

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Spiers End/Semi (ASHP+PV)				Issued on Date	15/12/2022
Assessment Reference	Spiers End/Semi (ASHP+PV)	Prop Type Ref	Spiers			
Property	4 Bed, WC, B, 2 Storey					
SAP Rating	93 A	DER	8.22	TER	24.11	
Environmental	93 A	% DER<TER	65.90			
CO ₂ Emissions (t/year)	0.65	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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 24.11 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.22 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: Heat pump with radiators or underfloor - Electric

Vaillant aroTHERM 8kW VWL 85/3 A 230v

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.56 kWh/day	
Permitted by DBSCG 2.24	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	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
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Based on:

Overshading:	Average
Windows facing North East:	9.04 m ² , No overhang
Windows facing South West:	5.44 m ² , 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
Photovoltaic array	1.20 kW

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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	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					
	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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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 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	Total = Sum(45)m = 1583.2061 (45)												
	(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:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b													
Enter (49) or (54) in (55)													
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	213.5214	188.1603	197.5198	176.9387	173.3038	154.7236	148.4720	163.0900	162.8553	183.4813	194.1696	208.3421	(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													
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	158.2630	139.5390	147.8960	136.1164	135.4029	123.4597	122.0168	131.0574	129.8862	142.7202	146.9468	154.9308	(64)
	Total per year (kWh/year) = Sum(64)m = 1668.2352 (64)												
Heat gains from water heating, kWh/month													
	94.0795	83.4131	88.7590	81.1711	80.7072	73.7846	72.4506	77.3111	76.4884	84.0912	86.9004	92.3574	(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)	126.4510	124.1266	119.2997	112.7377	108.4774	102.4786	97.3798	103.9128	106.2339	113.0258	120.6950	124.1363	(72)
Total internal gains	484.6222	482.1907	466.0946	440.1208	413.5076	388.2042	372.0217	378.6617	392.2521	418.4557	448.4779	471.2238	(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	590.7780	674.7251	760.6375	857.2167	928.2835	920.1924	876.2030	806.7687	728.7306	639.6351	577.7609	560.6909 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

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	0.9886	0.9800	0.9597	0.9064	0.7961	0.6331	0.4841	0.5404	0.7731	0.9360	0.9806	0.9907	(86)
Tweekday	18.1057	18.3822	18.8402	19.4029	19.8521	20.0727	20.1276	20.1194	19.9723	19.3968	18.6368	18.0278	
Tweekend	20.0260	20.1492	20.3545	20.6121	20.8292	20.9490	20.9861	20.9788	20.8868	20.6045	20.2615	19.9914	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.4968	19.6839	20.0038	20.3942	20.7365	20.9216	20.9786	20.9673	20.8233	20.3896	19.8469	19.4433	(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	0.9864	0.9762	0.9516	0.8873	0.7559	0.5654	0.3966	0.4505	0.7149	0.9190	0.9761	0.9888	(89)
Tweekday	18.1057	18.3822	18.8402	19.4029	19.8521	20.0727	20.1276	20.1194	19.9723	19.3968	18.6368	18.0278	
Tweekend	18.1057	18.3822	18.8402	19.4029	19.8521	20.0727	20.1276	20.1194	19.9723	19.3968	18.6368	18.0278	
MIT 2	18.1057	18.3822	18.8402	19.4029	19.8521	20.0727	20.1276	20.1194	19.9723	19.3968	18.6368	18.0278	(90)
Living area fraction									fLA =	Living area / (4) =		0.1539	(91)
MIT	18.3199	18.5826	19.0193	19.5555	19.9883	20.2034	20.2586	20.2500	20.1033	19.5497	18.8231	18.2457	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3199	18.5826	19.0193	19.5555	19.9883	20.2034	20.2586	20.2500	20.1033	19.5497	18.8231	18.2457	(93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9666	0.9381	0.8719	0.7480	0.5707	0.4090	0.4625	0.7121	0.9042	0.9667	0.9830	(94)
Useful gains	578.7737	652.1841	713.5766	747.3915	694.3434	525.1454	358.3536	373.0979	518.9064	578.3759	558.4937	551.1417	(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													
	1400.6909	1366.9916	1250.7688	1064.5633	828.0601	559.8195	365.5206	384.6385	599.7767	894.1366	1171.2215	1403.2701	(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													
	611.5064	480.3506	399.6710	228.3637	99.4852	0.0000	0.0000	0.0000	0.0000	234.9260	441.1640	633.9835	(98)
Space heating													3129.4503 (98)
Space heating per m2											(98) / (4) =	29.1981	(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 %)													265.6833	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1177.8876	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	611.5064	480.3506	399.6710	228.3637	99.4852	0.0000	0.0000	0.0000	0.0000	234.9260	441.1640	633.9835	(98)	
Space heating efficiency (main heating system 1)	265.6833	265.6833	265.6833	265.6833	265.6833	0.0000	0.0000	0.0000	0.0000	265.6833	265.6833	265.6833	(210)	
Space heating fuel (main heating system)	230.1637	180.7982	150.4314	85.9533	37.4450	0.0000	0.0000	0.0000	0.0000	88.4233	166.0488	238.6238	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	158.2630	139.5390	147.8960	136.1164	135.4029	123.4597	122.0168	131.0574	129.8862	142.7202	146.9468	154.9308	(64)	
Efficiency of water heater													170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	92.9428	81.9468	86.8546	79.9368	79.5178	72.5039	71.6566	76.9658	76.2780	83.8150	86.2971	90.9859	(219)	
Water heating fuel used													979.7012	(219)
Annual totals kWh/year														
Space heating fuel - main system													1177.8876	(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)
Total electricity for the above, kWh/year													73.3959	(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 * 1.20 * 1029 * 1.00) =										-988.0192			-988.0192	(233)
Total delivered energy for all uses													1698.2279	(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	1177.8876	0.5190	611.3237	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	979.7012	0.5190	508.4649	(264)
Space and water heating			1119.7886	(265)
Pumps and fans	73.3959	0.5190	38.0925	(267)
Energy for lighting	455.2624	0.5190	236.2812	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total CO2, kg/year			881.3803	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2200	(273)

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

DER		8.2200	ZC1
Total Floor Area		107.1800	
Assumed number of occupants		2.7968	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		14.7863	ZC2
CO2 emissions from cooking, equation (L16)		1.7365	ZC3
Total CO2 emissions		24.7428	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		24.7428	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	215.0707	189.5597	199.0691	178.4380	174.8531	156.2229	150.0213	164.6393	164.3546	185.0306	195.6689	209.8914 (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	215.0707	189.5597	199.0691	178.4380	174.8531	156.2229	150.0213	164.6393	164.3546	185.0306	195.6689	209.8914 (64)
Heat gains from water heating, kWh/month	95.3189	84.5325	89.9984	82.3706	81.9466	74.9840	73.6900	78.5505	77.6879	85.3306	88.0998	93.5968 (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	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)	128.1169	125.7925	120.9656	114.4036	110.1433	104.1445	99.0457	105.5786	107.8998	114.6917	122.3609	125.8022	(72)
Total internal gains	489.2881	486.8566	470.7605	444.7867	418.1735	392.8700	376.6876	383.3276	396.9180	423.1216	453.1438	475.8897	(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					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	581.6309	654.5046	727.6461	809.1782	868.3983	858.3469	817.7548	757.5298	690.5869	615.8238	565.6348	553.6958	(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	0.9988	0.9974	0.9930	0.9744	0.9090	0.7512	0.5771	0.6400	0.8843	0.9848	0.9974	0.9991 (86)
MIT	19.8205	19.9501	20.1786	20.4972	20.7800	20.9480	20.9900	20.9830	20.8647	20.5070	20.1134	19.8046 (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	0.9984	0.9965	0.9904	0.9642	0.8724	0.6666	0.4613	0.5223	0.8247	0.9770	0.9963	0.9988 (89)
MIT 2	18.4460	18.6376	18.9726	19.4406	19.8259	20.0267	20.0591	20.0577	19.9427	19.4612	18.8866	18.4310 (90)
Living area fraction	18.6576	18.8397	19.1583	19.6033	19.9728	20.1685	20.2024	20.2001	20.0847	19.6222	19.0755	18.6424 (91)
Temperature adjustment									fLA = Living area / (4) =			0.1539 (92)
adjusted MIT	18.6576	18.8397	19.1583	19.6033	19.9728	20.1685	20.2024	20.2001	20.0847	19.6222	19.0755	18.6424 (93)
												0.0000

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	580.1544	651.1505	718.2178	775.1434	754.5005	581.0468	391.8024	409.2148	570.8881	598.5841	562.6137	552.6168	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1638.8365	1585.8455	1435.3644	1194.9943	920.9334	611.4240	395.5439	416.1848	660.6255	1004.3546	1341.0363	1627.2668	(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	787.6595	628.1150	533.5571	302.2926	123.8261	0.0000	0.0000	0.0000	0.0000	301.8932	560.4643	799.5396	(98)
Space heating												4037.3474	(98)
Space heating per m ²												37.6689	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4318.0186 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	787.6595	628.1150	533.5571	302.2926	123.8261	0.0000	0.0000	0.0000	0.0000	301.8932	560.4643	799.5396	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	842.4166	671.7807	570.6493	323.3076	132.4343	0.0000	0.0000	0.0000	0.0000	322.8804	599.4270	855.1226	(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	215.0707	189.5597	199.0691	178.4380	174.8531	156.2229	150.0213	164.6393	164.3546	185.0306	195.6689	209.8914	(64)
Efficiency of water heater (217)m	87.9700	87.7716	87.3187	86.2094	83.9131	79.8000	79.8000	79.8000	79.8000	86.1124	87.4651	88.0453	(216)
Fuel for water heating, kWh/month	244.4817	215.9691	227.9800	206.9821	208.3739	195.7680	187.9966	206.3149	205.9582	214.8711	223.7107	238.3903	(219)
Water heating fuel used												2576.7968	(219)
Annual totals kWh/year													
Space heating fuel - main system												4318.0186	(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												7425.0778	(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	4318.0186	0.2160	932.6920 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.7968	0.2160	556.5881 (264)
Space and water heating			1489.2801 (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			1764.4863 (272)
Emissions per m2 for space and water heating			13.8951 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2045 (272b)
Emissions per m2 for pumps and fans			0.3632 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8951 * 1.55) + 2.2045 + 0.3632, rounded to 2 d.p.			24.1100 (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	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1517 (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 (30a)
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												

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Calculation Type: New Build (As Designed)

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	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									fLA = Living area / (4) =			0.1539	(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	496.8728	569.7270	641.4697	710.4389	713.6464	568.5117	389.6874	404.9669	537.2030	528.5079	482.3750	469.9357	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	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)
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	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)
Space heating												4597.5569	(98)
Space heating per m2												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) =

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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 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) =																		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 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:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	213.5214	188.1603	197.5198	176.9387	173.3038	154.7236	148.4720	163.0900	162.8553	183.4813	194.1696	208.3421	(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	213.5214	188.1603	197.5198	176.9387	173.3038	154.7236	148.4720	163.0900	162.8553	183.4813	194.1696	208.3421	(64)
RHI water heating demand													2165 (64)
Heat gains from water heating, kWh/month	94.0795	83.4131	88.7590	81.1711	80.7072	73.7846	72.4506	77.3111	76.4884	84.0912	86.9004	92.3574	(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	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)	126.4510	124.1266	119.2997	112.7377	108.4774	102.4786	97.3798	103.9128	106.2339	113.0258	120.6950	124.1363	(72)
Total internal gains	700.5764	695.1883	669.2340	629.1418	587.9330	551.4677	530.5479	540.1445	563.5932	603.9152	648.5329	682.4407	(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	818.9425	889.0436	963.8251	1061.2269	1108.5968	1127.5063	1070.5160	1008.4208	929.2057	842.1775	796.3534	781.1502	(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	0.9618	0.9465	0.9063	0.8129	0.6505	0.4325	0.2877	0.3146	0.5822	0.8367	0.9367	0.9670	(86)
Tweekday	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	
Tweekend	20.2807	20.3739	20.5642	20.7788	20.9299	20.9893	20.9984	20.9978	20.9655	20.7894	20.5034	20.2517	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8899	20.0315	20.3274	20.6545	20.8918	20.9836	20.9976	20.9965	20.9461	20.6749	20.2246	19.8451	(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	0.9549	0.9370	0.8895	0.7809	0.5969	0.3622	0.2087	0.2313	0.5090	0.8009	0.9236	0.9609	(89)
Tweekday	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	
Tweekend	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	
MIT 2	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	(90)
Living area fraction	fLA = Living area / (4) =												0.1539 (91)
MIT	18.8611	19.0567	19.4537	19.8848	20.1671	20.2610	20.2716	20.2710	20.2288	19.9149	19.3313	18.8001	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8611	19.0567	19.4537	19.8848	20.1671	20.2610	20.2716	20.2710	20.2288	19.9149	19.3313	18.8001	(93)

8. Space heating requirement

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	
Utilisation	0.9417	0.9221	0.8737	0.7704	0.5987	0.3722	0.2208	0.2440	0.5169	0.7903	0.9083	0.9484	(94)
Useful gains	771.1584	819.7759	842.1000	817.5914	663.6973	419.6895	236.4173	246.0989	480.2981	665.5318	723.3158	740.8450	(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													
Month fracti	1374.8356	1344.4281	1204.2553	997.5597	716.0441	425.7008	236.9358	246.8753	502.4174	830.7148	1132.0830	1368.7370	(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)
RHI space heating demand	449.1359	352.5663	269.4436	129.5772	38.9461	0.0000	0.0000	0.0000	0.0000	122.8961	294.3124	467.1517	(98)
												2124.0291	(98)
												2124	(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	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					
	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:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	213.5214	188.1603	197.5198	176.9387	173.3038	154.7236	148.4720	163.0900	162.8553	183.4813	194.1696	208.3421	(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	158.2630	139.5390	147.8960	136.1164	135.4029	123.4597	122.0168	131.0574	129.8862	142.7202	146.9468	154.9308	(64)
Heat gains from water heating, kWh/month	94.0795	83.4131	88.7590	81.1711	80.7072	73.7846	72.4506	77.3111	76.4884	84.0912	86.9004	92.3574	(65)
Total per year (kWh/year) = Sum (64)m =												1668.2352	(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	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)	126.4510	124.1266	119.2997	112.7377	108.4774	102.4786	97.3798	103.9128	106.2339	113.0258	120.6950	124.1363	(72)
Total internal gains	700.5764	695.1883	669.2340	629.1418	587.9330	551.4677	530.5479	540.1445	563.5932	603.9152	648.5329	682.4407	(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	806.7322	887.7228	963.7769	1046.2377	1102.7089	1083.4560	1034.7292	968.2516	900.0717	825.0946	777.8160	771.9078 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	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	0.9687	0.9532	0.9208	0.8489	0.7227	0.5566	0.4160	0.4606	0.6789	0.8760	0.9511	0.9732	(86)
Tweekday	18.5010	18.7492	19.1460	19.6070	19.9461	20.0985	20.1330	20.1287	20.0410	19.6258	18.9790	18.4207	
Tweekend	20.2033	20.3153	20.4960	20.7119	20.8813	20.9674	20.9918	20.9878	20.9297	20.7160	20.4172	20.1672	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7705	19.9409	20.2221	20.5502	20.8167	20.9499	20.9873	20.9812	20.8902	20.5617	20.0900	19.7147	(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	0.9631	0.9451	0.9070	0.8229	0.6782	0.4919	0.3384	0.3801	0.6163	0.8488	0.9413	0.9684	(89)
Tweekday	18.5010	18.7492	19.1460	19.6070	19.9461	20.0985	20.1330	20.1287	20.0410	19.6258	18.9790	18.4207	
Tweekend	18.5010	18.7492	19.1460	19.6070	19.9461	20.0985	20.1330	20.1287	20.0410	19.6258	18.9790	18.4207	
MIT 2	18.5010	18.7492	19.1460	19.6070	19.9461	20.0985	20.1330	20.1287	20.0410	19.6258	18.9790	18.4207	(90)
Living area fraction									fLA = Living area / (4) =			0.1539	(91)
MIT	18.6964	18.9326	19.3116	19.7522	20.0801	20.2295	20.2645	20.2599	20.1717	19.7699	19.1500	18.6199	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6964	18.9326	19.3116	19.7522	20.0801	20.2295	20.2645	20.2599	20.1717	19.7699	19.1500	18.6199	(93)

8. Space heating requirement

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	
Utilisation	0.9509	0.9308	0.8910	0.8097	0.6748	0.4989	0.3498	0.3916	0.6187	0.8351	0.9268	0.9572	(94)
Useful gains	767.1596	826.2621	858.7699	847.1148	744.1233	540.5162	361.9540	379.1377	556.8856	689.0763	720.9084	738.8317	(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													
	1438.3089	1401.9646	1279.9779	1084.2182	837.2329	562.4310	366.1118	385.6367	606.6089	916.1418	1203.8852	1440.6575	(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													
	499.3351	386.8721	313.3787	170.7145	69.2736	0.0000	0.0000	0.0000	0.0000	168.9367	347.7433	522.1584	(98)
Space heating													2478.4124 (98)
Space heating per m2										(98) / (4) =			23.1238 (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 %)		265.6833	(206)
Efficiency of secondary/supplementary heating system, %		100.0000	(208)
Space heating requirement		932.8447	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	499.3351	386.8721	313.3787	170.7145	69.2736	0.0000	0.0000	0.0000	0.0000	168.9367	347.7433	522.1584	(98)
Space heating efficiency (main heating system 1)	265.6833	265.6833	265.6833	265.6833	265.6833	0.0000	0.0000	0.0000	0.0000	265.6833	265.6833	265.6833	(210)
Space heating fuel (main heating system)	187.9438	145.6140	117.9520	64.2549	26.0737	0.0000	0.0000	0.0000	0.0000	63.5858	130.8864	196.5342	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	158.2630	139.5390	147.8960	136.1164	135.4029	123.4597	122.0168	131.0574	129.8862	142.7202	146.9468	154.9308	(64)
Efficiency of water heater												170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	92.9428	81.9468	86.8546	79.9368	79.5178	72.5039	71.6566	76.9658	76.2780	83.8150	86.2971	90.9859	(219)
Water heating fuel used												979.7012	(219)
Annual totals kWh/year													
Space heating fuel - main system												932.8447	(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)
Total electricity for the above, kWh/year			73.3959 (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 * 1.20 * 1029 * 1.00) =	-988.0192	-988.0192 (233)
Total delivered energy for all uses		1453.1850 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	932.8447	13.1900	123.0422 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	979.7012	13.1900	129.2226 (247)	
Mechanical ventilation fans	73.3959	13.1900	9.6809 (249)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Energy for lighting	455.2624	13.1900	60.0491 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197 (252)	
Total energy cost			191.6751 (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] =	0.5290 (257)
SAP value		92.6204
SAP rating (Section 12)		93 (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	932.8447	0.5190	484.1464 (261)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	979.7012	0.5190	508.4649 (264)
Space and water heating			992.6113 (265)
Pumps and fans	73.3959	0.5190	38.0925 (267)
Energy for lighting	455.2624	0.5190	236.2812 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			754.2030 (272)
CO2 emissions per m2			7.0400 (273)
EI value			93.3590
EI rating			93 (274)
EI band			A

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.6568 = 4.965$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.6568 = 0.1953$, stars = 5
Water heating energy efficiency	$13.19 / 1.7028 = 7.746$, stars = 3
Water heating environmental impact	$0.519 / 1.7028 = 0.3048$, 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 heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			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:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	213.5214	188.1603	197.5198	176.9387	173.3038	154.7236	148.4720	163.0900	162.8553	183.4813	194.1696	208.3421	(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	158.2630	139.5390	147.8960	136.1164	135.4029	123.4597	122.0168	131.0574	129.8862	142.7202	146.9468	154.9308	(64)
Heat gains from water heating, kWh/month	94.0795	83.4131	88.7590	81.1711	80.7072	73.7846	72.4506	77.3111	76.4884	84.0912	86.9004	92.3574	(65)
Total per year (kWh/year) = Sum (64)m =												1668.2352	(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	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)	126.4510	124.1266	119.2997	112.7377	108.4774	102.4786	97.3798	103.9128	106.2339	113.0258	120.6950	124.1363	(72)
Total internal gains	700.5764	695.1883	669.2340	629.1418	587.9330	551.4677	530.5479	540.1445	563.5932	603.9152	648.5329	682.4407	(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	818.9425	889.0436	963.8251	1061.2269	1108.5968	1127.5063	1070.5160	1008.4208	929.2057	842.1775	796.3534	781.1502	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000	(85)
	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	0.9618	0.9465	0.9063	0.8129	0.6505	0.4325	0.2877	0.3146	0.5822	0.8367	0.9367	0.9670	(86)
Tweekday	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	
Tweekend	20.2807	20.3739	20.5642	20.7788	20.9299	20.9893	20.9984	20.9978	20.9655	20.7894	20.5034	20.2517	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8899	20.0315	20.3274	20.6545	20.8918	20.9836	20.9976	20.9965	20.9461	20.6749	20.2246	19.8451	(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	0.9549	0.9370	0.8895	0.7809	0.5969	0.3622	0.2087	0.2313	0.5090	0.8009	0.9236	0.9609	(89)
Tweekday	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	
Tweekend	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	
MIT 2	18.6739	18.8794	19.2948	19.7448	20.0352	20.1295	20.1395	20.1390	20.0983	19.7765	19.1688	18.6099	(90)
Living area fraction												fLA = Living area / (4) =	0.1539 (91)
MIT	18.8611	19.0567	19.4537	19.8848	20.1671	20.2610	20.2716	20.2710	20.2288	19.9149	19.3313	18.8001	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8611	19.0567	19.4537	19.8848	20.1671	20.2610	20.2716	20.2710	20.2288	19.9149	19.3313	18.8001	(93)

8. Space heating requirement

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	
Utilisation	0.9417	0.9221	0.8737	0.7704	0.5987	0.3722	0.2208	0.2440	0.5169	0.7903	0.9083	0.9484	(94)
Useful gains	771.1584	819.7759	842.1000	817.5914	663.6973	419.6895	236.4173	246.0989	480.2981	665.5318	723.3158	740.8450	(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	1374.8356	1344.4281	1204.2553	997.5597	716.0441	425.7008	236.9358	246.8753	502.4174	830.7148	1132.0830	1368.7370	(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	449.1359	352.5663	269.4436	129.5772	38.9461	0.0000	0.0000	0.0000	0.0000	122.8961	294.3124	467.1517	(98)
Space heating												2124.0291	(98)
Space heating per m2											(98) / (4) =	19.8174	(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 %)													265.6833	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													799.4591	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	449.1359	352.5663	269.4436	129.5772	38.9461	0.0000	0.0000	0.0000	0.0000	122.8961	294.3124	467.1517	(98)	
Space heating efficiency (main heating system 1)	265.6833	265.6833	265.6833	265.6833	265.6833	0.0000	0.0000	0.0000	0.0000	265.6833	265.6833	265.6833	(210)	
Space heating fuel (main heating system)	169.0494	132.7017	101.4153	48.7713	14.6588	0.0000	0.0000	0.0000	0.0000	46.2566	110.7756	175.8303	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	158.2630	139.5390	147.8960	136.1164	135.4029	123.4597	122.0168	131.0574	129.8862	142.7202	146.9468	154.9308	(64)	
Efficiency of water heater													170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	92.9428	81.9468	86.8546	79.9368	79.5178	72.5039	71.6566	76.9658	76.2780	83.8150	86.2971	90.9859	(219)	
Water heating fuel used													979.7012	(219)
Annual totals kWh/year														
Space heating fuel - main system													799.4591	(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)
Total electricity for the above, kWh/year													73.3959	(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 * 1.20 * 1090 * 1.00) =										-1046.8728			-1046.8728	(233)
Total delivered energy for all uses													1260.9458	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	799.4591	16.9600	135.5883	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	979.7012	16.9600	166.1573	(247)
Mechanical ventilation fans	73.3959	16.9600	12.4479	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	455.2624	16.9600	77.2125	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			213.8564	(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	799.4591	0.5190	414.9193	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	979.7012	0.5190	508.4649	(264)
Space and water heating			923.3842	(265)
Pumps and fans	73.3959	0.5190	38.0925	(267)
Energy for lighting	455.2624	0.5190	236.2812	(268)
Energy saving/generation technologies				
PV Unit	-1046.8728	0.5190	-543.3270	(269)
Total kg/year			654.4309	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	799.4591	3.0700	2454.3394 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	979.7012	3.0700	3007.6826 (264)
Space and water heating			5462.0221 (265)
Pumps and fans	73.3959	3.0700	225.3254 (267)
Energy for lighting	455.2624	3.0700	1397.6556 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			3871.1037 (272)
Primary energy kWh/m2/year			36.1178 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 93
Current environmental impact rating: A 93

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 66	-202 kg (30.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£66 1.89 kg/m²	A 95	A 95
Total Savings	£66 1.89 kg/m²		

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 95

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 £391	Potential £325	Saving £66
Electricity			
Space heating	£148	£148	-£0
Water heating	£166	£100	£66
Lighting	£77	£77	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£213	£147	£66
Total cost of uses	£213	£147	£66
Delivered energy	12 kWh/m²	8 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	6 kg/m²	4 kg/m²	2 kg/m²
Primary energy	36 kWh/m²	25 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	213.5214	188.1603	196.1241	170.1851	160.5095	142.1169	135.4451	150.9936	157.4525	182.0856	194.1696	208.3421	(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	
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.6687	(H8)
Utilisation factor												0.4508	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												100.6239	(H14)
Volume ratio Veff/V												0.7453	(H15)
Solar storage volume factor												0.9412	(H16)
Solar input												-676.6222	(H17)
Solar input	-19.6207	-32.7413	-55.7622	-74.7323	-92.3255	-90.7707	-89.5711	-78.2587	-61.2923	-41.8554	-23.2730	-16.4192	(63)
Output from w/h	138.6423	106.7977	90.7381	54.6305	30.2831	20.0823	19.4188	40.7022	63.1910	99.4691	123.6738	138.5117	(64)
Heat gains from water heating, kWh/month	94.0795	83.4131	87.6424	75.7683	70.4717	63.6992	62.0291	67.6339	72.1661	82.9746	86.9004	92.3574	(65)
Total per year (kWh/year) = Sum (64)m =													926.1406 (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	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)	126.4510	124.1266	117.7989	105.2337	94.7200	88.4712	83.3724	90.9058	100.2307	111.5250	120.6950	124.1363	(72)
Total internal gains	700.5764	695.1883	667.7332	621.6378	574.1757	537.4603	516.5405	527.1376	557.5900	602.4144	648.5329	682.4407	(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	806.7322	887.7228	962.2761	1038.7337	1088.9516	1069.4485	1020.7217	955.2446	894.0685	823.5938	777.8160	771.9078	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	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	0.9687	0.9532	0.9211	0.8513	0.7283	0.5626	0.4213	0.4663	0.6820	0.8766	0.9511	0.9732	(86)
Tweekday	18.5010	18.7492	19.1439	19.6001	19.9400	20.0968	20.1326	20.1282	20.0392	19.6243	18.9790	18.4207	
Tweekend	20.2033	20.3153	20.4950	20.7084	20.8778	20.9661	20.9914	20.9873	20.9285	20.7152	20.4172	20.1672	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7705	19.9409	20.2206	20.5447	20.8115	20.9480	20.9868	20.9803	20.8884	20.5604	20.0900	19.7147	(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														
	0.9631	0.9451	0.9074	0.8255	0.6840	0.4976	0.3429	0.3850	0.6194	0.8494	0.9413	0.9684	(89)	
Tweekday	18.5010	18.7492	19.1439	19.6001	19.9400	20.0968	20.1326	20.1282	20.0392	19.6243	18.9790	18.4207		
Tweekend	18.5010	18.7492	19.1439	19.6001	19.9400	20.0968	20.1326	20.1282	20.0392	19.6243	18.9790	18.4207		
MIT 2	18.5010	18.7492	19.1439	19.6001	19.9400	20.0968	20.1326	20.1282	20.0392	19.6243	18.9790	18.4207	(90)	
Living area fraction									fLA = Living area / (4) =				0.1539	(91)
MIT	18.6964	18.9326	19.3097	19.7455	20.0742	20.2278	20.2641	20.2594	20.1699	19.7684	19.1500	18.6199	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6964	18.9326	19.3097	19.7455	20.0742	20.2278	20.2641	20.2594	20.1699	19.7684	19.1500	18.6199	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9509	0.9308	0.8914	0.8122	0.6803	0.5045	0.3544	0.3965	0.6217	0.8357	0.9268	0.9572	(94)
Useful gains	767.1596	826.2621	857.7968	843.6511	740.8591	539.4959	361.7224	378.7898	555.8707	688.3050	720.9084	738.8317	(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	1438.3089	1401.9646	1279.7828	1083.5450	836.6421	562.2596	366.0739	385.5795	606.4303	915.9905	1203.8852	1440.6575	(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	499.3351	386.8721	313.9576	172.7236	71.2625	0.0000	0.0000	0.0000	0.0000	169.3980	347.7433	522.1584	(98)
Space heating												2483.4507	(98)
Space heating per m2												(98) / (4) =	23.1708 (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 %)													265.6833	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													934.7411	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	499.3351	386.8721	313.9576	172.7236	71.2625	0.0000	0.0000	0.0000	0.0000	169.3980	347.7433	522.1584	(98)	
Space heating efficiency (main heating system 1)	265.6833	265.6833	265.6833	265.6833	265.6833	0.0000	0.0000	0.0000	0.0000	265.6833	265.6833	265.6833	(210)	
Space heating fuel (main heating system)	187.9438	145.6140	118.1699	65.0111	26.8224	0.0000	0.0000	0.0000	0.0000	63.7594	130.8864	196.5342	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	138.6423	106.7977	90.7381	54.6305	30.2831	20.0823	19.4188	40.7022	63.1910	99.4691	123.6738	138.5117	(64)	
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)	
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	81.4202	62.7189	53.2876	32.0827	17.7843	11.7937	11.4040	23.9031	37.1101	58.4150	72.6297	81.3435	(219)	
Water heating fuel used													543.8927	(219)
Annual totals kWh/year														
Space heating fuel - main system													934.7411	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													123.3959	(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 * 1.20 * 1029 * 1.00) =										-988.0192			-988.0192	(233)
Total delivered energy for all uses													1069.2729	(238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	934.7411	13.1900	123.2923 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	543.8927	13.1900	71.7395 (247)
Mechanical ventilation fans	73.3959	13.1900	9.6809 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	455.2624	13.1900	60.0491 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-988.0192	13.1900	-130.3197 (252)
Total energy cost			141.0371 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3892 (257)
SAP value		94.5700
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	934.7411	0.5190	485.1306 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	543.8927	0.5190	282.2803 (264)
Space and water heating			767.4109 (265)
Pumps and fans	123.3959	0.5190	64.0425 (267)
Energy for lighting	455.2624	0.5190	236.2812 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			554.9526 (272)
CO2 emissions per m2			5.1800 (273)
EI value			95.1134
EI rating			95 (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 heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			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 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:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	213.5214	188.1603	196.1241	170.1851	160.5095	142.1169	135.4451	150.9936	157.4525	182.0856	194.1696	208.3421	(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
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1140.0998 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1915.3676 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.7623 (H8)
Utilisation factor													0.4330 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													100.6239 (H14)
Volume ratio Veff/V													0.7453 (H15)
Solar storage volume factor													0.9412 (H16)
Solar input													-686.4232 (H17)
Solar input	-21.1278	-31.7550	-53.4794	-73.9249	-89.0305	-93.7007	-91.4508	-81.6661	-63.7407	-43.3616	-25.6813	-17.5045	(63)
Output from w/h	137.1352	107.7840	93.0209	55.4379	33.5781	17.1523	17.5391	37.2948	60.7426	97.9629	121.2654	137.4264	(64)
Heat gains from water heating, kWh/month	94.0795	83.4131	87.6424	75.7683	70.4717	63.6992	62.0291	67.6339	72.1661	82.9746	86.9004	92.3574	(65)
Total per year (kWh/year) = Sum (64)m =													

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	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)	126.4510	124.1266	117.7989	105.2337	94.7200	88.4712	83.3724	90.9058	100.2307	111.5250	120.6950	124.1363	(72)
Total internal gains	700.5764	695.1883	667.7332	621.6378	574.1757	537.4603	516.5405	527.1376	557.5900	602.4144	648.5329	682.4407	(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	818.9425	889.0436	962.3243	1053.7229	1094.8394	1113.4988	1056.5085	995.4139	923.2025	840.6767	796.3534	781.1502	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	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	0.9618	0.9465	0.9067	0.8156	0.6564	0.4375	0.2914	0.3186	0.5853	0.8373	0.9367	0.9670	(86)
Tweekday	18.6739	18.8794	19.2929	19.7391	20.0316	20.1290	20.1394	20.1390	20.0975	19.7753	19.1688	18.6099	
Tweekend	20.2807	20.3739	20.5633	20.7758	20.9276	20.9889	20.9983	20.9977	20.9648	20.7887	20.5034	20.2517	

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24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0		
MIT	19.8899	20.0315	20.3260	20.6499	20.8883	20.9829	20.9974	20.9964	20.9451	20.6739	20.2246	19.8451	(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															
	0.9549	0.9370	0.8899	0.7838	0.6028	0.3665	0.2115	0.2342	0.5119	0.8016	0.9236	0.9609	(89)		
Tweekday	18.6739	18.8794	19.2929	19.7391	20.0316	20.1290	20.1394	20.1390	20.0975	19.7753	19.1688	18.6099			
Tweekend	18.6739	18.8794	19.2929	19.7391	20.0316	20.1290	20.1394	20.1390	20.0975	19.7753	19.1688	18.6099			
MIT 2	18.6739	18.8794	19.2929	19.7391	20.0316	20.1290	20.1394	20.1390	20.0975	19.7753	19.1688	18.6099	(90)		
Living area fraction										fLA = Living area / (4) =				0.1539	(91)
MIT	18.8611	19.0567	19.4519	19.8793	20.1635	20.2605	20.2715	20.2710	20.2280	19.9136	19.3313	18.8001	(92)		
Temperature adjustment												0.0000			
adjusted MIT	18.8611	19.0567	19.4519	19.8793	20.1635	20.2605	20.2715	20.2710	20.2280	19.9136	19.3313	18.8001	(93)		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9417	0.9221	0.8741	0.7732	0.6043	0.3766	0.2237	0.2472	0.5197	0.7909	0.9083	0.9484	(94)
Useful gains	771.1584	819.7759	841.1931	814.6989	661.6327	419.3882	236.3870	246.0548	479.7991	664.9004	723.3158	740.8450	(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	1374.8356	1344.4281	1204.0745	997.0087	715.6837	425.6515	236.9306	246.8679	502.3330	830.5937	1132.0830	1368.7370	(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	449.1359	352.5663	269.9838	131.2630	40.2139	0.0000	0.0000	0.0000	0.0000	123.2758	294.3124	467.1517	(98)
Space heating												2127.9028	(98)
Space heating per m2										(98) / (4) =		19.8535	(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 %)													265.6833	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													800.9171	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	449.1359	352.5663	269.9838	131.2630	40.2139	0.0000	0.0000	0.0000	0.0000	123.2758	294.3124	467.1517	(98)	
Space heating efficiency (main heating system 1)	265.6833	265.6833	265.6833	265.6833	265.6833	0.0000	0.0000	0.0000	0.0000	265.6833	265.6833	265.6833	(210)	
Space heating fuel (main heating system)	169.0494	132.7017	101.6187	49.4058	15.1360	0.0000	0.0000	0.0000	0.0000	46.3995	110.7756	175.8303	(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	137.1352	107.7840	93.0209	55.4379	33.5781	17.1523	17.5391	37.2948	60.7426	97.9629	121.2654	137.4264	(64)	
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)	
Fuel for water heating, kWh/month	80.5351	63.2981	54.6282	32.5569	19.7194	10.0730	10.3002	21.9021	35.6722	57.5305	71.2153	80.7061	(219)	
Water heating fuel used												538.1369	(219)	
Annual totals kWh/year														
Space heating fuel - main system												800.9171	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													123.3959	(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 * 1.20 * 1090 * 1.00) =									-1046.8728			-1046.8728	(233)	
Total delivered energy for all uses												870.8396	(238)	

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	800.9171	16.9600	135.8355 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	538.1369	16.9600	91.2680 (247)
Mechanical ventilation fans	73.3959	16.9600	12.4479 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	16.9600	8.4800 (249)
Energy for lighting	455.2624	16.9600	77.2125 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1046.8728	16.9600	-177.5496 (252)
Total energy cost			147.6944 (255)

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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	800.9171	0.5190	415.6760 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	538.1369	0.5190	279.2931 (264)
Space and water heating			694.9690 (265)
Pumps and fans	123.3959	0.5190	64.0425 (267)
Energy for lighting	455.2624	0.5190	236.2812 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			451.9658 (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	800.9171	3.0700	2458.8155 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	538.1369	3.0700	1652.0804 (264)
Space and water heating			4110.8959 (265)
Pumps and fans	123.3959	3.0700	378.8254 (267)
Energy for lighting	455.2624	3.0700	1397.6556 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			2673.4776 (272)
Primary energy kWh/m2/year			24.9438 (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	551	531	540	
Total summer gains	1225	1162	1087	(P5)
Summer gain/loss ratio	3.03	2.87	2.69	(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	20.01	21.75	21.47	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

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Assessment of likelihood of high internal temperature:

Slight