

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X414 Det (ASHP)			Issued on Date	15/12/2022
Assessment Reference	X414 Det (ASHP)	Prop Type Ref	Aspen		
Property	4 Bed, K, WC, B, En				
SAP Rating	87 B	DER	13.01	TER	24.33
Environmental	88 B	% DER<TER	46.53		
CO ₂ Emissions (t/year)	1.44	DFEE	43.93	TFEE	56.72
General Requirements Compliance	Pass	% DFEE<TFEE	22.54		
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

Detached House, total floor area 127 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) 24.33 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.01 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.9 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	1.23 (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

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): Medium OK

Based on:

Overshading: Average
Windows facing North: 11.35 m², No overhang
Windows facing East: 3.75 m², No overhang
Windows facing South: 13.22 m², No overhang
Windows facing West: 2.06 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.020 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (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	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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					
Window (Uw = 1.20)			24.0800	1.1450	27.5725		(27)					
French Door (Uw = 1.40)			6.3000	1.3258	8.3523		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500 (28a)					
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960 (29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500 (30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.7598		(33)					
1F Timber			134.4400			9.0000	1209.9600 (32c)					
GF Masonry			62.6400			39.0000	2442.9600 (32c)					
GF Timber			31.1400			9.0000	280.2600 (32c)					
Internal Floor			63.6500			12.6000	801.9900 (32d)					
Internal Ceiling			63.6500			9.0000	572.8500 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17825.9160 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.0308 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8591 (36)					
Total fabric heat loss						(33) + (36) =	90.6189 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.6964	Feb 54.1542	Mar 54.0866	Apr 54.0866	May 54.0866	Jun 54.0866	Jul 54.0866	Aug 54.0866	Sep 54.0866	Oct 54.0866	Nov 54.0866	Dec 54.0866 (38)
Heat transfer coeff	145.3153	144.7731	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055 (39)
Average = Sum(39)m / 12 =												144.7619 (39)
HLP	Jan 1.1415	Feb 1.1373	Mar 1.1367	Apr 1.1367	May 1.1367	Jun 1.1367	Jul 1.1367	Aug 1.1367	Sep 1.1367	Oct 1.1367	Nov 1.1367	Dec 1.1367 (40)
HLP (average)												1.1372 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)										Total = Sum (45)m =		1617.1494 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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												
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 (57)
Total heat required for water heating calculated for each month												
WWHRS	-52.8549	-46.5072	-47.4657	-39.0426	-36.2462	-29.8974	-25.2960	-30.6300	-31.5268	-38.9810	-45.1649	-51.0891 eq. (G10)
Total of WWHRS savings												-474.7017
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	164.1857	144.7310	153.2302	140.6652	139.7145	127.1189	125.3007	134.8980	133.7957	147.3755	152.1432	160.6611 (64)
Heat gains from water heating, kWh/month	95.2497	84.4365	89.8151	82.0918	81.5906	74.5469	73.1570	78.1217	77.3087	85.0472	87.9439	93.4906 (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	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2492	23.3143	18.9605	14.3543	10.7300	9.0587	9.7883	12.7232	17.0770	21.6832	25.3075	26.9787 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4361	297.4914	289.7921	273.4011	252.7105	233.2642	220.2729	217.2176	224.9169	241.3079	261.9985	281.4448 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382 (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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053 (71)
Water heating gains (Table 5)	128.0237	125.6495	120.7192	114.0164	109.6648	103.5374	98.3293	105.0023	107.3732	114.3107	122.1444	125.6594 (72)
Total internal gains	515.0235	512.7697	495.7862	468.0863	439.4198	412.1749	394.7050	401.2576	415.6816	443.6163	475.7648	500.3974 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					11.3500	10.6334		0.4600	0.0000	0.7700		42.7480 (74)
East					3.7500	19.6403		0.4600	0.0000	0.7700		26.0872 (76)
South					6.9200	46.7521		0.4600	0.0000	0.7700		114.5923 (78)
West					2.0600	19.6403		0.4600	0.0000	0.7700		14.3306 (80)
South					6.3000	46.7521		0.4300	0.0000	0.7700		97.5215 (78)

Solar gains	295.2796	508.1472	711.5379	913.0128	1054.2730	1061.3539	1017.0803	908.9198	780.5976	565.7541	354.5586	252.1603 (83)
Total gains	810.3031	1020.9168	1207.3241	1381.0992	1493.6928	1473.5287	1411.7853	1310.1774	1196.2792	1009.3704	830.3234	752.5577 (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	34.0752	34.2028	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188
alpha	3.2717	3.2802	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813
util living area	0.9814	0.9614	0.9236	0.8480	0.7250	0.5696	0.4322	0.4794	0.6931	0.8916	0.9670	0.9852 (86)
Tweekday	17.5022	17.9627	18.5551	19.1897	19.6589	19.8909	19.9545	19.9459	19.7978	19.1675	18.1989	17.4054
Tweekend	19.8042	20.0098	20.2784	20.5745	20.8071	20.9363	20.9805	20.9724	20.8757	20.5560	20.1131	19.7599
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	19.1545	19.4684	19.8864	20.3356	20.7023	20.9021	20.9700	20.9575	20.8059	20.3147	19.6151	19.0861 (87)
Th 2	19.9671	19.9705	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710 (88)
util rest of house	0.9778	0.9542	0.9093	0.8198	0.6756	0.4948	0.3385	0.3829	0.6231	0.8648	0.9596	0.9823 (89)
Tweekday	17.5022	17.9627	18.5551	19.1897	19.6589	19.8909	19.9545	19.9459	19.7978	19.1675	18.1989	17.4054
Tweekend	17.5022	17.9627	18.5551	19.1897	19.6589	19.8909	19.9545	19.9459	19.7978	19.1675	18.1989	17.4054
MIT 2	17.5022	17.9627	18.5551	19.1897	19.6589	19.8909	19.9545	19.9459	19.7978	19.1675	18.1989	17.4054 (90)
Living area fraction									fLA = Living area / (4) =			0.1342 (91)
MIT	17.7240	18.1648	18.7338	19.3435	19.7990	20.0267	20.0909	20.0817	19.9331	19.3216	18.3890	17.6310 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7240	18.1648	18.7338	19.3435	19.7990	20.0267	20.0909	20.0817	19.9331	19.3216	18.3890	17.6310 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9662	0.9368	0.8876	0.7997	0.6666	0.4991	0.3498	0.3938	0.6203	0.8438	0.9435	0.9723	(94)
Useful gains	782.9174	956.4127	1071.6034	1104.4349	995.6772	735.3924	493.8784	515.9029	742.0039	851.6949	783.4128	731.6965	(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	1950.7181	1920.3903	1770.3002	1511.2381	1171.9710	785.2693	505.1466	532.7637	844.0820	1262.0573	1633.5844	1943.5421	(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	868.8437	647.7930	519.8304	292.8983	131.1626	0.0000	0.0000	0.0000	0.0000	305.3096	612.1236	901.6131	(98)
Space heating												4279.5743	(98)
Space heating per m2												33.6180	(99)

(98) / (4) = 33.6180 (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 %)													263.7856	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1622.3683	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	868.8437	647.7930	519.8304	292.8983	131.1626	0.0000	0.0000	0.0000	0.0000	305.3096	612.1236	901.6131	(98)	
Space heating efficiency (main heating system 1)	263.7856	263.7856	263.7856	263.7856	263.7856	0.0000	0.0000	0.0000	0.0000	263.7856	263.7856	263.7856	(210)	
Space heating fuel (main heating system)	329.3749	245.5755	197.0655	111.0365	49.7232	0.0000	0.0000	0.0000	0.0000	115.7416	232.0534	341.7977	(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	164.1857	144.7310	153.2302	140.6652	139.7145	127.1189	125.3007	134.8980	133.7957	147.3755	152.1432	160.6611	(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	96.4210	84.9959	89.9872	82.6081	82.0499	74.6529	73.5851	79.2213	78.5739	86.5489	89.3488	94.3511	(219)	
Water heating fuel used													1012.3442	(219)
Annual totals kWh/year														
Space heating fuel - main system													1622.3683	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)														
mechanical ventilation fans (SFP = 0.2294)													91.7530	(230a)
Total electricity for the above, kWh/year													91.7530	(231)
Electricity for lighting (calculated in Appendix L)													463.5689	(232)
Total delivered energy for all uses													3190.0344	(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	1622.3683	0.5190	842.0091	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1012.3442	0.5190	525.4066	(264)
Space and water heating			1367.4158	(265)
Pumps and fans	91.7530	0.5190	47.6198	(267)
Energy for lighting	463.5689	0.5190	240.5923	(268)
Total CO2, kg/year			1655.6278	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0100	(273)

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

DER			13.0100	ZC1
Total Floor Area		TFA	127.3000	
Assumed number of occupants		N	2.8876	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.7059	ZC2
CO2 emissions from cooking, equation (L16)			1.4792	ZC3
Total CO2 emissions			28.1951	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			28.1951	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1220 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3720 (18)					
Number of sides sheltered							0 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3720 (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	0.4743	0.4650	0.4557	0.4092	0.3999	0.3534	0.3534	0.3441	0.3720	0.3999	0.4185	0.4371 (22b)
Effective ac	0.6125	0.6081	0.6038	0.5837	0.5800	0.5625	0.5625	0.5592	0.5692	0.5800	0.5876	0.5955 (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)			29.7100	1.3258	39.3883		(27)					
FP McCann System			63.6500	0.1300	8.2745		(28a)					
100mm Knauf Supafil 34	168.3500	31.8600	136.4900	0.1800	24.5682		(29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.1300	8.2745		(30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.6555		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8426 (36)					
Total fabric heat loss						(33) + (36) =	95.4981 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.2557	Feb 65.7831	Mar 65.3199	Apr 63.1444	May 62.7374	Jun 60.8425	Jul 60.8425	Aug 60.4916	Sep 61.5724	Oct 62.7374	Nov 63.5608	Dec 64.4217 (38)
Heat transfer coeff	161.7537	161.2812	160.8180	158.6424	158.2354	156.3406	156.3406	155.9897	157.0704	158.2354	159.0588	159.9197 (39)
Average = Sum(39)m / 12 =												158.6405 (39)
HLP	Jan 1.2706	Feb 1.2669	Mar 1.2633	Apr 1.2462	May 1.2430	Jun 1.2281	Jul 1.2281	Aug 1.2254	Sep 1.2339	Oct 1.2430	Nov 1.2495	Dec 1.2562 (40)
HLP (average)												1.2462 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)											Total = Sum(45)m =	1617.1494 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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	26.7713	27.6637	26.7713	27.6637	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month	218.5899	192.6376	202.2452	181.2070	177.5100	158.5156	152.1459	167.0773	166.8217	187.9058	198.8073	213.2995 (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	218.5899	192.6376	202.2452	181.2070	177.5100	158.5156	152.1459	167.0773	166.8217	187.9058	198.8073	213.2995 (64)
Heat gains from water heating, kWh/month	96.4891	85.5559	91.0545	83.2913	82.8300	75.7464	74.3964	79.3611	78.5082	86.2866	89.1434	94.7300 (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	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2492	23.3143	18.9605	14.3543	10.7300	9.0587	9.7883	12.7232	17.0770	21.6832	25.3075	26.9787	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4361	297.4914	289.7921	273.4011	252.7105	233.2642	220.2729	217.2176	224.9169	241.3079	261.9985	281.4448	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	(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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	(71)
Water heating gains (Table 5)	129.6896	127.3154	122.3851	115.6823	111.3307	105.2033	99.9952	106.6682	109.0391	115.9766	123.8103	127.3253	(72)
Total internal gains	519.6893	517.4355	500.4521	472.7522	444.0857	416.8407	399.3709	405.9234	420.3475	448.2821	480.4307	505.0633	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				11.1000	10.6334	0.6300	0.7000	0.7700	36.0717 (74)			
East				3.6700	19.6403	0.6300	0.7000	0.7700	22.0285 (76)			
South				12.9100	46.7521	0.6300	0.7000	0.7700	184.4586 (78)			
West				2.0300	19.6403	0.6300	0.7000	0.7700	12.1847 (80)			
Solar gains	254.7435	437.9588	612.1748	783.8296	903.6850	909.1686	871.4823	779.7640	671.0149	487.3125	305.8053	217.5956 (83)
Total gains	774.4328	955.3944	1112.6269	1256.5818	1347.7706	1326.0094	1270.8532	1185.6874	1091.3624	935.5947	786.2360	722.6589 (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	54.6527	54.8128	54.9707	55.7245	55.8679	56.5450	56.5450	56.6722	56.2823	55.8679	55.5787	55.2795
alpha	4.6435	4.6542	4.6647	4.7150	4.7245	4.7697	4.7697	4.7781	4.7522	4.7245	4.7052	4.6853
util living area	0.9978	0.9940	0.9832	0.9486	0.8595	0.6944	0.5276	0.5822	0.8233	0.9688	0.9950	0.9984 (86)
MIT	19.6078	19.8103	20.1052	20.4725	20.7728	20.9419	20.9873	20.9802	20.8653	20.4637	19.9648	19.5778 (87)
Th 2	19.8639	19.8668	19.8697	19.8832	19.8857	19.8976	19.8976	19.8998	19.8930	19.8857	19.8806	19.8753 (88)
util rest of house	0.9971	0.9919	0.9771	0.9294	0.8085	0.5980	0.4024	0.4543	0.7437	0.9534	0.9929	0.9979 (89)
MIT 2	18.0185	18.3155	18.7444	19.2731	19.6673	19.8600	19.8931	19.8920	19.7884	19.2723	18.5517	17.9824 (90)
Living area fraction	18.2319	18.5162	18.9271	19.4341	19.8157	20.0052	20.0400	20.0380	fLA = Living area / (4) = 19.9330	19.4323	18.7414	0.1342 (91)
MIT	18.2319	18.5162	18.9271	19.4341	19.8157	20.0052	20.0400	20.0380	19.9330	19.4323	18.7414	18.1966 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2319	18.5162	18.9271	19.4341	19.8157	20.0052	20.0400	20.0380	19.9330	19.4323	18.7414	18.1966 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9954	0.9882	0.9701	0.9196	0.8048	0.6082	0.4191	0.4711	0.7470	0.9448	0.9897	0.9966	(94)
Ext temp.	770.8590	944.0744	1079.3181	1155.4928	1084.6793	806.4434	532.6462	558.6210	815.2658	883.9625	778.1374	720.2049	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2253.5351	2196.0353	1998.4963	1671.1546	1284.1958	845.0575	537.8154	567.4981	916.1884	1397.5777	1851.6634	2238.3320	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m ²	1103.1110	841.3178	683.8686	371.2765	148.4403	0.0000	0.0000	0.0000	0.0000	382.1297	772.9387	1129.4865	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5810.2344 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1103.1110	841.3178	683.8686	371.2765	148.4403	0.0000	0.0000	0.0000	0.0000	382.1297	772.9387	1129.4865	(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)	1179.7979	899.8051	731.4102	397.0872	158.7597	0.0000	0.0000	0.0000	0.0000	408.6949	826.6724	1208.0070	(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	218.5899	192.6376	202.2452	181.2070	177.5100	158.5156	152.1459	167.0773	166.8217	187.9058	198.8073	213.2995	(64)
Efficiency of water heater (217)m	88.5366	88.2943	87.8126	86.6876	84.3413	79.8000	79.8000	79.8000	79.8000	86.6692	88.0837	88.6126	(216)
Fuel for water heating, kWh/month	246.8920	218.1768	230.3145	209.0344	210.4664	198.6411	190.6590	209.3700	209.0498	216.8079	225.7028	240.7101	(219)
Water heating fuel used												2605.8248	(219)
Annual totals kWh/year													
Space heating fuel - main system												5810.2344	(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)												463.5689	(232)
Total delivered energy for all uses												8954.6281	(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	5810.2344	0.2160	1255.0106 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2605.8248	0.2160	562.8582 (264)
Space and water heating			1817.8688 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	463.5689	0.5190	240.5923 (268)
Total CO2, kg/m2/year			2097.3860 (272)
Emissions per m2 for space and water heating			14.2802 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.8900 (272b)
Emissions per m2 for pumps and fans			0.3058 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2802 * 1.55) + 1.8900 + 0.3058, rounded to 2 d.p.			24.3300 (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	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (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) = 0.1220 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3225 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3225 (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	0.4112	0.4032	0.3951	0.3548	0.3467	0.3064	0.3064	0.2983	0.3225	0.3467	0.3628	0.3790 (22b)
Effective ac	0.5846	0.5813	0.5781	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5718 (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
Window (Uw = 1.20)			24.0800	1.1450	27.5725		(27)
French Door (Uw = 1.40)			6.3000	1.3258	8.3523		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500 (28a)
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960 (29a)
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500 (30)
Total net area of external elements Aum(A, m ²)			295.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.7598		(33)
1F Timber			134.4400			9.0000	1209.9600 (32c)
GF Masonry			62.6400			39.0000	2442.9600 (32c)
GF Timber			31.1400			9.0000	280.2600 (32c)
Internal Floor			63.6500			12.6000	801.9900 (32d)
Internal Ceiling			63.6500			9.0000	572.8500 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17825.9160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.0308 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8591 (36)
Total fabric heat loss							(33) + (36) = 90.6189 (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	63.2328	62.8776	62.5295	60.8944	60.5884	59.1643	59.1643	58.9006	59.7129	60.5884	61.2073	61.8544 (38)
Heat transfer coeff	153.8517	153.4965	153.1484	151.5133	151.2073	149.7832	149.7832	149.5195	150.3317	151.2073	151.8262	152.4732 (39)
Average = Sum(39)m / 12 =												151.5118 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2086	1.2058	1.2031	1.1902	1.1878	1.1766	1.1766	1.1745	1.1809	1.1878	1.1927	1.1977 (40)
HLP (average)												1.1902 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1617.1494 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.6286	31.1610	32.1553	28.0338	26.8991	23.2119	21.5092	24.6821	24.9769	29.1082	31.7739	34.5044 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2492	23.3143	19.9605	14.3543	10.7300	9.0587	9.7883	12.7232	17.0770	21.6832	25.3075	26.9787	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4361	297.4914	289.7921	273.4011	252.7105	233.2642	220.2729	217.2176	224.9169	241.3079	261.9985	281.4448	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	(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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	(71)
Water heating gains (Table 5)	47.8878	46.3705	43.2195	38.9358	36.1547	32.2387	28.9102	33.1749	34.6902	39.1239	44.1304	46.3768	(72)
Total internal gains	434.8876	433.4906	418.2865	393.0057	365.9097	340.8761	325.2859	329.4302	342.9986	368.4294	397.7508	421.1148	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					11.3500	10.6334	0.4600	0.0000			0.7700			42.7480 (74)
East					3.7500	19.6403	0.4600	0.0000			0.7700			26.0872 (76)
South					6.9200	46.7521	0.4600	0.0000			0.7700			114.5923 (78)
West					2.0600	19.6403	0.4600	0.0000			0.7700			14.3306 (80)
South					6.3000	46.7521	0.4300	0.0000			0.7700			97.5215 (78)
Solar gains	295.2796	508.1472	711.5379	913.0128	1054.2730	1061.3539	1017.0803	908.9198	780.5976	565.7541	354.5586			252.1603 (83)
Total gains	730.1672	941.6378	1129.8244	1306.0186	1420.1827	1402.2300	1342.3662	1238.3500	1123.5962	934.1835	752.3094			673.2751 (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	32.1845	32.2590	32.3323	32.6813	32.7474	33.0587	33.0587	33.1171	32.9381	32.7474	32.6139	32.4755	
alpha	3.1456	3.1506	3.1555	3.1788	3.1832	3.2039	3.2039	3.2078	3.1959	3.1832	3.1743	3.1650	
util living area	0.9862	0.9698	0.9380	0.8708	0.7572	0.6035	0.4640	0.5145	0.7304	0.9128	0.9753	0.9892	(86)
MIT	18.9421	19.2648	19.7062	20.2215	20.6296	20.8738	20.9594	20.9431	20.7571	20.1943	19.4612	18.8842	(87)
Th 2	19.9131	19.9154	19.9176	19.9278	19.9298	19.9388	19.9388	19.9404	19.9353	19.9298	19.9259	19.9218	(88)
util rest of house	0.9834	0.9639	0.9256	0.8448	0.7085	0.5255	0.3625	0.4110	0.6606	0.8893	0.9694	0.9870	(89)
MIT 2	18.0390	18.3593	18.7929	19.2930	19.6632	19.8683	19.9236	19.9175	19.7839	19.2807	18.5645	17.9879	(90)
Living area fraction	18.1603	18.4809	18.9155	19.4176	19.7929	20.0033	20.0627	20.0552	19.9146	19.4033	18.6849	18.1082	(91)
MIT	18.1603	18.4809	18.9155	19.4176	19.7929	20.0033	20.0627	20.0552	19.9146	19.4033	18.6849	18.1082	(92)
Temperature adjustment	18.1603	18.4809	18.9155	19.4176	19.7929	20.0033	20.0627	20.0552	19.9146	19.4033	18.6849	18.1082	(93)
adjusted MIT	18.1603	18.4809	18.9155	19.4176	19.7929	20.0033	20.0627	20.0552	19.9146	19.4033	18.6849	18.1082	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9771	0.9534	0.9113	0.8302	0.7016	0.5306	0.3749	0.4229	0.6591	0.8750	0.9602	0.9818	(94)
Ext temp.	713.4804	897.8012	1029.5901	1084.2882	996.3793	744.0248	503.2469	523.6455	740.5339	817.3876	722.3917	661.0029	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2132.4266	2084.6137	1901.4113	1593.5626	1223.7088	809.3222	518.6505	546.5204	874.1143	1331.1243	1758.8852	2120.6289	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1055.6960	797.5380	648.6350	366.6776	169.1331	0.0000	0.0000	0.0000	0.0000	382.2201	746.2753	1085.9617	(98)
Space heating per m2													(98) / (4) = 41.2579 (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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1407.9620	1108.3956	1136.3479	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8386	0.8919	0.8673	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1180.7744	988.5312	985.5873	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1756.5506	1683.9077	1564.5281	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	414.5589	517.3601	430.7320	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1362.6510	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	103.6397	129.3400	107.6830	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												340.6627	(107)
Space cooling per m2												2.6761	(108)
Energy for space heating												41.2579	(99)
Energy for space cooling												2.6761	(108)
Total												43.9340	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.9	(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	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1220 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3720 (18)					
Number of sides sheltered							0 (19)					
Shelter factor	(20) = 1 - [0.075 x (19)] =						1.0000 (20)					
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =						0.3720 (21)					
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4743	0.4650	0.4557	0.4092	0.3999	0.3534	0.3534	0.3441	0.3720	0.3999	0.4185	0.4371 (22b)
Effective ac	0.6125	0.6081	0.6038	0.5837	0.5800	0.5625	0.5625	0.5592	0.5692	0.5800	0.5876	0.5955 (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)			29.7100	1.3258	39.3883		(27)					
FP McCann System			63.6500	0.1300	8.2745		(28a)					
100mm Knauf Supafil 34	168.3500	31.8600	136.4900	0.1800	24.5682		(29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.1300	8.2745		(30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.6555		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8426 (36)					
Total fabric heat loss						(33) + (36) =	95.4981 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.2557	Feb 65.7831	Mar 65.3199	Apr 63.1444	May 62.7374	Jun 60.8425	Jul 60.8425	Aug 60.4916	Sep 61.5724	Oct 62.7374	Nov 63.5608	Dec 64.4217 (38)
Heat transfer coeff	161.7537	161.2812	160.8180	158.6424	158.2354	156.3406	156.3406	155.9897	157.0704	158.2354	159.0588	159.9197 (39)
Average = Sum(39)m / 12 =												158.6405 (39)
HLP	Jan 1.2706	Feb 1.2669	Mar 1.2633	Apr 1.2462	May 1.2430	Jun 1.2281	Jul 1.2281	Aug 1.2254	Sep 1.2339	Oct 1.2430	Nov 1.2495	Dec 1.2562 (40)
HLP (average)												1.2462 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Daily hot water use	Jan 113.0594	Feb 108.9481	Mar 104.8369	Apr 100.7256	May 96.6144	Jun 92.5031	Jul 92.5031	Aug 96.6144	Sep 100.7256	Oct 104.8369	Nov 108.9481	Dec 113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)										Total = Sum(45)m =		1617.1494 (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	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.6286	31.1610	32.1553	28.0338	26.8991	23.2119	21.5092	24.6821	24.9769	29.1082	31.7739	34.5044	(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	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	144.3816	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2492	23.3143	18.9605	14.3543	10.7300	9.0587	9.7883	12.7232	17.0770	21.6832	25.3075	26.9787	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4361	297.4914	289.7921	273.4011	252.7105	233.2642	220.2729	217.2176	224.9169	241.3079	261.9985	281.4448	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	37.4382	(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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	(71)
Water heating gains (Table 5)	47.8878	46.3705	43.2195	38.9358	36.1547	32.2387	28.9102	33.1749	34.6902	39.1239	44.1304	46.3768	(72)
Total internal gains	434.8876	433.4906	418.2865	393.0057	365.9097	340.8761	325.2859	329.4302	342.9986	368.4294	397.7508	421.1148	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	11.1000	10.6334	0.6300	0.7000	0.7700	36.0717 (74)
East	3.6700	19.6403	0.6300	0.7000	0.7700	22.0285 (76)
South	12.9100	46.7521	0.6300	0.7000	0.7700	184.4586 (78)
West	2.0300	19.6403	0.6300	0.7000	0.7700	12.1847 (80)

Solar gains	254.7435	437.9588	612.1748	783.8296	903.6850	909.1686	871.4823	779.7640	671.0149	487.3125	305.8053	217.5956	(83)
Total gains	689.6311	871.4495	1030.4614	1176.8353	1269.5946	1250.0448	1196.7682	1109.1941	1014.0135	855.7419	703.5561	638.7104	(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	54.6527	54.8128	54.9707	55.7245	55.8679	56.5450	56.5450	56.6722	56.2823	55.8679	55.5787	55.2795	
alpha	4.6435	4.6542	4.6647	4.7150	4.7245	4.7697	4.7697	4.7781	4.7522	4.7245	4.7052	4.6853	
util living area	0.9987	0.9959	0.9875	0.9590	0.8802	0.7240	0.5566	0.6159	0.8525	0.9776	0.9969	0.9991	(86)
MIT	19.5472	19.7512	20.0500	20.4265	20.7432	20.9305	20.9842	20.9750	20.8406	20.4131	19.9061	19.5174	(87)
Th 2	19.8639	19.8668	19.8697	19.8832	19.8857	19.8976	19.8976	19.8998	19.8930	19.8857	19.8806	19.8753	(88)
util rest of house	0.9982	0.9944	0.9829	0.9429	0.8335	0.6280	0.4263	0.4836	0.7786	0.9660	0.9956	0.9988	(89)
MIT 2	18.5435	18.7491	19.0476	19.4244	19.7137	19.8661	19.8937	19.8928	19.8055	19.4195	18.9151	18.5227	(90)
Living area fraction									fLA = Living area / (4) =			0.1342	(91)
MIT	18.6782	18.8836	19.1822	19.5590	19.8519	20.0090	20.0401	20.0381	19.9445	19.5529	19.0481	18.6562	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6782	18.8836	19.1822	19.5590	19.8519	20.0090	20.0401	20.0381	19.9445	19.5529	19.0481	18.6562	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9975	0.9926	0.9791	0.9370	0.8318	0.6386	0.4439	0.5013	0.7827	0.9613	0.9941	0.9983	(94)
Ext temp.	687.9139	865.0205	1008.9076	1102.7187	1056.0530	798.2656	531.2342	555.9920	793.6509	822.5821	699.4122	637.5943	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2325.7308	2255.2979	2039.5270	1690.9640	1289.9247	845.6462	537.8254	567.5060	917.9951	1416.6619	1900.4582	2311.8351	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1218.5358	934.2664	766.7808	423.5366	174.0005	0.0000	0.0000	0.0000	0.0000	441.9954	864.7531	1245.6351	(98)
Space heating per m2												6069.5038	(98)
										(98) / (4) =		47.6787	(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	1469.6013	1156.9202	1185.5215	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8549	0.9170	0.8909	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1256.3418	1060.9017	1056.2218	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1578.6718	1513.7282	1413.5667	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	232.0776	336.9029	265.8646	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											834.8451 (104)
Cooled fraction											1.0000 (105)
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	58.0194	84.2257	66.4661	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											208.7113 (107)
Space cooling per m2											1.6395 (108)
Energy for space heating											47.6787 (99)
Energy for space cooling											1.6395 (108)
Total											49.3183 (109)
Target Fabric Energy Efficiency (TFEE)											56.7 (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	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (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																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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					
Window (Uw = 1.20)			24.0800	1.1450	27.5725		(27)					
French Door (Uw = 1.40)			6.3000	1.3258	8.3523		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500 (28a)					
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960 (29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500 (30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.7598		(33)					
1F Timber			134.4400			9.0000	1209.9600 (32c)					
GF Masonry			62.6400			39.0000	2442.9600 (32c)					
GF Timber			31.1400			9.0000	280.2600 (32c)					
Internal Floor			63.6500			12.6000	801.9900 (32d)					
Internal Ceiling			63.6500			9.0000	572.8500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17825.9160 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.0308 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8591 (36)					
Total fabric heat loss						(33) + (36) =	90.6189 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.0866	Feb 54.0866	Mar 54.0866	Apr 54.0866	May 54.0866	Jun 54.0866	Jul 54.0866	Aug 54.0866	Sep 54.0866	Oct 54.0866	Nov 54.0866	Dec 54.0866 (38)
Heat transfer coeff	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055 (39)
Average = Sum(39)m / 12 =												144.7055 (39)
HLP	Jan 1.1367	Feb 1.1367	Mar 1.1367	Apr 1.1367	May 1.1367	Jun 1.1367	Jul 1.1367	Aug 1.1367	Sep 1.1367	Oct 1.1367	Nov 1.1367	Dec 1.1367 (40)
HLP (average)												1.1367 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)	Total = Sum (45)m = 1617.1494 (45)											
Distribution loss (46)m = 0.15 x (45)m	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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	217.0406	191.2382	200.6960	179.7077	175.9607	157.0163	150.5966	165.5280	165.3224	186.3565	197.3080	211.7502 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	217.0406	191.2382	200.6960	179.7077	175.9607	157.0163	150.5966	165.5280	165.3224	186.3565	197.3080	211.7502 (64)
RHI water heating demand												2199 (64)
Heat gains from water heating, kWh/month	95.2497	84.4365	89.8151	82.0918	81.5906	74.5469	73.1570	78.1217	77.3087	85.0472	87.9439	93.4906 (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	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.6230	58.2857	47.4012	35.8857	26.8250	22.6468	24.4707	31.8079	42.6925	54.2079	63.2686	67.4468	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.4568	444.0170	432.5255	408.0614	377.1799	348.1556	328.7656	324.2054	335.6969	360.1610	391.0425	420.0668	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	(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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	(71)
Water heating gains (Table 5)	128.0237	125.6495	120.7192	114.0164	109.6648	103.5374	98.3293	105.0023	107.3732	114.3107	122.1444	125.6594	(72)
Total internal gains	746.0696	740.9183	713.6119	670.9296	626.6357	587.3059	564.5316	573.9816	598.7287	641.6457	689.4216	726.1391	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				11.3500	11.9814	0.4600	0.0000	0.7700	48.1674 (74)				
East				3.7500	22.3313	0.4600	0.0000	0.7700	29.6616 (76)				
South				6.9200	50.9848	0.4600	0.0000	0.7700	124.9671 (78)				
West				2.0600	22.3313	0.4600	0.0000	0.7700	16.2941 (80)				
South				6.3000	50.9848	0.4300	0.0000	0.7700	106.3508 (78)				
Solar gains	325.4409	504.4179	700.1326	931.5903	1053.5359	1137.4968	1077.2742	980.3889	834.4619	600.2084	400.3989	275.2163	(83)
Total gains	1071.5105	1245.3362	1413.7444	1602.5199	1680.1716	1724.8026	1641.8058	1554.3705	1433.1906	1241.8541	1089.8205	1001.3554	(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	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	
alpha	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	
util living area	0.9548	0.9287	0.8744	0.7673	0.6098	0.4051	0.2704	0.2940	0.5390	0.8000	0.9223	0.9621	(86)
Tweekday	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827	
Tweekend	20.0622	20.2133	20.4629	20.7236	20.9024	20.9817	20.9966	20.9955	20.9509	20.7309	20.3571	20.0184	
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	19.5527	19.7831	20.1711	20.5684	20.8493	20.9719	20.9948	20.9930	20.9234	20.5846	19.9961	19.4851	(87)
Th 2	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	(88)
util rest of house	0.9463	0.9161	0.8524	0.7288	0.5497	0.3271	0.1820	0.2013	0.4579	0.7568	0.9060	0.9548	(89)
Tweekday	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827	
Tweekend	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827	
MIT 2	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827	(90)
Living area fraction	fLA = Living area / (4) =											0.1342	(91)
MIT	18.2767	18.5944	19.1139	19.6346	19.9663	20.0902	20.1071	20.1063	20.0498	19.6625	18.9020	18.1844	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2767	18.5944	19.1139	19.6346	19.9663	20.0902	20.1071	20.1063	20.0498	19.6625	18.9020	18.1844	(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	0.9278	0.8946	0.8306	0.7148	0.5494	0.3363	0.1938	0.2136	0.4645	0.7420	0.8844	0.9377	(94)
Useful gains	994.1155	1114.0362	1174.2924	1145.5258	923.0870	580.1288	318.1786	332.0439	665.6926	921.4010	963.8569	938.9321	(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	1906.7462	1880.3572	1695.0681	1408.6448	1008.0582	591.8780	319.3745	333.7290	701.7899	1166.6892	1577.5853	1893.3779	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	678.9973	514.9677	387.4572	189.4457	63.2186	0.0000	0.0000	0.0000	0.0000	182.4944	441.8845	710.1077	(98)
RHI space heating demand												3168.5731	(98)
												3169	(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	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (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	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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					
Window (Uw = 1.20)			24.0800	1.1450	27.5725			(27)				
French Door (Uw = 1.40)			6.3000	1.3258	8.3523			(27)				
Front Door			2.1500	1.0000	2.1500			(26)				
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500	(28a)				
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960	(29a)				
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500	(30)				
Total net area of external elements Aum(A, m2)			295.6500					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.7598			(33)				
1F Timber			134.4400			9.0000	1209.9600	(32c)				
GF Masonry			62.6400			39.0000	2442.9600	(32c)				
GF Timber			31.1400			9.0000	280.2600	(32c)				
Internal Floor			63.6500			12.6000	801.9900	(32d)				
Internal Ceiling			63.6500			9.0000	572.8500	(32e)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17825.9160	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								140.0308 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								5.8591 (36)				
Total fabric heat loss						(33) + (36) =		90.6189 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.6964	Feb 54.1542	Mar 54.0866	Apr 54.0866	May 54.0866	Jun 54.0866	Jul 54.0866	Aug 54.0866	Sep 54.0866	Oct 54.0866	Nov 54.0866	Dec 54.0866 (38)
Heat transfer coeff	145.3153	144.7731	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055 (39)
Average = Sum(39)m / 12 =												144.7619 (39)
HLP	Jan 1.1415	Feb 1.1373	Mar 1.1367	Apr 1.1367	May 1.1367	Jun 1.1367	Jul 1.1367	Aug 1.1367	Sep 1.1367	Oct 1.1367	Nov 1.1367	Dec 1.1367 (40)
HLP (average)												1.1372 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)										Total = Sum (45)m =		1617.1494 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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												
Primary 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 (57)
Total heat required for water heating calculated for each month	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)
WWHRS	217.0406	191.2382	200.6960	179.7077	175.9607	157.0163	150.5966	165.5280	165.3224	186.3565	197.3080	211.7502 (62)
Total of WWHRS savings	-52.8549	-46.5072	-47.4657	-39.0426	-36.2462	-29.8974	-25.2960	-30.6300	-31.5268	-38.9810	-45.1649	-51.0891 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-474.7017
Output from w/h	164.1857	144.7310	153.2302	140.6652	139.7145	127.1189	125.3007	134.8980	133.7957	147.3755	152.1432	160.6611 (64)
Heat gains from water heating, kWh/month	95.2497	84.4365	89.8151	82.0918	81.5906	74.5469	73.1570	78.1217	77.3087	85.0472	87.9439	93.4906 (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	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.6230	58.2857	47.4012	35.8857	26.8250	22.6468	24.4707	31.8079	42.6925	54.2079	63.2686	67.4468 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.4568	444.0170	432.5255	408.0614	377.1799	348.1556	328.7656	324.2054	335.6969	360.1610	391.0425	420.0668 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134 (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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053 (71)
Water heating gains (Table 5)	128.0237	125.6495	120.7192	114.0164	109.6648	103.5374	98.3293	105.0023	107.3732	114.3107	122.1444	125.6594 (72)
Total internal gains	746.0696	740.9183	713.6119	670.9296	626.6357	587.3059	564.5316	573.9816	598.7287	641.6457	689.4216	726.1391 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				11.3500	10.6334		0.4600		0.0000		0.7700		42.7480 (74)
East				3.7500	19.6403		0.4600		0.0000		0.7700		26.0872 (76)
South				6.9200	46.7521		0.4600		0.0000		0.7700		114.5923 (78)
West				2.0600	19.6403		0.4600		0.0000		0.7700		14.3306 (80)
South				6.3000	46.7521		0.4300		0.0000		0.7700		97.5215 (78)
Solar gains	295.2796	508.1472	711.5379	913.0128	1054.2730	1061.3539	1017.0803	908.9198	780.5976	565.7541	354.5586		252.1603 (83)
Total gains	1041.3492	1249.0655	1425.1498	1583.9424	1680.9087	1648.6597	1581.6119	1482.9015	1379.3263	1207.3998	1043.9802		978.2995 (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	34.0752	34.2028	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188
alpha	3.2717	3.2802	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813
util living area	0.9632	0.9356	0.8886	0.8033	0.6753	0.5212	0.3902	0.4304	0.6315	0.8428	0.9405	0.9692 (86)
Tweekday	17.8405	18.2629	18.7906	19.3371	19.7256	19.9106	19.9591	19.9531	19.8444	19.3399	18.4853	17.7437
Tweekend	19.9565	20.1471	20.3895	20.6487	20.8454	20.9510	20.9856	20.9799	20.9065	20.6424	20.2444	19.9117
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	19.3895	19.6807	20.0577	20.4515	20.7614	20.9247	20.9778	20.9690	20.8540	20.4480	19.8201	19.3204 (87)
Th 2	19.9671	19.9705	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710 (88)
util rest of house	0.9565	0.9244	0.8697	0.7708	0.6242	0.4494	0.3039	0.3412	0.5608	0.8088	0.9282	0.9636 (89)
Tweekday	17.8405	18.2629	18.7906	19.3371	19.7256	19.9106	19.9591	19.9531	19.8444	19.3399	18.4853	17.7437
Tweekend	17.8405	18.2629	18.7906	19.3371	19.7256	19.9106	19.9591	19.9531	19.8444	19.3399	18.4853	17.7437
MIT 2	17.8405	18.2629	18.7906	19.3371	19.7256	19.9106	19.9591	19.9531	19.8444	19.3399	18.4853	17.7437 (90)
Living area fraction									fLA = Living area / (4) =			0.1342 (91)
MIT	18.0484	18.4533	18.9607	19.4867	19.8647	20.0468	20.0958	20.0895	19.9800	19.4887	18.6645	17.9553 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0484	18.4533	18.9607	19.4867	19.8647	20.0468	20.0958	20.0895	19.9800	19.4887	18.6645	17.9553 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9395	0.9034	0.8474	0.7535	0.6186	0.4549	0.3146	0.3519	0.5614	0.7901	0.9078	0.9481	(94)
Useful gains	978.3027	1128.4297	1207.6438	1193.4638	1039.7575	750.0331	497.6317	521.7779	774.3981	953.9136	947.7167	927.5045	(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	1997.8598	1962.1465	1803.1299	1531.9560	1181.4706	788.1750	505.8640	533.8943	850.8641	1286.2445	1673.4486	1990.4739	(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	758.5505	560.2577	443.0416	243.7144	105.4346	0.0000	0.0000	0.0000	0.0000	247.2542	522.5270	790.8492	(98)
Space heating												3671.6292	(98)
Space heating per m2											(98) / (4) =	28.8423	(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 %)													263.7856	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1391.8989	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	758.5505	560.2577	443.0416	243.7144	105.4346	0.0000	0.0000	0.0000	0.0000	247.2542	522.5270	790.8492	(98)	
Space heating efficiency (main heating system 1)	263.7856	263.7856	263.7856	263.7856	263.7856	0.0000	0.0000	0.0000	0.0000	263.7856	263.7856	263.7856	(210)	
Space heating fuel (main heating system)	287.5632	212.3913	167.9552	92.3911	39.9698	0.0000	0.0000	0.0000	0.0000	93.7330	198.0877	299.8075	(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	164.1857	144.7310	153.2302	140.6652	139.7145	127.1189	125.3007	134.8980	133.7957	147.3755	152.1432	160.6611	(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	96.4210	84.9959	89.9872	82.6081	82.0499	74.6529	73.5851	79.2213	78.5739	86.5489	89.3488	94.3511	(219)	
Water heating fuel used													1012.3442	(219)
Annual totals kWh/year														
Space heating fuel - main system													1391.8989	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)														
mechanical ventilation fans (SFP = 0.2294)														91.7530 (230a)
Total electricity for the above, kWh/year														91.7530 (231)
Electricity for lighting (calculated in Appendix L)														463.5689 (232)
Total delivered energy for all uses														2959.5650 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1391.8989	13.1900	183.5915	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1012.3442	13.1900	133.5282	(247)
Mechanical ventilation fans	91.7530	13.1900	12.1022	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	463.5689	13.1900	61.1447	(250)
Additional standing charges			0.0000	(251)
Total energy cost			390.3666	(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] =	0.9516	(257)
SAP value		86.7257	
SAP rating (Section 12)		87	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1391.8989	0.5190	722.3955	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1012.3442	0.5190	525.4066	(264)
Space and water heating			1247.8022	(265)
Pumps and fans	91.7530	0.5190	47.6198	(267)
Energy for lighting	463.5689	0.5190	240.5923	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total kg/year	1536.0142 (272)
CO2 emissions per m2	12.0700 (273)
EI value	88.0542
EI rating	88 (274)
EI band	B

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

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.6379 = 5.000$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.6379 = 0.1968$, 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	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (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															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (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																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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					
Window (Uw = 1.20)			24.0800	1.1450	27.5725		(27)					
French Door (Uw = 1.40)			6.3000	1.3258	8.3523		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500 (28a)					
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960 (29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500 (30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.7598		(33)					
1F Timber			134.4400			9.0000	1209.9600 (32c)					
GF Masonry			62.6400			39.0000	2442.9600 (32c)					
GF Timber			31.1400			9.0000	280.2600 (32c)					
Internal Floor			63.6500			12.6000	801.9900 (32d)					
Internal Ceiling			63.6500			9.0000	572.8500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17825.9160 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.0308 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8591 (36)					
Total fabric heat loss						(33) + (36) =	90.6189 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.0866	Feb 54.0866	Mar 54.0866	Apr 54.0866	May 54.0866	Jun 54.0866	Jul 54.0866	Aug 54.0866	Sep 54.0866	Oct 54.0866	Nov 54.0866	Dec 54.0866 (38)
Heat transfer coeff	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055 (39)
Average = Sum(39)m / 12 =												144.7055 (39)
HLP	Jan 1.1367	Feb 1.1367	Mar 1.1367	Apr 1.1367	May 1.1367	Jun 1.1367	Jul 1.1367	Aug 1.1367	Sep 1.1367	Oct 1.1367	Nov 1.1367	Dec 1.1367 (40)
HLP (average)												1.1367 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)										Total = Sum (45)m =		1617.1494 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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	217.0406	191.2382	200.6960	179.7077	175.9607	157.0163	150.5966	165.5280	165.3224	186.3565	197.3080	211.7502 (62)
WWHRS	-52.8549	-46.5072	-47.4657	-39.0426	-36.2462	-29.8974	-25.2960	-30.6300	-31.5268	-38.9810	-45.1649	-51.0891 eq. (G10)
Total of WWHRS savings												-474.7017
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	164.1857	144.7310	153.2302	140.6652	139.7145	127.1189	125.3007	134.8980	133.7957	147.3755	152.1432	160.6611 (64)
Heat gains from water heating, kWh/month	95.2497	84.4365	89.8151	82.0918	81.5906	74.5469	73.1570	78.1217	77.3087	85.0472	87.9439	93.4906 (65)
Total per year (kWh/year) = Sum (64)m =												1723.8197 (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	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.6230	58.2857	47.4012	35.8857	26.8250	22.6468	24.4707	31.8079	42.6925	54.2079	63.2686	67.4468 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.4568	444.0170	432.5255	408.0614	377.1799	348.1556	328.7656	324.2054	335.6969	360.1610	391.0425	420.0668 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134 (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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053 (71)
Water heating gains (Table 5)	128.0237	125.6495	120.7192	114.0164	109.6648	103.5374	98.3293	105.0023	107.3732	114.3107	122.1444	125.6594 (72)
Total internal gains	746.0696	740.9183	713.6119	670.9296	626.6357	587.3059	564.5316	573.9816	598.7287	641.6457	689.4216	726.1391 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				11.3500	11.9814		0.4600		0.0000		0.7700		48.1674 (74)
East				3.7500	22.3313		0.4600		0.0000		0.7700		29.6616 (76)
South				6.9200	50.9848		0.4600		0.0000		0.7700		124.9671 (78)
West				2.0600	22.3313		0.4600		0.0000		0.7700		16.2941 (80)
South				6.3000	50.9848		0.4300		0.0000		0.7700		106.3508 (78)
Solar gains	325.4409	504.4179	700.1326	931.5903	1053.5359	1137.4968	1077.2742	980.3889	834.4619	600.2084	400.3989	275.2163	(83)
Total gains	1071.5105	1245.3362	1413.7444	1602.5199	1680.1716	1724.8026	1641.8058	1554.3705	1433.1906	1241.8541	1089.8205	1001.3554	(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	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188
alpha	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813
util living area	0.9548	0.9287	0.8744	0.7673	0.6098	0.4051	0.2704	0.2940	0.5390	0.8000	0.9223	0.9621 (86)
Tweekday	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827
Tweekend	20.0622	20.2133	20.4629	20.7236	20.9024	20.9817	20.9966	20.9955	20.9509	20.7309	20.3571	20.0184
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	19.5527	19.7831	20.1711	20.5684	20.8493	20.9719	20.9948	20.9930	20.9234	20.5846	19.9961	19.4851 (87)
Th 2	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710 (88)
util rest of house	0.9463	0.9161	0.8524	0.7288	0.5497	0.3271	0.1820	0.2013	0.4579	0.7568	0.9060	0.9548 (89)
Tweekday	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827
Tweekend	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827
MIT 2	18.0789	18.4100	18.9500	19.4898	19.8293	19.9535	19.9694	19.9688	19.9143	19.5195	18.7324	17.9827 (90)
Living area fraction									fLA = Living area / (4) =			0.1342 (91)
MIT	18.2767	18.5944	19.1139	19.6346	19.9663	20.0902	20.1071	20.1063	20.0498	19.6625	18.9020	18.1844 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2767	18.5944	19.1139	19.6346	19.9663	20.0902	20.1071	20.1063	20.0498	19.6625	18.9020	18.1844 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9278	0.8946	0.8306	0.7148	0.5494	0.3363	0.1938	0.2136	0.4645	0.7420	0.8844	0.9377	(94)
Useful gains	994.1155	1114.0362	1174.2924	1145.5258	923.0870	580.1288	318.1786	332.0439	665.6926	921.4010	963.8569	938.9321	(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	1906.7462	1880.3572	1695.0681	1408.6448	1008.0582	591.8780	319.3745	333.7290	701.7899	1166.6892	1577.5853	1893.3779	(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	678.9973	514.9677	387.4572	189.4457	63.2186	0.0000	0.0000	0.0000	0.0000	182.4944	441.8845	710.1077	(98)
Space heating												3168.5731	(98)
Space heating per m2												(98) / (4) =	24.8906 (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 %)													263.7858 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1201.1917 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	678.9973	514.9677	387.4572	189.4457	63.2186	0.0000	0.0000	0.0000	0.0000	182.4944	441.8845	710.1077	(98)
Space heating efficiency (main heating system 1)	263.7858	263.7858	263.7858	263.7858	263.7858	0.0000	0.0000	0.0000	0.0000	263.7858	263.7858	263.7858	(210)
Space heating fuel (main heating system)	257.4048	195.2219	146.8833	71.8180	23.9659	0.0000	0.0000	0.0000	0.0000	69.1828	167.5164	269.1986	(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	164.1857	144.7310	153.2302	140.6652	139.7145	127.1189	125.3007	134.8980	133.7957	147.3755	152.1432	160.6611	(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	96.4210	84.9959	89.9872	82.6081	82.0499	74.6529	73.5851	79.2213	78.5739	86.5489	89.3488	94.3511	(219)
Water heating fuel used													
Annual totals kWh/year													1012.3442 (219)
Space heating fuel - main system													1201.1917 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													91.7530 (230a)
Total electricity for the above, kWh/year													91.7530 (231)
Electricity for lighting (calculated in Appendix L)													463.5689 (232)
Total delivered energy for all uses													2768.8578 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1201.1917	16.9600	203.7221	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1012.3442	16.9600	171.6936	(247)
Mechanical ventilation fans	91.7530	16.9600	15.5613	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	463.5689	16.9600	78.6213	(250)
Additional standing charges			0.0000	(251)
Total energy cost			469.5983	(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	1201.1917	0.5190	623.4185	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1012.3442	0.5190	525.4066	(264)
Space and water heating			1148.8251	(265)
Pumps and fans	91.7530	0.5190	47.6198	(267)
Energy for lighting	463.5689	0.5190	240.5923	(268)
Total kg/year			1437.0372	(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	1201.1917	3.0700	3687.6584	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1012.3442	3.0700	3107.8967 (264)
Space and water heating			6795.5552 (265)
Pumps and fans	91.7530	3.0700	281.6817 (267)
Energy for lighting	463.5689	3.0700	1423.1565 (268)
Primary energy kWh/year			8500.3933 (272)
Primary energy kWh/m ² /year			66.7745 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 68	-209 kg (14.6%)
U Solar photovoltaic panels	+ 7.7	-£ 309	-947 kg (77.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£68	1.65 kg/m ²	B 89 B 90
Solar photovoltaic panels	£309	7.44 kg/m ²	A 96 A 97
Total Savings	£378	9.08 kg/m ²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 97

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

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

	Current	Potential	Saving
Electricity	£470	£401	£68
Space heating	£219	£219	-£0
Water heating	£172	£103	£69
Lighting	£79	£79	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£470	£92	£377
Total cost of uses	£470	£92	£378
Delivered energy	22 kWh/m ²	4 kWh/m ²	17 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.2 tonnes
CO2 emissions per m ²	11 kg/m ²	2 kg/m ²	9 kg/m ²
Primary energy	67 kWh/m ²	13 kWh/m ²	54 kWh/m ²

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	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (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	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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					
Window (Uw = 1.20)			24.0800	1.1450	27.5725		(27)					
French Door (Uw = 1.40)			6.3000	1.3258	8.3523		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500 (28a)					
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960 (29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500 (30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.7598		(33)					
1F Timber			134.4400			9.0000	1209.9600 (32c)					
GF Masonry			62.6400			39.0000	2442.9600 (32c)					
GF Timber			31.1400			9.0000	280.2600 (32c)					
Internal Floor			63.6500			12.6000	801.9900 (32d)					
Internal Ceiling			63.6500			9.0000	572.8500 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17825.9160 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.0308 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8591 (36)					
Total fabric heat loss						(33) + (36) =	90.6189 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.6964	Feb 54.1542	Mar 54.0866	Apr 54.0866	May 54.0866	Jun 54.0866	Jul 54.0866	Aug 54.0866	Sep 54.0866	Oct 54.0866	Nov 54.0866	Dec 54.0866 (38)
Heat transfer coeff	145.3153	144.7731	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055 (39)
Average = Sum(39)m / 12 =												144.7619 (39)
HLP	Jan 1.1415	Feb 1.1373	Mar 1.1367	Apr 1.1367	May 1.1367	Jun 1.1367	Jul 1.1367	Aug 1.1367	Sep 1.1367	Oct 1.1367	Nov 1.1367	Dec 1.1367 (40)
HLP (average)												1.1372 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy conte	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Energy content (annual)										Total = Sum (45)m =		1617.1494 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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												
	217.0406	191.2382	199.3002	172.9541	163.1664	144.4096	137.5697	153.4316	159.9195	184.9608	197.3080	211.7502 (62)
WWHRS	-52.8549	-46.5072	-47.4657	-39.0426	-36.2462	-29.8974	-25.2960	-30.6300	-31.5268	-38.9810	-45.1649	-51.0891 eq. (G10)
Total of WWHRS savings												-474.7017
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												1.5875 (H8)
Utilisation factor												0.4674 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.7813 (H14)
Volume ratio Veff/V												0.7297 (H15)
Solar storage volume factor												0.9370 (H16)
Solar input												-698.3415 (H17)
Solar input	-20.2505	-33.7923	-57.5521	-77.1312	-95.2891	-93.6844	-92.4463	-80.7708	-63.2597	-43.1989	-24.0200	-16.9462 (63)
Solar input (sum of months) = Sum(63)m =												-698.3415 (63)
Output from w/h												
	143.9351	110.9388	94.2824	56.7804	31.6311	20.8279	19.8274	42.0308	65.1331	102.7808	128.1232	143.7149 (64)
Total per year (kWh/year) = Sum(64)m =												960.0058 (64)
Heat gains from water heating, kWh/month												
	95.2497	84.4365	88.6985	76.6890	71.3551	64.4616	62.7355	68.4446	72.9864	83.9306	87.9439	93.4906 (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	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.6230	58.2857	47.4012	35.8857	26.8250	22.6468	24.4707	31.8079	42.6925	54.2079	63.2686	67.4468	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	439.4568	444.0170	432.5255	408.0614	377.1799	348.1556	328.7656	324.2054	335.6969	360.1610	391.0425	420.0668	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	(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)													
	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	(71)
Water heating gains (Table 5)													
	128.0237	125.6495	119.2184	106.5124	95.9075	89.5300	84.3219	91.9954	101.3700	112.8099	122.1444	125.6594	(72)
Total internal gains													
	746.0696	740.9183	712.1111	663.4256	612.8784	573.2984	550.5242	560.9747	592.7255	640.1449	689.4216	726.1391	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					11.3500	10.6334		0.4600	0.0000		0.7700		42.7480 (74)	
East					3.7500	19.6403		0.4600	0.0000		0.7700		26.0872 (76)	
South					6.9200	46.7521		0.4600	0.0000		0.7700		114.5923 (78)	
West					2.0600	19.6403		0.4600	0.0000		0.7700		14.3306 (80)	
South					6.3000	46.7521		0.4300	0.0000		0.7700		97.5215 (78)	
Solar gains	295.2796	508.1472	711.5379	913.0128	1054.2730	1061.3539	1017.0803	908.9198	780.5976	565.7541	354.5586	252.1603	(83)	
Total gains	1041.3492	1249.0655	1423.6490	1576.4384	1667.1514	1634.6523	1567.6045	1469.8945	1373.3231	1205.8990	1043.9802	978.2995	(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	34.0752	34.2028	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	
alpha	3.2717	3.2802	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	
util living area	0.9632	0.9356	0.8888	0.8049	0.6788	0.5248	0.3933	0.4338	0.6334	0.8432	0.9405	0.9692	(86)
Tweekday	17.8405	18.2629	18.7891	19.3322	19.7213	19.9093	19.9587	19.9527	19.8432	19.3388	18.4853	17.7437	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekend	19.9565	20.1471	20.3888	20.6462	20.8429	20.9499	20.9853	20.9794	20.9056	20.6418	20.2444	19.9117
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	19.3895	19.6807	20.0566	20.4476	20.7575	20.9231	20.9772	20.9683	20.8526	20.4471	19.8201	19.3204 (87)
Th 2	19.9671	19.9705	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710 (88)
util rest of house												
	0.9565	0.9244	0.8700	0.7726	0.6278	0.4528	0.3065	0.3441	0.5627	0.8092	0.9282	0.9636 (89)
Tweekday	17.8405	18.2629	18.7891	19.3322	19.7213	19.9093	19.9587	19.9527	19.8432	19.3388	18.4853	17.7437
Tweekend	17.8405	18.2629	18.7891	19.3322	19.7213	19.9093	19.9587	19.9527	19.8432	19.3388	18.4853	17.7437
MIT 2	17.8405	18.2629	18.7891	19.3322	19.7213	19.9093	19.9587	19.9527	19.8432	19.3388	18.4853	17.7437 (90)
Living area fraction									fLA = Living area / (4) =			0.1342 (91)
MIT	18.0484	18.4533	18.9592	19.4820	19.8604	20.0454	20.0955	20.0890	19.9787	19.4876	18.6645	17.9553 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0484	18.4533	18.9592	19.4820	19.8604	20.0454	20.0955	20.0890	19.9787	19.4876	18.6645	17.9553 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9395	0.9034	0.8477	0.7552	0.6219	0.4582	0.3173	0.3547	0.5632	0.7905	0.9078	0.9481 (94)
Useful gains	978.3027	1128.4297	1206.7742	1190.4661	1036.8816	749.0310	497.3752	521.4151	773.5013	953.2175	947.7167	927.5045 (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	1997.8598	1962.1465	1802.9212	1531.2666	1180.8585	787.9777	505.8151	533.8248	850.6790	1286.0819	1673.4486	1990.4739 (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	758.5505	560.2577	443.5334	245.3764	107.1188	0.0000	0.0000	0.0000	0.0000	247.6511	522.5270	790.8492 (98)
Space heating												3675.8640 (98)
Space heating per m2										(98) / (4) =		28.8756 (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 %)												263.7856 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1393.5043 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	758.5505	560.2577	443.5334	245.3764	107.1188	0.0000	0.0000	0.0000	0.0000	247.6511	522.5270	790.8492 (98)
Space heating efficiency (main heating system 1)	263.7856	263.7856	263.7856	263.7856	263.7856	0.0000	0.0000	0.0000	0.0000	263.7856	263.7856	263.7856 (210)
Space heating fuel (main heating system)	287.5632	212.3913	168.1416	93.0211	40.6083	0.0000	0.0000	0.0000	0.0000	93.8835	198.0877	299.8075 (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	143.9351	110.9388	94.2824	56.7804	31.6311	20.8279	19.8274	42.0308	65.1331	102.7808	128.1232	143.7149 (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	84.5285	65.1508	55.3690	33.3453	18.5760	12.2315	11.6440	24.6834	38.2506	60.3599	75.2426	84.3992 (219)
Water heating fuel used												563.7807 (219)
Annual totals kWh/year												
Space heating fuel - main system												1393.5043 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.7530 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												141.7530 (231)
Electricity for lighting (calculated in Appendix L)												463.5689 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												835.3675 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1393.5043	13.1900	183.8032 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	563.7807	13.1900	74.3627 (247)
Mechanical ventilation fans	91.7530	13.1900	12.1022 (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	463.5689	13.1900	61.1447 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Total energy cost 110.1850 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 0.2686 (257)
 SAP value 96.2532
 SAP rating (Section 12) 96 (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	1393.5043	0.5190	723.2287	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	563.7807	0.5190	292.6022	(264)
Space and water heating			1015.8309	(265)
Pumps and fans	141.7530	0.5190	73.5698	(267)
Energy for lighting	463.5689	0.5190	240.5923	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			433.5557	(272)
CO2 emissions per m2			3.4100	(273)
EI value			96.6282	
EI rating			97	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.6500 (1b)	x 2.5400 (2b)	= 161.6710 (1b) - (3b)
First floor	63.6500 (1c)	x 2.6100 (2c)	= 166.1265 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.7975 (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															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (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																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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					
Window (Uw = 1.20)			24.0800	1.1450	27.5725		(27)					
French Door (Uw = 1.40)			6.3000	1.3258	8.3523		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.6500	0.1100	7.0015	75.0000	4773.7500 (28a)					
100mm Knauf Supafil 34	168.3500	32.5300	135.8200	0.2500	33.9550	52.8000	7171.2960 (29a)					
Plane Ceiling-500mm Loft Roll	63.6500		63.6500	0.0900	5.7285	9.0000	572.8500 (30)					
Total net area of external elements Aum(A, m2)			295.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.7598		(33)					
1F Timber			134.4400			9.0000	1209.9600 (32c)					
GF Masonry			62.6400			39.0000	2442.9600 (32c)					
GF Timber			31.1400			9.0000	280.2600 (32c)					
Internal Floor			63.6500			12.6000	801.9900 (32d)					
Internal Ceiling			63.6500			9.0000	572.8500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17825.9160 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.0308 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8591 (36)					
Total fabric heat loss						(33) + (36) =	90.6189 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.0866	Feb 54.0866	Mar 54.0866	Apr 54.0866	May 54.0866	Jun 54.0866	Jul 54.0866	Aug 54.0866	Sep 54.0866	Oct 54.0866	Nov 54.0866	Dec 54.0866 (38)
Heat transfer coeff	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055	144.7055 (39)
Average = Sum(39)m / 12 =												144.7055 (39)
HLP	Jan 1.1367	Feb 1.1367	Mar 1.1367	Apr 1.1367	May 1.1367	Jun 1.1367	Jul 1.1367	Aug 1.1367	Sep 1.1367	Oct 1.1367	Nov 1.1367	Dec 1.1367 (40)
HLP (average)												1.1367 (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												2.8876 (42)
Average daily hot water use (litres/day)												102.7813 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	113.0594	108.9481	104.8369	100.7256	96.6144	92.5031	92.5031	96.6144	100.7256	104.8369	108.9481	113.0594 (44)
Energy content (annual)	167.6638	146.6398	151.3192	131.9237	126.5839	109.2323	101.2198	116.1512	117.5384	136.9797	149.5240	162.3734 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1496	21.9960	22.6979	19.7886	18.9876	16.3848	15.1830	17.4227	17.6308	20.5470	22.4286	24.3560 (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	217.0406	191.2382	199.3002	172.9541	163.1664	144.4096	137.5697	153.4316	159.9195	184.9608	197.3080	211.7502 (62)
WWHRS	-52.8549	-46.5072	-47.4657	-39.0426	-36.2462	-29.8974	-25.2960	-30.6300	-31.5268	-38.9810	-45.1649	-51.0891 eq. (G10)
Total of WWHRS savings												-474.7017
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												1.6765 (H8)
Utilisation factor												0.4492 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.7813 (H14)
Volume ratio Veff/V												0.7297 (H15)
Solar storage volume factor												0.9370 (H16)
Solar input												-708.9204 (H17)
Solar input	-21.8202	-32.7957	-55.2322	-76.3478	-91.9484	-96.7717	-94.4480	-84.3427	-65.8297	-44.7827	-26.5230	-18.0782 (63)
Output from w/h	142.3654	111.9353	96.6023	57.5638	34.9718	17.7405	17.8257	38.4589	62.5630	101.1970	125.6201	142.5830 (64)
Heat gains from water heating, kWh/month	95.2497	84.4365	88.6985	76.6890	71.3551	64.4616	62.7355	68.4446	72.9864	83.9306	87.9439	93.4906 (65)
												949.4269 (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	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	173.2579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.6230	58.2857	47.4012	35.8857	26.8250	22.6468	24.4707	31.8079	42.6925	54.2079	63.2686	67.4468	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.4568	444.0170	432.5255	408.0614	377.1799	348.1556	328.7656	324.2054	335.6969	360.1610	391.0425	420.0668	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	55.2134	(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)	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	-115.5053	(71)
Water heating gains (Table 5)	128.0237	125.6495	119.2184	106.5124	95.9075	89.5300	84.3219	91.9954	101.3700	112.8099	122.1444	125.6594	(72)
Total internal gains	746.0696	740.9183	712.1111	663.4256	612.8784	573.2984	550.5242	560.9747	592.7255	640.1449	689.4216	726.1391	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					11.3500	11.9814	0.4600	0.0000			0.7700			48.1674 (74)
East					3.7500	22.3313	0.4600	0.0000			0.7700			29.6616 (76)
South					6.9200	50.9848	0.4600	0.0000			0.7700			124.9671 (78)
West					2.0600	22.3313	0.4600	0.0000			0.7700			16.2941 (80)
South					6.3000	50.9848	0.4300	0.0000			0.7700			106.3508 (78)
Solar gains	325.4409	504.4179	700.1326	931.5903	1053.5359	1137.4968	1077.2742	980.3889	834.4619	600.2084	400.3989	275.2163	(83)	
Total gains	1071.5105	1245.3362	1412.2436	1595.0159	1666.4143	1710.7952	1627.7983	1541.3636	1427.1874	1240.3533	1089.8205	1001.3554	(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	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188	34.2188
alpha	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813	3.2813
util living area	0.9548	0.9287	0.8747	0.7691	0.6134	0.4081	0.2727	0.2963	0.5408	0.8005	0.9223	0.9621 (86)
Tweekday	18.0789	18.4100	18.9486	19.4857	19.8266	19.9531	19.9694	19.9687	19.9137	19.5186	18.7324	17.9827

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Tweekend	20.0622	20.2133	20.4622	20.7215	20.9006	20.9813	20.9965	20.9954	20.9505	20.7304	20.3571	20.0184
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	19.5527	19.7831	20.1700	20.5651	20.8466	20.9713	20.9946	20.9929	20.9226	20.5839	19.9961	19.4851 (87)
Th 2	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710 (88)
util rest of house												
	0.9463	0.9161	0.8527	0.7307	0.5532	0.3296	0.1835	0.2029	0.4596	0.7573	0.9060	0.9548 (89)
Tweekday	18.0789	18.4100	18.9486	19.4857	19.8266	19.9531	19.9694	19.9687	19.9137	19.5186	18.7324	17.9827
Tweekend	18.0789	18.4100	18.9486	19.4857	19.8266	19.9531	19.9694	19.9687	19.9137	19.5186	18.7324	17.9827
MIT 2	18.0789	18.4100	18.9486	19.4857	19.8266	19.9531	19.9694	19.9687	19.9137	19.5186	18.7324	17.9827 (90)
Living area fraction									fLA = Living area / (4) =			0.1342 (91)
MIT	18.2767	18.5944	19.1126	19.6306	19.9636	20.0898	20.1070	20.1062	20.0492	19.6616	18.9020	18.1844 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2767	18.5944	19.1126	19.6306	19.9636	20.0898	20.1070	20.1062	20.0492	19.6616	18.9020	18.1844 (93)

8. Space heating requirement

Utilisation	Jan 0.9278	Feb 0.8946	Mar 0.8309	Apr 0.7166	May 0.5528	Jun 0.3389	Jul 0.1954	Aug 0.2154	Sep 0.4661	Oct 0.7424	Nov 0.8844	Dec 0.9377 (94)
Useful gains	994.1155	1114.0362	1173.4761	1142.9986	921.1707	579.7994	318.1394	331.9905	665.2327	920.8324	963.8569	938.9321 (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	1906.7462	1880.3572	1694.8735	1408.0762	1007.6648	591.8152	319.3668	333.7186	701.6989	1166.5598	1577.5853	1893.3779 (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	678.9973	514.9677	387.9197	190.8558	64.3516	0.0000	0.0000	0.0000	0.0000	182.8212	441.8845	710.1077 (98)
Space heating												3171.9056 (98)
Space heating per m2											(98) / (4) =	24.9168 (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 %)												263.7858 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1202.4550 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	678.9973	514.9677	387.9197	190.8558	64.3516	0.0000	0.0000	0.0000	0.0000	182.8212	441.8845	710.1077 (98)
Space heating efficiency (main heating system 1)	263.7858	263.7858	263.7858	263.7858	263.7858	0.0000	0.0000	0.0000	0.0000	263.7858	263.7858	263.7858 (210)
Space heating fuel (main heating system)	257.4048	195.2219	147.0586	72.3526	24.3954	0.0000	0.0000	0.0000	0.0000	69.3067	167.5164	269.1986 (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	142.3654	111.9353	96.6023	57.5638	34.9718	17.7405	17.8257	38.4589	62.5630	101.1970	125.6201	142.5830 (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	83.6067	65.7360	56.7314	33.8054	20.5378	10.4184	10.4685	22.5857	36.7413	59.4298	73.7727	83.7344 (219)
Water heating fuel used												557.5681 (219)
Annual totals kWh/year												
Space heating fuel - main system												1202.4550 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.7530 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												141.7530 (231)
Electricity for lighting (calculated in Appendix L)												463.5689 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596 (233)
Total delivered energy for all uses												541.1853 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1202.4550	16.9600	203.9364 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	557.5681	16.9600	94.5635 (247)
Mechanical ventilation fans	91.7530	16.9600	15.5613 (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	463.5689	16.9600	78.6213 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Total energy cost 91.7850 (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	1202.4550	0.5190	624.0741 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	557.5681	0.5190	289.3778 (264)
Space and water heating			913.4520 (265)
Pumps and fans	141.7530	0.5190	73.5698 (267)
Energy for lighting	463.5689	0.5190	240.5923 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			280.8752 (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	1202.4550	3.0700	3691.5369 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	557.5681	3.0700	1711.7340 (264)
Space and water heating			5403.2708 (265)
Pumps and fans	141.7530	3.0700	435.1817 (267)
Energy for lighting	463.5689	3.0700	1423.1565 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1661.4389 (272)
Primary energy kWh/m2/year			13.0514 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	140.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	432.69 (P1)
Transmission heat loss coefficient	90.62 (37)
Summer heat loss coefficient	523.31 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
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	11.3500	81.1852	0.4600	0.0000	0.9000	381.4810
East	3.7500	117.5071	0.4600	0.0000	0.9000	182.4297
South	6.9200	112.2060	0.4600	0.0000	0.9000	321.4567
West	2.0600	117.5071	0.4600	0.0000	0.9000	100.2147
South	6.3000	112.2060	0.4300	0.0000	0.9000	273.5694
total:						1259.1516

Solar gains	Jun 1330	Jul 1259	Aug 1146	(P4)
Internal gains	587	565	574	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total summer gains	1917	1824	1720	(P5)
Summer gain/loss ratio	3.66	3.48	3.29	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 140.0)	1.02	1.02	1.02	
Threshold temperature	20.68	22.40	22.11	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			