

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Harcourt - Semi (ASHP+PV)				Issued on Date	15/12/2022
Assessment Reference	Harcourt - Semi (ASHP+PV)	Prop Type Ref				
Property	Plot, 2 Bed, K, WC, B					
SAP Rating		93 A	DER	9.48	TER	28.45
Environmental		94 A	% DER<TER	66.68		
CO ₂ Emissions (t/year)		0.39	DFEE	40.45	TFEE	51.48
General Requirements Compliance		Pass	% DFEE<TFEE	21.42		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 60 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 28.45 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.48 kgCO₂/m²OK

1b TFEE and DFEE

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

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

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM 8kW VWL 85/3 A 230v

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

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

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)	
Specific fan power:	0.1700 0.1800
Maximum	0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
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Based on:

Overshading:	Average
Windows facing North East:	3.56 m ² , No overhang
Windows facing South East:	0.66 m ² , No overhang
Windows facing South West:	5.55 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Window U-value	0.90 W/m ² K
Thermal bridging y-value	0.031 W/m ² K
Photovoltaic array	1.20 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											4.0100		
Number of sides sheltered											0.2005 (18)		
											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

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Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
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	182.3117	160.8641	169.3526	152.3818	149.7409	134.3906	129.6305	141.4691	140.9762	157.9833	166.3365	178.1171 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	140.8453	124.3845	132.1174	121.7086	121.2409	110.8659	109.6961	117.3415	116.1558	127.3270	130.8619	138.0463 (64)
Heat gains from water heating, kWh/month	83.7023	74.3371	79.3934	73.0060	72.8725	67.0239	66.1858	70.1221	69.2136	75.6131	77.6459	82.3076 (65)
Total per year (kWh/year) = Sum (64)m =												1490.5912 (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	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	112.5031	110.6206	106.7115	101.3972	97.9469	93.0887	88.9594	94.2502	96.1300	101.6305	107.8415	110.6285 (72)
Total internal gains	355.3028	353.4207	342.2917	324.4718	306.5812	289.2172	277.8675	283.1579	292.2576	310.2637	330.9150	346.2078 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast						3.5600	11.2829	0.4600	0.0000	0.7700	14.2272 (75)	
Southeast						0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (77)	
Southwest						2.4000	36.7938	0.4600	0.0000	0.7700	31.2777 (79)	
Southwest						3.1500	36.7938	0.4300	0.0000	0.7700	38.3747 (79)	

Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876 (83)
Total gains	447.7838	515.6758	576.8485	636.1388	674.8782	663.2980	635.0060	596.7564	553.3148	492.9745	442.5465	424.7954 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9764	0.9601	0.9277	0.8587	0.7383	0.5771	0.4347	0.4782	0.6945	0.8883	0.9608	0.9803 (86)
Tweekday	18.0834	18.3997	18.8646	19.3882	19.7808	19.9679	20.0139	20.0084	19.8996	19.4058	18.6411	17.9939
Tweekend	20.0536	20.1960	20.4073	20.6522	20.8482	20.9543	20.9875	20.9822	20.9088	20.6545	20.3025	20.0135
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	19.5394	19.7563	20.0853	20.4569	20.7657	20.9298	20.9808	20.9725	20.8576	20.4668	19.9109	19.4774 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9717	0.9524	0.9136	0.8312	0.6895	0.5034	0.3439	0.3849	0.6249	0.8602	0.9518	0.9763 (89)
Tweekday	18.0834	18.3997	18.8646	19.3882	19.7808	19.9679	20.0139	20.0084	19.8996	19.4058	18.6411	17.9939
Tweekend	18.0834	18.3997	18.8646	19.3882	19.7808	19.9679	20.0139	20.0084	19.8996	19.4058	18.6411	17.9939
MIT 2	18.0834	18.3997	18.8646	19.3882	19.7808	19.9679	20.0139	20.0084	19.8996	19.4058	18.6411	17.9939 (90)
Living area fraction									fLA = Living area / (4) =			0.1811 (91)
MIT	18.3472	18.6454	19.0858	19.5818	19.9592	20.1421	20.1890	20.1831	20.0731	19.5980	18.8711	18.2626 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3472	18.6454	19.0858	19.5818	19.9592	20.1421	20.1890	20.1831	20.0731	19.5980	18.8711	18.2626 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9607	0.9381	0.8969	0.8168	0.6860	0.5128	0.3596	0.4006	0.6287	0.8456	0.9378	0.9663	(94)
Useful gains	430.1663	483.7578	517.3704	519.6164	462.9741	340.1072	228.3698	239.0536	347.8594	416.8500	414.9984	410.4975	(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													
Month fracti	908.3290	888.8186	813.8295	690.7157	534.0636	358.3701	232.0764	244.6248	386.2388	581.8345	761.1550	909.3261	(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	355.7530	272.2008	220.5656	123.1915	52.8905	0.0000	0.0000	0.0000	0.0000	122.7485	249.2327	371.1285	(98)
Space heating per m2												1767.7113	(98)
											(98) / (4) =	29.2958	(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 %)													199.0158	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													888.2265	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	355.7530	272.2008	220.5656	123.1915	52.8905	0.0000	0.0000	0.0000	0.0000	122.7485	249.2327	371.1285	(98)	
Space heating efficiency (main heating system 1)	199.0158	199.0158	199.0158	199.0158	199.0158	0.0000	0.0000	0.0000	0.0000	199.0158	199.0158	199.0158	(210)	
Space heating fuel (main heating system)	178.7561	136.7735	110.8282	61.9004	26.5760	0.0000	0.0000	0.0000	0.0000	61.6778	125.2326	186.4819	(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	140.8453	124.3845	132.1174	121.7086	121.2409	110.8659	109.6961	117.3415	116.1558	127.3270	130.8619	138.0463	(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	82.7140	73.0470	77.5883	71.4756	71.2009	65.1080	64.4210	68.9109	68.2146	74.7751	76.8510	81.0702	(219)	
Water heating fuel used													875.3766	(219)
Annual totals kWh/year														
Space heating fuel - main system													888.2265	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													41.3203	(230a)
Total electricity for the above, kWh/year													41.3203	(231)
Electricity for lighting (calculated in Appendix L)													284.8198	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192			-988.0192	(233)
Total delivered energy for all uses													1101.7240	(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	888.2265	0.5190	460.9896	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	875.3766	0.5190	454.3204	(264)
Space and water heating			915.3100	(265)
Pumps and fans	41.3203	0.5190	21.4452	(267)
Energy for lighting	284.8198	0.5190	147.8215	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total CO2, kg/year			571.7947	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.4800	(273)

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

DER			9.4800	ZC1
Total Floor Area		TFA	60.3400	
Assumed number of occupants		N	1.9912	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.0687	ZC2
CO2 emissions from cooking, equation (L16)			2.7642	ZC3
Total CO2 emissions			29.3128	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			29.3128	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000	/ (5) =	0.1347 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3847 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3559 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4538	0.4449	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182	(22b)				
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5801	0.5874	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			9.7700	1.3258	12.9527		(27)					
FP McCann System			30.1700	0.1300	3.9221		(28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.1800	11.6658		(29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.1300	3.9221		(30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4427		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0612 (36)					
Total fabric heat loss						(33) + (36) =	42.5039 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.5346	29.3388	29.1469	28.2454	28.0767	27.2915	27.2915	27.1461	27.5940	28.0767	28.4179	28.7747 (38)
Heat transfer coeff	72.0385	71.8427	71.6508	70.7492	70.5806	69.7954	69.7954	69.6500	70.0978	70.5806	70.9218	71.2785 (39)
Average = Sum(39)m / 12 =												70.7484 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1939	1.1906	1.1875	1.1725	1.1697	1.1567	1.1567	1.1543	1.1617	1.1697	1.1754	1.1813 (40)
HLP (average)												1.1725 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	183.8610	162.2634	170.9019	153.8811	151.2902	135.8899	131.1798	143.0184	142.4755	159.5326	167.8358	179.6664 (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	183.8610	162.2634	170.9019	153.8811	151.2902	135.8899	131.1798	143.0184	142.4755	159.5326	167.8358	179.6664 (64)
Heat gains from water heating, kWh/month	84.9417	75.4565	80.6328	74.2054	74.1119	68.2233	67.4252	71.3616	70.4130	76.8525	78.8453	83.5470 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	(71)
Water heating gains (Table 5)	114.1690	112.2865	108.3774	103.0631	99.6128	94.7546	90.6253	95.9161	97.7959	103.2964	109.5074	112.2944	(72)
Total internal gains	359.9687	358.0866	346.9576	329.1377	311.2471	293.8831	282.5334	287.8238	296.9235	314.9295	335.5809	350.8737	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				3.5600	11.2829	0.6300	0.7000	0.7700		12.2756 (75)		
Southeast				0.6600	36.7938	0.6300	0.7000	0.7700		7.4215 (77)		
Southwest				5.5500	36.7938	0.6300	0.7000	0.7700		62.4079 (79)		
Solar gains	82.1051	143.9328	207.7656	275.5852	325.2481	330.1846	315.3000	277.1350	231.0765	161.9966	99.0855	69.7843 (83)
Total gains	442.0738	502.0194	554.7232	604.7229	636.4953	624.0677	597.8334	564.9588	528.0001	476.9261	434.6664	420.6580 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.1672	58.3257	58.4820	59.2272	59.3687	60.0366	60.0366	60.1619	59.7776	59.3687	59.0831	58.7874
alpha	4.8778	4.8884	4.8988	4.9485	4.9579	5.0024	5.0024	5.0108	4.9852	4.9579	4.9389	4.9192
util living area	0.9952	0.9904	0.9779	0.9398	0.8447	0.6717	0.5046	0.5523	0.7944	0.9553	0.9901	0.9962 (86)
MIT	19.8217	19.9811	20.2325	20.5540	20.8158	20.9572	20.9916	20.9870	20.9002	20.5682	20.1395	19.7953 (87)
Th 2	19.9249	19.9275	19.9301	19.9421	19.9443	19.9548	19.9548	19.9567	19.9508	19.9443	19.9398	19.9350 (88)
util rest of house	0.9936	0.9872	0.9703	0.9186	0.7928	0.5795	0.3895	0.4345	0.7136	0.9351	0.9863	0.9950 (89)
MIT 2	18.3727	18.6059	18.9700	19.4297	19.7687	19.9273	19.9518	19.9516	19.8749	19.4592	18.8462	18.3414 (90)
Living area fraction										fLA = Living area / (4) =		0.1811 (91)
MIT	18.6352	18.8550	19.1987	19.6333	19.9584	20.1138	20.1401	20.1392	20.0606	19.6601	19.0805	18.6048 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6352	18.8550	19.1987	19.6333	19.9584	20.1138	20.1401	20.1392	20.0606	19.6601	19.0805	18.6048 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	438.0144	493.3482	534.4539	550.9360	505.0907	370.9362	245.3324	257.5070	381.8008	442.6280	426.7695	417.5616	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1032.6835	1002.5652	909.8722	759.3739	582.8825	384.8397	247.0856	260.4326	417.8285	639.4663	849.6765	1026.7517	(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	442.4338	342.1939	279.3112	150.0753	57.8771	0.0000	0.0000	0.0000	0.0000	146.4477	304.4930	453.2374	(98)
Space heating													(98)
Space heating per m2													(98) / (4) =

8c. Space cooling requirement

Not applicable

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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												2327.3470 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	442.4338	342.1939	279.3112	150.0753	57.8771	0.0000	0.0000	0.0000	0.0000	146.4477	304.4930	453.2374 (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)	473.1912	365.9828	298.7286	160.5083	61.9006	0.0000	0.0000	0.0000	0.0000	156.6286	325.6610	484.7459 (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	183.8610	162.2634	170.9019	153.8811	151.2902	135.8899	131.1798	143.0184	142.4755	159.5326	167.8358	179.6664 (64)
Efficiency of water heater (217)m	87.0725	86.7581	86.1167	84.7472	82.4990	79.8000	79.8000	79.8000	79.8000	84.5866	86.3842	79.8000 (216)
Fuel for water heating, kWh/month	211.1584	187.0296	198.4537	181.5766	183.3843	170.2881	164.3857	179.2210	178.5407	188.6027	194.2899	206.0831 (219)
Water heating fuel used												2243.0139 (219)
Annual totals kWh/year												
Space heating fuel - main system												2327.3470 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												284.8198 (232)
Total delivered energy for all uses												4930.1807 (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	2327.3470	0.2160	502.7070 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2243.0139	0.2160	484.4910 (264)
Space and water heating			987.1980 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Total CO2, kg/m2/year			1173.9445 (272)
Emissions per m2 for space and water heating			16.3606 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4498 (272b)
Emissions per m2 for pumps and fans			0.6451 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3606 * 1.55) + 2.4498 + 0.6451, rounded to 2 d.p.			28.4500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3352 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3101 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2868	0.3101	0.3334	0.3489	0.3644 (22b)
Effective ac	0.5782	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)
Total net area of external elements Aum(A, m ²)			136.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			59.3600			9.0000	534.2400 (32c)
Timber FF			59.4200			9.0000	534.7800 (32c)
Internal Floor			30.1700			12.6000	380.1420 (32d)
Internal Ceiling			30.1700			9.0000	271.5300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9313.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							154.3444 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)
Total fabric heat loss							(33) + (36) = 40.1708 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.3206	28.1719	28.0262	27.3417	27.2136	26.6175	26.6175	26.5071	26.8471	27.2136	27.4727	27.7435 (38)
Heat transfer coeff	68.4913	68.3426	68.1969	67.5125	67.3844	66.7883	66.7883	66.6779	67.0179	67.3844	67.6435	67.9143 (39)
Average = Sum(39)m / 12 =												67.5119 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1351	1.1326	1.1302	1.1189	1.1167	1.1069	1.1069	1.1050	1.1107	1.1167	1.1210	1.1255 (40)
HLP (average)												1.1189 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1282.1824 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.2487	24.7065	25.4949	22.2270	21.3274	18.4039	17.0539	19.5696	19.8033	23.0789	25.1924	27.3573 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	(71)
Water heating gains (Table 5)	37.9686	36.7656	34.2673	30.8709	28.6658	25.5610	22.9219	26.3032	27.5046	31.0200	34.9895	36.7706	(72)
Total internal gains	280.7684	279.5656	269.8475	253.9455	237.3002	221.6895	211.8300	215.2110	223.6323	239.6532	258.0629	272.3499	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			3.5600		11.2829		0.4600		0.0000		0.7700		14.2272 (75)
Southeast			0.6600		36.7938		0.4600		0.0000		0.7700		8.6014 (77)
Southwest			2.4000		36.7938		0.4600		0.0000		0.7700		31.2777 (79)
Southwest			3.1500		36.7938		0.4300		0.0000		0.7700		38.3747 (79)
Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315		78.5876 (83)
Total gains	373.2494	441.8207	504.4043	565.6125	605.5971	595.7703	568.9685	528.8095	484.6895	422.3640	369.6944		350.9375 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7710	37.8531	37.9340	38.3186	38.3914	38.7341	38.7341	38.7982	38.6014	38.3914	38.2444	38.0919
alpha	3.5181	3.5235	3.5289	3.5546	3.5594	3.5823	3.5823	3.5865	3.5734	3.5594	3.5496	3.5395
util living area	0.9868	0.9756	0.9522	0.8975	0.7938	0.6385	0.4919	0.5424	0.7626	0.9272	0.9776	0.9893 (86)
MIT	19.2628	19.4998	19.8593	20.3043	20.6715	20.8939	20.9684	20.9551	20.7908	20.3041	19.6986	19.2174 (87)
Th 2	19.9723	19.9743	19.9762	19.9855	19.9872	19.9952	19.9952	19.9967	19.9921	19.9872	19.9837	19.9800 (88)
util rest of house	0.9840	0.9704	0.9419	0.8748	0.7480	0.5610	0.3895	0.4386	0.6954	0.9062	0.9720	0.9870 (89)
MIT 2	18.3904	18.6261	18.9804	19.4149	19.7498	19.9363	19.9837	19.9789	19.8617	19.4249	18.8322	18.3512 (90)
Living area fraction	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081 (91)
MIT	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081 (92)
Temperature adjustment	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081 (93)
adjusted MIT	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9787	0.9627	0.9313	0.8640	0.7444	0.5704	0.4072	0.4559	0.6982	0.8959	0.9647	0.9825 (94)
Useful gains	365.3082	425.3282	469.7664	488.6641	450.8322	339.8491	231.6972	241.0892	338.4169	378.3940	356.6564	344.7805 (95)
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	975.8967	948.8920	861.9839	720.7607	553.6831	367.9861	237.9019	250.4231	397.4180	605.3922	804.2200	971.7221 (97)
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	454.2778	351.8349	291.8098	167.1095	76.5210	0.0000	0.0000	0.0000	0.0000	168.8866	322.2457	466.4445 (98)
Space heating												2299.1299 (99)
Space heating per m2										(98) / (4) =		38.1029 (99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											2 * 10 =	20.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										20.0000	/ (5) =	0.1347 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3847 (18)		
Number of sides sheltered												1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3559 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
Adj infilt rate	0.4538	0.4449	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182 (22b)		
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5801	0.5874 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			9.7700	1.3258	12.9527		(27)					
FP McCann System			30.1700	0.1300	3.9221		(28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.1800	11.6658		(29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.1300	3.9221		(30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4427		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0612 (36)					
Total fabric heat loss						(33) + (36) =	42.5039 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5346	Feb 29.3388	Mar 29.1469	Apr 28.2454	May 28.0767	Jun 27.2915	Jul 27.2915	Aug 27.1461	Sep 27.5940	Oct 28.0767	Nov 28.4179	Dec 28.7747 (38)
Heat transfer coeff	72.0385	71.8427	71.6508	70.7492	70.5806	69.7954	69.7954	69.6500	70.0978	70.5806	70.9218	71.2785 (39)
Average = Sum(39)m / 12 =												70.7484 (39)
HLP	Jan 1.1939	Feb 1.1906	Mar 1.1875	Apr 1.1725	May 1.1697	Jun 1.1567	Jul 1.1567	Aug 1.1543	Sep 1.1617	Oct 1.1697	Nov 1.1754	Dec 1.1813 (40)
HLP (average)												1.1725 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	28.2487	24.7065	25.4949	22.2270	21.3274	18.4039	17.0539	19.5696	19.8033	23.0789	25.1924	27.3573 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	37.9686	36.7656	34.2673	30.8709	28.6658	25.5610	22.9219	26.3032	27.5046	31.0200	34.9895	36.7706 (72)
Total internal gains	280.7684	279.5656	269.8475	253.9455	237.3002	221.6895	211.8300	215.2110	223.6323	239.6532	258.0629	272.3499 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				3.5600	11.2829	0.6300		0.7000		0.7700		12.2756 (75)
Southeast				0.6600	36.7938	0.6300		0.7000		0.7700		7.4215 (77)
Southwest				5.5500	36.7938	0.6300		0.7000		0.7700		62.4079 (79)
Solar gains	82.1051	143.9328	207.7656	275.5852	325.2481	330.1846	315.3000	277.1350	231.0765	161.9966	99.0855	69.7843 (83)
Total gains	362.8734	423.4984	477.6131	529.5307	562.5483	551.8740	527.1300	492.3460	454.7088	401.6497	357.1484	342.1342 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.1672	58.3257	58.4820	59.2272	59.3687	60.0366	60.0366	60.1619	59.7776	59.3687	59.0831	58.7874
alpha	4.8778	4.8884	4.8988	4.9485	4.9579	5.0024	5.0024	5.0108	4.9852	4.9579	4.9389	4.9192
util living area	0.9980	0.9953	0.9879	0.9624	0.8893	0.7349	0.5656	0.6222	0.8575	0.9766	0.9958	0.9985 (86)
MIT	19.7016	19.8642	20.1233	20.4630	20.7579	20.9361	20.9861	20.9781	20.8544	20.4699	20.0237	19.6754 (87)
Th 2	19.9249	19.9275	19.9301	19.9421	19.9443	19.9548	19.9548	19.9567	19.9508	19.9443	19.9398	19.9350 (88)
util rest of house	0.9973	0.9937	0.9834	0.9478	0.8459	0.6428	0.4399	0.4950	0.7872	0.9647	0.9940	0.9980 (89)
MIT 2	18.7457	18.9097	19.1686	19.5091	19.7799	19.9253	19.9513	19.9505	19.8697	19.5224	19.0790	18.7277 (90)
Living area fraction									fLA = Living area / (4) =			0.1811 (91)
MIT	18.9188	19.0826	19.3415	19.6819	19.9570	20.1084	20.1387	20.1367	20.0481	19.6940	19.2501	18.8993 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9188	19.0826	19.3415	19.6819	19.9570	20.1084	20.1387	20.1367	20.0481	19.6940	19.2501	18.8993 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9964	0.9920	0.9802	0.9433	0.8465	0.6575	0.4629	0.5182	0.7949	0.9610	0.9924	0.9973 (94)
Ext temp.	361.5551	420.0932	468.1652	499.5063	476.2035	362.8741	243.9963	255.1178	361.4304	385.9806	354.4347	341.1965 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1053.1171	1018.9143	920.1053	762.8091	582.7857	384.4582	246.9866	260.2580	416.9480	641.8616	861.7053	1047.7472 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	514.5222	402.4078	336.2434	189.5780	79.2972	0.0000	0.0000	0.0000	0.0000	190.3754	365.2348	525.6737 (98)
												2603.3326 (98)
												43.1444 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	656.0766	516.4859	529.3399	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8695	0.9281	0.9064	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.4323	479.3623	479.7836	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.6824	689.3207	649.9097	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	107.4601	156.2091	126.5738	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												390.2430 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
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	182.3117	160.8641	169.3526	152.3818	149.7409	134.3906	129.6305	141.4691	140.9762	157.9833	166.3365	178.1171 (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	182.3117	160.8641	169.3526	152.3818	149.7409	134.3906	129.6305	141.4691	140.9762	157.9833	166.3365	178.1171 (64)
RHI water heating demand												1863.5544 (64)
Heat gains from water heating, kWh/month	83.7023	74.3371	79.3934	73.0060	72.8725	67.0239	66.1858	70.1221	69.2136	75.6131	77.6459	82.3076 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	112.5031	110.6206	106.7115	101.3972	97.9469	93.0887	88.9594	94.2502	96.1300	101.6305	107.8415	110.6285 (72)
Total internal gains	500.9939	497.2952	479.9152	453.0847	425.8383	401.2802	386.8257	393.9326	409.2834	436.3001	466.3072	488.7941 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.5600	12.9236	0.4600	0.0000	0.7700	16.2960 (75)			
Southeast				0.6600	40.4699	0.4600	0.0000	0.7700	9.4607 (77)			
Southwest				2.4000	40.4699	0.4600	0.0000	0.7700	34.4027 (79)			
Southwest				3.1500	40.4699	0.4300	0.0000	0.7700	42.2087 (79)			
Solar gains	102.3681	161.8974	232.1447	319.7013	369.5572	402.2980	379.6920	339.9022	280.6891	194.9082	126.6420	86.1213 (83)
Total gains	603.3620	659.1926	712.0599	772.7860	795.3956	803.5781	766.5177	733.8348	689.9725	631.2082	592.9492	574.9155 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
Feb	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9362	0.9128	0.8600	0.7558	0.5961	0.3937	0.2601	0.2800	0.5154	0.7707	0.8981	0.9440 (86)
Tweekday	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950
Tweekend	20.3177	20.4197	20.6067	20.8031	20.9365	20.9898	20.9984	20.9979	20.9714	20.8213	20.5463	20.2851
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	19.9470	20.1023	20.3930	20.6926	20.9020	20.9843	20.9975	20.9967	20.9553	20.7241	20.2915	19.8967 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9246	0.8976	0.8359	0.7164	0.5372	0.3203	0.1789	0.1956	0.4383	0.7245	0.8776	0.9336 (89)
Tweekday	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950
Tweekend	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950
MIT 2	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950 (90)
Living area fraction									fLA = Living area / (4) =			0.1811 (91)
MIT	18.8977	19.1066	19.4868	19.8691	20.1095	20.1903	20.1998	20.1994	20.1667	19.9120	19.3699	18.8308 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8977	19.1066	19.4868	19.8691	20.1095	20.1903	20.1998	20.1994	20.1667	19.9120	19.3699	18.8308 (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	0.9081	0.8804	0.8207	0.7096	0.5426	0.3330	0.1936	0.2109	0.4500	0.7186	0.8612	0.9175	(94)
Useful gains	547.8900	580.3814	584.4040	548.3396	431.5549	267.5993	148.4203	154.7447	310.4647	453.6028	510.6344	527.5098	(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													
	892.1997	873.3724	781.5660	644.6280	459.7199	270.9539	148.7136	155.1551	321.1605	537.4776	735.2108	887.8729	(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													
	256.1665	196.8900	146.6886	69.3276	20.9547	0.0000	0.0000	0.0000	0.0000	62.4029	161.6951	268.1101	(98)
Space heating													
RHI space heating demand												1182.2354	(98)
												1182	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
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	182.3117	160.8641	169.3526	152.3818	149.7409	134.3906	129.6305	141.4691	140.9762	157.9833	166.3365	178.1171 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	140.8453	124.3845	132.1174	121.7086	121.2409	110.8659	109.6961	117.3415	116.1558	127.3270	130.8619	138.0463 (64)
Total per year (kWh/year) = Sum (64)m =												1490.5912 (64)
Heat gains from water heating, kWh/month	83.7023	74.3371	79.3934	73.0060	72.8725	67.0239	66.1858	70.1221	69.2136	75.6131	77.6459	82.3076 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	112.5031	110.6206	106.7115	101.3972	97.9469	93.0887	88.9594	94.2502	96.1300	101.6305	107.8415	110.6285 (72)
Total internal gains	500.9939	497.2952	479.9152	453.0847	425.8383	401.2802	386.8257	393.9326	409.2834	436.3001	466.3072	488.7941 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.5600	11.2829	0.4600	0.0000	0.7700	14.2272 (75)			
Southeast				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (77)			
Southwest				2.4000	36.7938	0.4600	0.0000	0.7700	31.2777 (79)			
Southwest				3.1500	36.7938	0.4300	0.0000	0.7700	38.3747 (79)			
Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876 (83)
Total gains	593.4749	659.5503	714.4720	764.7516	794.1352	775.3610	743.9642	707.5312	670.3406	619.0109	577.9387	567.3817 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9466	0.9220	0.8778	0.7946	0.6660	0.5074	0.3754	0.4101	0.6068	0.8170	0.9190	0.9536 (86)
Tweekday	18.4872	18.7607	19.1497	19.5660	19.8580	19.9882	20.0179	20.0149	19.9481	19.6009	18.9767	18.3995
Tweekend	20.2370	20.3624	20.5428	20.7427	20.8933	20.9700	20.9923	20.9892	20.9419	20.7544	20.4585	20.1970
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	19.8225	20.0137	20.2944	20.5982	20.8353	20.9539	20.9881	20.9834	20.9093	20.6210	20.1545	19.7607 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9371	0.9087	0.8572	0.7610	0.6151	0.4385	0.2951	0.3273	0.5375	0.7795	0.9029	0.9453 (89)
Tweekday	18.4872	18.7607	19.1497	19.5660	19.8580	19.9882	20.0179	20.0149	19.9481	19.6009	18.9767	18.3995
Tweekend	18.4872	18.7607	19.1497	19.5660	19.8580	19.9882	20.0179	20.0149	19.9481	19.6009	18.9767	18.3995
MIT 2	18.4872	18.7607	19.1497	19.5660	19.8580	19.9882	20.0179	20.0149	19.9481	19.6009	18.9767	18.3995 (90)
Living area fraction									fLA = Living area / (4) =			0.1811 (91)
MIT	18.7291	18.9877	19.3570	19.7529	20.0351	20.1632	20.1937	20.1903	20.1222	19.7856	19.1901	18.6461 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7291	18.9877	19.3570	19.7529	20.0351	20.1632	20.1937	20.1903	20.1222	19.7856	19.1901	18.6461 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9212	0.8915	0.8409	0.7508	0.6157	0.4486	0.3093	0.3417	0.5448	0.7692	0.8861	0.9301	(94)
Useful gains	546.7138	588.0060	600.7964	574.1519	488.9764	347.8629	230.1270	241.7880	365.2289	476.1580	512.0947	527.7188	(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													
Month fracti	933.0246	910.9498	831.3718	701.7809	538.9680	359.7289	232.3773	245.0942	389.4143	593.9692	781.7774	934.1237	(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	287.4152	217.0182	171.5480	91.8929	37.1937	0.0000	0.0000	0.0000	0.0000	87.6516	194.1716	302.3652	(98)
Space heating per m2												1389.2564	(98)
											(98) / (4) =	23.0238	(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 %)													199.0158	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													698.0633	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	287.4152	217.0182	171.5480	91.8929	37.1937	0.0000	0.0000	0.0000	0.0000	87.6516	194.1716	302.3652	(98)	
Space heating efficiency (main heating system 1)	199.0158	199.0158	199.0158	199.0158	199.0158	0.0000	0.0000	0.0000	0.0000	199.0158	199.0158	199.0158	(210)	
Space heating fuel (main heating system)	144.4183	109.0457	86.1982	46.1737	18.6888	0.0000	0.0000	0.0000	0.0000	44.0425	97.5659	151.9303	(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	140.8453	124.3845	132.1174	121.7086	121.2409	110.8659	109.6961	117.3415	116.1558	127.3270	130.8619	138.0463	(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	82.7140	73.0470	77.5883	71.4756	71.2009	65.1080	64.4210	68.9109	68.2146	74.7751	76.8510	81.0702	(219)	
Water heating fuel used													875.3766	(219)
Annual totals kWh/year														
Space heating fuel - main system													698.0633	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													41.3203	(230a)
Total electricity for the above, kWh/year													41.3203	(231)
Electricity for lighting (calculated in Appendix L)													284.8198	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192			-988.0192	(233)
Total delivered energy for all uses													911.5608	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	698.0633	13.1900	92.0746	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	875.3766	13.1900	115.4622	(247)
Mechanical ventilation fans	41.3203	13.1900	5.4501	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	284.8198	13.1900	37.5677	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			120.2349	(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] =	0.4794	(257)
SAP value			93.3125	
SAP rating (Section 12)			93	(258)
SAP band			A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	698.0633	0.5190	362.2949	(261)

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Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	875.3766	0.5190	454.3204 (264)
Space and water heating			816.6153 (265)
Pumps and fans	41.3203	0.5190	21.4452 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			473.1000 (272)
CO2 emissions per m2			7.8400 (273)
EI value			93.9818
EI rating			94 (274)
EI band			A

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

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 1.9902 = 6.628$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 1.9902 = 0.2608$, stars = 4
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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

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Calculation Type: New Build (As Designed)

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Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
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	182.3117	160.8641	169.3526	152.3818	149.7409	134.3906	129.6305	141.4691	140.9762	157.9833	166.3365	178.1171 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	140.8453	124.3845	132.1174	121.7086	121.2409	110.8659	109.6961	117.3415	116.1558	127.3270	130.8619	138.0463 (64)
Heat gains from water heating, kWh/month	83.7023	74.3371	79.3934	73.0060	72.8725	67.0239	66.1858	70.1221	69.2136	75.6131	77.6459	82.3076 (65)
Total per year (kWh/year) = Sum (64)m =												1490.5912 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	112.5031	110.6206	106.7115	101.3972	97.9469	93.0887	88.9594	94.2502	96.1300	101.6305	107.8415	110.6285 (72)
Total internal gains	500.9939	497.2952	479.9152	453.0847	425.8383	401.2802	386.8257	393.9326	409.2834	436.3001	466.3072	488.7941 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.5600	12.9236	0.4600	0.0000	0.7700	16.2960 (75)			
Southeast				0.6600	40.4699	0.4600	0.0000	0.7700	9.4607 (77)			
Southwest				2.4000	40.4699	0.4600	0.0000	0.7700	34.4027 (79)			
Southwest				3.1500	40.4699	0.4300	0.0000	0.7700	42.2087 (79)			
Solar gains	102.3681	161.8974	232.1447	319.7013	369.5572	402.2980	379.6920	339.9022	280.6891	194.9082	126.6420	86.1213 (83)
Total gains	603.3620	659.1926	712.0599	772.7860	795.3956	803.5781	766.5177	733.8348	689.9725	631.2082	592.9492	574.9155 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9362	0.9128	0.8600	0.7558	0.5961	0.3937	0.2601	0.2800	0.5154	0.7707	0.8981	0.9440 (86)
Tweekday	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950
Tweekend	20.3177	20.4197	20.6067	20.8031	20.9365	20.9898	20.9984	20.9979	20.9714	20.8213	20.5463	20.2851
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	19.9470	20.1023	20.3930	20.6926	20.9020	20.9843	20.9975	20.9967	20.9553	20.7241	20.2915	19.8967 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9246	0.8976	0.8359	0.7164	0.5372	0.3203	0.1789	0.1956	0.4383	0.7245	0.8776	0.9336 (89)
Tweekday	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950
Tweekend	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950
MIT 2	18.6656	18.8863	19.2863	19.6869	19.9342	20.0146	20.0234	20.0231	19.9923	19.7324	19.1661	18.5950 (90)
Living area fraction									fLA = Living area / (4) =			0.1811 (91)
MIT	18.8977	19.1066	19.4868	19.8691	20.1095	20.1903	20.1998	20.1994	20.1667	19.9120	19.3699	18.8308 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8977	19.1066	19.4868	19.8691	20.1095	20.1903	20.1998	20.1994	20.1667	19.9120	19.3699	18.8308 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9081	0.8804	0.8207	0.7096	0.5426	0.3330	0.1936	0.2109	0.4500	0.7186	0.8612	0.9175	(94)
Useful gains	547.8900	580.3814	584.4040	548.3396	431.5549	267.5993	148.4203	154.7447	310.4647	453.6028	510.6344	527.5098	(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	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	256.1665	196.8900	146.6886	69.3276	20.9547	0.0000	0.0000	0.0000	0.0000	62.4029	161.6951	268.1101	(98)
Space heating												1182.2354	(98)
Space heating per m2											(98) / (4) =	19.5929	(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 %)													199.0158	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													594.0409	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	256.1665	196.8900	146.6886	69.3276	20.9547	0.0000	0.0000	0.0000	0.0000	62.4029	161.6951	268.1101	(98)	
Space heating efficiency (main heating system 1)	199.0158	199.0158	199.0158	199.0158	199.0158	0.0000	0.0000	0.0000	0.0000	199.0158	199.0158	199.0158	(210)	
Space heating fuel (main heating system)	128.7166	98.9318	73.7070	34.8352	10.5292	0.0000	0.0000	0.0000	0.0000	31.3557	81.2473	134.7180	(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	140.8453	124.3845	132.1174	121.7086	121.2409	110.8659	109.6961	117.3415	116.1558	127.3270	130.8619	138.0463	(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	82.7140	73.0470	77.5883	71.4756	71.2009	65.1080	64.4210	68.9109	68.2146	74.7751	76.8510	81.0702	(219)	
Water heating fuel used													875.3766	(219)
Annual totals kWh/year														
Space heating fuel - main system													594.0409	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													41.3203	(230a)
Total electricity for the above, kWh/year													41.3203	(231)
Electricity for lighting (calculated in Appendix L)													284.8198	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =										-1046.8728			-1046.8728	(233)
Total delivered energy for all uses													748.6848	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	594.0409	16.9600	100.7493	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	875.3766	16.9600	148.4639	(247)
Mechanical ventilation fans	41.3203	16.9600	7.0079	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	284.8198	16.9600	48.3054	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			126.9769	(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	594.0409	0.5190	308.3072	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	875.3766	0.5190	454.3204	(264)
Space and water heating			762.6277	(265)
Pumps and fans	41.3203	0.5190	21.4452	(267)
Energy for lighting	284.8198	0.5190	147.8215	(268)
Energy saving/generation technologies				
PV Unit	-1046.8728	0.5190	-543.3270	(269)
Total kg/year			388.5674	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	594.0409	3.0700	1823.7056 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	875.3766	3.0700	2687.4061 (264)
Space and water heating			4511.1116 (265)
Pumps and fans	41.3203	3.0700	126.8533 (267)
Energy for lighting	284.8198	3.0700	874.3969 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			2298.4625 (272)
Primary energy kWh/m ² /year			38.0919 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 93
Current environmental impact rating: A 94

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO ₂ change
N Solar water heating	+ 2.6	-£ 60	-184 kg (47.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£60	3.05 kg/m ²	A 96
Total Savings	£60	3.05 kg/m ²	A 96

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

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 £305	Potential £244	Saving £60
Electricity			
Space heating	£108	£108	-£0
Water heating	£148	£88	£60
Lighting	£48	£48	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£127	£66	£60
Total cost of uses	£126	£66	£60
Delivered energy	12 kWh/m ²	7 kWh/m ²	6 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO ₂ emissions per m ²	6 kg/m ²	3 kg/m ²	3 kg/m ²
Primary energy	38 kWh/m ²	20 kWh/m ²	18 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											4.0100		
Number of sides sheltered											0.2005 (18)		
											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
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	182.3117	160.8641	167.9568	145.6282	136.9466	121.7838	116.6036	129.3727	135.5733	156.5876	166.3365	178.1171 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.9947 (H8)
Utilisation factor												0.3943 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												81.4917 (H14)
Volume ratio Veff/V												0.9203 (H15)
Solar storage volume factor												0.9834 (H16)
Solar input												-618.3108 (H17)
Solar input	-17.9298	-29.9196	-50.9566	-68.2919	-84.3689	-82.9480	-81.8518	-71.5144	-56.0101	-38.2483	-21.2673	-15.0042 (63)
Output from w/h	122.9155	94.4648	79.7651	46.6631	24.0777	15.3111	14.8174	33.7307	54.7429	87.6830	109.5946	123.0421 (64)
Heat gains from water heating, kWh/month	83.7023	74.3371	78.2768	67.6031	62.6370	56.9385	55.7642	60.4450	64.8913	74.4965	77.6459	82.3076 (65)
Total per year (kWh/year) = Sum (64)m =												806.8080 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	112.5031	110.6206	105.2107	93.8932	84.1896	79.0813	74.9519	81.2432	90.1268	100.1297	107.8415	110.6285 (72)
Total internal gains	500.9939	497.2952	478.4144	445.5807	412.0810	387.2727	372.8182	380.9257	403.2802	434.7993	466.3072	488.7941 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					3.5600	11.2829	0.4600	0.0000	0.7700		14.2272 (75)	
Southeast					0.6600	36.7938	0.4600	0.0000	0.7700		8.6014 (77)	
Southwest					2.4000	36.7938	0.4600	0.0000	0.7700		31.2777 (79)	
Southwest					3.1500	36.7938	0.4300	0.0000	0.7700		38.3747 (79)	

Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876 (83)
Total gains	593.4749	659.5503	712.9712	757.2476	780.3779	761.3535	729.9567	694.5242	664.3374	617.5101	577.9387	567.3817 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9466	0.9220	0.8784	0.7984	0.6740	0.5154	0.3822	0.4171	0.6109	0.8179	0.9190	0.9536 (86)
Tweekday	18.4872	18.7607	19.1469	19.5571	19.8507	19.9863	20.0176	20.0144	19.9463	19.5989	18.9767	18.3995
Tweekend	20.2370	20.3624	20.5415	20.7381	20.8890	20.9684	20.9918	20.9886	20.9406	20.7534	20.4585	20.1970

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8225	20.0137	20.2924	20.5911	20.8286	20.9515	20.9874	20.9824	20.9073	20.6195	20.1545	19.7607	(87)	
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	(88)	
util rest of house														
	0.9371	0.9087	0.8578	0.7651	0.6232	0.4458	0.3006	0.3332	0.5415	0.7805	0.9029	0.9453	(89)	
Tweekday	18.4872	18.7607	19.1469	19.5571	19.8507	19.9863	20.0176	20.0144	19.9463	19.5989	18.9767	18.3995		
Tweekend	18.4872	18.7607	19.1469	19.5571	19.8507	19.9863	20.0176	20.0144	19.9463	19.5989	18.9767	18.3995		
MIT 2	18.4872	18.7607	19.1469	19.5571	19.8507	19.9863	20.0176	20.0144	19.9463	19.5989	18.9767	18.3995	(90)	
Living area fraction									fLA = Living area / (4) =				0.1811	(91)
MIT	18.7291	18.9877	19.3544	19.7444	20.0279	20.1611	20.1932	20.1897	20.1203	19.7838	19.1901	18.6461	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7291	18.9877	19.3544	19.7444	20.0279	20.1611	20.1932	20.1897	20.1203	19.7838	19.1901	18.6461	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9212	0.8915	0.8415	0.7546	0.6234	0.4559	0.3150	0.3478	0.5487	0.7701	0.8861	0.9301	(94)
Useful gains	546.7138	588.0060	599.9850	571.3962	486.4739	347.0980	229.9568	241.5497	364.5452	475.5621	512.0947	527.7188	(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													
	933.0246	910.9498	831.2028	701.2310	538.5034	359.5960	232.3482	245.0534	389.2914	593.8497	781.7774	934.1237	(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													
	287.4152	217.0182	172.0261	93.4811	38.7100	0.0000	0.0000	0.0000	0.0000	88.0060	194.1716	302.3652	(98)
Space heating													1393.1933 (98)
Space heating per m2											(98) / (4) =		23.0891 (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 %)													199.0158	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													700.0415	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	287.4152	217.0182	172.0261	93.4811	38.7100	0.0000	0.0000	0.0000	0.0000	88.0060	194.1716	302.3652	(98)	
Space heating efficiency (main heating system 1)	199.0158	199.0158	199.0158	199.0158	199.0158	0.0000	0.0000	0.0000	0.0000	199.0158	199.0158	199.0158	(210)	
Space heating fuel (main heating system)	144.4183	109.0457	86.4384	46.9717	19.4507	0.0000	0.0000	0.0000	0.0000	44.2206	97.5659	151.9303	(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	122.9155	94.4648	79.7651	46.6631	24.0777	15.3111	14.8174	33.7307	54.7429	87.6830	109.5946	123.0421	(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	72.1844	55.4762	46.8435	27.4037	14.1401	8.9917	8.7018	19.8090	32.1487	51.4934	64.3614	72.2587	(219)	
Water heating fuel used												473.8126	(219)	
Annual totals kWh/year														
Space heating fuel - main system												700.0415	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													41.3203	(230a)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													91.3203	(231)
Electricity for lighting (calculated in Appendix L)													284.8198	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192		-988.0192	(233)	
Total delivered energy for all uses												561.9749	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	700.0415	13.1900	92.3355 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	473.8126	13.1900	62.4959 (247)
Mechanical ventilation fans	41.3203	13.1900	5.4501 (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	284.8198	13.1900	37.5677 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-988.0192	13.1900	-130.3197 (252)
Total energy cost			74.1245 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2955 (257)
SAP value		95.8772
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	700.0415	0.5190	363.3215 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	473.8126	0.5190	245.9087 (264)
Space and water heating			609.2303 (265)
Pumps and fans	91.3203	0.5190	47.3952 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			291.6650 (272)
CO2 emissions per m2			4.8300 (273)
EI value			96.2898
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

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Calculation Type: New Build (As Designed)

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

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
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												
	182.3117	160.8641	167.9568	145.6282	136.9466	121.7838	116.6036	129.3727	135.5733	156.5876	166.3365	178.1171 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												2.1066 (H8)
Utilisation factor												0.3779 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												81.4917 (H14)
Volume ratio Veff/V												0.9203 (H15)
Solar storage volume factor												0.9834 (H16)
Solar input												-625.9250 (H17)
Solar input	-19.2657	-28.9562	-48.7660	-67.4095	-81.1837	-85.4423	-83.3907	-74.4684	-58.1229	-39.5399	-23.4179	-15.9617 (63)
Output from w/h												
	121.5797	95.4282	81.9557	47.5455	27.2628	12.8168	13.2785	30.7766	52.6301	86.3914	107.4440	122.0846 (64)
Heat gains from water heating, kWh/month												
	83.7023	74.3371	78.2768	67.6031	62.6370	56.9385	55.7642	60.4450	64.8913	74.4965	77.6459	82.3076 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)												
	112.5031	110.6206	105.2107	93.8932	84.1896	79.0813	74.9519	81.2432	90.1268	100.1297	107.8415	110.6285 (72)
Total internal gains												
	500.9939	497.2952	478.4144	445.5807	412.0810	387.2727	372.8182	380.9257	403.2802	434.7993	466.3072	488.7941 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
Northeast				3.5600	12.9236	0.4600	0.0000	0.7700			16.2960 (75)	
Southeast				0.6600	40.4699	0.4600	0.0000	0.7700			9.4607 (77)	
Southwest				2.4000	40.4699	0.4600	0.0000	0.7700			34.4027 (79)	
Southwest				3.1500	40.4699	0.4300	0.0000	0.7700			42.2087 (79)	

Solar gains	102.3681	161.8974	232.1447	319.7013	369.5572	402.2980	379.6920	339.9022	280.6891	194.9082	126.6420	86.1213 (83)
Total gains	603.3620	659.1926	710.5591	765.2820	781.6382	789.5707	752.5102	720.8279	683.9693	629.7074	592.9492	574.9155 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area												
	0.9362	0.9128	0.8606	0.7599	0.6042	0.4002	0.2648	0.2849	0.5192	0.7716	0.8981	0.9440 (86)
Tweekday	18.6656	18.8863	19.2839	19.6799	19.9299	20.0141	20.0233	20.0230	19.9914	19.7309	19.1661	18.5950
Tweekend	20.3177	20.4197	20.6055	20.7994	20.9336	20.9892	20.9983	20.9978	20.9707	20.8204	20.5463	20.2851

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24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.9470	20.1023	20.3911	20.6867	20.8976	20.9834	20.9974	20.9965	20.9542	20.7229	20.2915	19.8967	(87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	(88)
util rest of house													
	0.9246	0.8976	0.8366	0.7206	0.5450	0.3258	0.1822	0.1991	0.4418	0.7255	0.8776	0.9336	(89)
Tweekday	18.6656	18.8863	19.2839	19.6799	19.9299	20.0141	20.0233	20.0230	19.9914	19.7309	19.1661	18.5950	
Tweekend	18.6656	18.8863	19.2839	19.6799	19.9299	20.0141	20.0233	20.0230	19.9914	19.7309	19.1661	18.5950	
MIT 2	18.6656	18.8863	19.2839	19.6799	19.9299	20.0141	20.0233	20.0230	19.9914	19.7309	19.1661	18.5950	(90)
Living area fraction									fLA = Living area / (4) =				0.1811
MIT	18.8977	19.1066	19.4844	19.8623	20.1052	20.1897	20.1998	20.1994	20.1658	19.9106	19.3699	18.8308	(91)
Temperature adjustment												0.0000	
adjusted MIT	18.8977	19.1066	19.4844	19.8623	20.1052	20.1897	20.1998	20.1994	20.1658	19.9106	19.3699	18.8308	(92)
													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9081	0.8804	0.8214	0.7136	0.5501	0.3386	0.1972	0.2146	0.4534	0.7196	0.8612	0.9175	(94)
Useful gains	547.8900	580.3814	583.6577	546.0815	429.9931	267.3692	148.3970	154.7134	310.1383	453.1341	510.6344	527.5098	(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	892.1997	873.3724	781.4121	644.1874	459.4393	270.9147	148.7094	155.1495	321.1037	537.3861	735.2108	887.8729	(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	256.1665	196.8900	147.1293	70.6363	21.9080	0.0000	0.0000	0.0000	0.0000	62.6835	161.6951	268.1101	(98)
Space heating												1185.2187	(98)
Space heating per m2										(98) / (4) =		19.6423	(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 %)													199.0158	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													595.5399	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	256.1665	196.8900	147.1293	70.6363	21.9080	0.0000	0.0000	0.0000	0.0000	62.6835	161.6951	268.1101	(98)	
Space heating efficiency (main heating system 1)	199.0158	199.0158	199.0158	199.0158	199.0158	0.0000	0.0000	0.0000	0.0000	199.0158	199.0158	199.0158	(210)	
Space heating fuel (main heating system)	128.7166	98.9318	73.9284	35.4928	11.0082	0.0000	0.0000	0.0000	0.0000	31.4968	81.2473	134.7180	(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	121.5797	95.4282	81.9557	47.5455	27.2628	12.8168	13.2785	30.7766	52.6301	86.3914	107.4440	122.0846	(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	71.3998	56.0420	48.1299	27.9219	16.0106	7.5269	7.7980	18.0741	30.9080	50.7349	63.0984	71.6964	(219)	
Water heating fuel used												469.3410	(219)	
Annual totals kWh/year														
Space heating fuel - main system												595.5399	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													41.3203	(230a)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													91.3203	(231)
Electricity for lighting (calculated in Appendix L)													284.8198	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =									-1046.8728			-1046.8728	(233)	
Total delivered energy for all uses												394.1483	(238)	

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

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	595.5399	16.9600	101.0036	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	469.3410	16.9600	79.6002	(247)
Mechanical ventilation fans	41.3203	16.9600	7.0079	(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	284.8198	16.9600	48.3054	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			66.8475	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	595.5399	0.5190	309.0852 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	469.3410	0.5190	243.5880 (264)
Space and water heating			552.6732 (265)
Pumps and fans	91.3203	0.5190	47.3952 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			204.5630 (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	595.5399	3.0700	1828.3076 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	469.3410	3.0700	1440.8768 (264)
Space and water heating			3269.1844 (265)
Pumps and fans	91.3203	3.0700	280.3533 (267)
Energy for lighting	284.8198	3.0700	874.3969 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			1210.0352 (272)
Primary energy kWh/m2/year			20.0536 (273)

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

Overheating Calculation Input Data

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

Overheating Calculation

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

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.5600	98.8453	0.4600	0.0000	0.9000	145.6821
South East	0.6600	119.9223	0.4600	0.0000	0.9000	32.7676
South West	2.4000	119.9223	0.4600	0.0000	0.9000	119.1548
South West	3.1500	119.9223	0.4300	0.0000	0.9000	146.1913
total:						443.7959
Solar gains		Jun	Jul	Aug		(P3/P4)
Internal gains		470	444	397		
Total summer gains		401	387	394		(P5)
Summer gain/loss ratio		871	831	791		(P6)
Summer external temperature		3.69	3.52	3.35		
		16.00	17.90	17.80		

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

Thermal mass temperature increment (TMP = 154.3)	0.92	0.92	0.92	
Threshold temperature	20.61	22.34	22.07	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			