4) =	20.2220	19.8763	19.2675
MIT	18.7873	18.9884	19.3973	19.8508	20.1546	20.2592	20.2714	20.2708	20.2220	19.8763	19.2675	18.7244 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6373	18.8384	19.2473	19.7008	20.0046	20.1092	20.1214	20.1208	20.0720	19.7263	19.1175	18.5744 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9481	0.9293	0.8827	0.7809	0.6076	0.3739	0.2161	0.2400	0.5251	0.8031	0.9173	0.9545	(94)
Useful gains	733.4273	784.0876	810.7506	793.2368	645.9670	404.6521	221.4835	231.1744	464.1229	639.9378	688.9136	702.3558	(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	1352.4741	1322.6172	1183.6315	979.1729	699.8097	410.5434	221.9318	231.8612	486.7514	811.8724	1110.7196	1346.1949	(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	460.5708	361.8919	277.4233	133.8740	40.0590	0.0000	0.0000	0.0000	0.0000	127.9194	303.7004	479.0163	(98)

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Space heating 2184.4550 (98)
 Space heating per m2 (98) / (4) = 20.3812 (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													2413.7624 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.5708	361.8919	277.4233	133.8740	40.0590	0.0000	0.0000	0.0000	0.0000	127.9194	303.7004	479.0163	(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)	508.9180	399.8805	306.5451	147.9271	44.2641	0.0000	0.0000	0.0000	0.0000	141.3474	335.5805	529.2997	(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	123.0367	107.7104	112.6313	101.9508	100.0640	89.2209	86.6119	95.6953	95.6873	107.4218	112.8269	119.6921	(64)
Efficiency of water heater (217)m	89.8060	89.7455	89.5521	89.0883	88.1915	87.3000	87.3000	87.3000	87.3000	89.0107	89.6103	89.8416	(216)
Fuel for water heating, kWh/month	137.0028	120.0177	125.7718	114.4380	113.4622	102.2003	99.2118	109.6166	109.6075	120.6841	125.9085	133.2257	(219)
Water heating fuel used												1411.1469	(219)
Annual totals kWh/year													
Space heating fuel - main system												2413.7624	(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)												73.3959	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												148.3959	(231)
Electricity for lighting (calculated in Appendix L)												455.2624	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												2604.4080	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2413.7624	3.9200	94.6195 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.1469	3.9200	55.3170 (247)
Mechanical ventilation fans	73.3959	16.9600	12.4479 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	455.2624	16.9600	77.2125 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			30.9394 (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	2413.7624	0.2160	521.3727 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.1469	0.2160	304.8077 (264)
Space and water heating			826.1804 (265)
Pumps and fans	148.3959	0.5190	77.0175 (267)
Energy for lighting	455.2624	0.5190	236.2812 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			192.7402 (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	2413.7624	1.2200	2944.7902 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.1469	1.2200	1721.5993 (264)

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Space and water heating			4666.3894 (265)
Pumps and fans	148.3959	3.0700	455.5754 (267)
Energy for lighting	455.2624	3.0700	1397.6556 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			919.4503 (272)
Primary energy kWh/m2/year			8.5786 (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	South West
Overshading	Average or unknown
Thermal mass parameter	145.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	348.03 (P1)
Transmission heat loss coefficient	56.40 (37)
Summer heat loss coefficient	404.44 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North 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 West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.7100	98.8453	0.4600	0.0000	0.9000	233.6643
South West	5.4400	119.9223	0.4600	0.0000	0.9000	270.0843
North East	3.3300	98.8453	0.4300	0.0000	0.9000	127.3829
total:						631.1315

	Jun	Jul	Aug	
Solar gains	673	631	547	(P3/P4)
Internal gains	503	482	492	
Total summer gains	1176	1113	1039	(P5)
Summer gain/loss ratio	2.91	2.75	2.57	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 145.8)	0.98	0.98	0.98	
Threshold temperature	19.89	21.63	21.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			