

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X308 Det (ASHP+PV)			Issued on Date	15/12/2022
Assessment Reference	X308 Det (ASHP+PV)	Prop Type Ref	Cypress		
Property	3 Bed, K, WC, U, B, En				
SAP Rating	91 B	DER	9.91	TER	26.59
Environmental	92 A	% DER<TER	62.74		
CO ₂ Emissions (t/year)	0.78	DFEE	48.98	TFEE	59.08
General Requirements Compliance	Pass	% DFEE<TFEE	17.09		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Detached House, total floor area 103 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) 26.59 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.0 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):	Slight	OK
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Based on:

Overshading:	Average
Windows facing North East:	9.60 m ² , No overhang
Windows facing South East:	2.03 m ² , No overhang
Windows facing South West:	6.69 m ² , No overhang
Windows facing North West:	1.88 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
Thermal bridging y-value	0.022 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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.5351	Feb 41.1233	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	116.3152	115.9035	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8950	(39)
HLP	Jan 1.1308	Feb 1.1268	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1267	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy content (annual)	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Distribution loss	Total = Sum(45)m = 1571.1266 (45)												
	(46)m = 0.15 x (45)m												
	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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													
	212.2690	187.0650	196.3895	175.9533	172.3583	153.9077	147.7160	162.2224	161.9774	182.4582	193.0527	207.1292	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings												-457.1528	
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													
	161.3758	142.2848	150.6859	138.3543	137.4492	125.1111	123.3475	132.7168	131.6097	144.9144	149.5589	157.9376	(64)
								Total per year (kWh/year) =	Sum(64)m =			1695.3458	(64)
Heat gains from water heating, kWh/month													
	93.6631	83.0489	88.3832	80.8435	80.3928	73.5133	72.1992	77.0226	76.1965	83.7510	86.5290	91.9541	(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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	125.8913	123.5846	118.7946	112.2826	108.0548	102.1018	97.0420	103.5250	105.8285	112.5685	120.1792	123.5942	(72)
Total internal gains	474.6961	472.4726	456.9685	431.8161	406.0162	381.3396	365.4217	371.8217	384.8392	410.2197	439.4025	461.5411	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					5.8000	11.2829	0.4600	0.7000	0.7700		14.6029 (75)	
Southeast					2.0300	36.7938	0.4600	0.7000	0.7700		16.6671 (77)	
Southwest					6.6900	36.7938	0.4600	0.7000	0.7700		54.9276 (79)	
Northwest					1.8800	11.2829	0.4600	0.7000	0.7700		4.7334 (81)	
Northeast					3.8000	11.2829	0.4300	0.0000	0.7700		14.1960 (75)	
Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542 (83)
Total gains	579.8230	662.6806	746.8041	840.5249	909.0661	900.6610	857.8177	790.7911	715.3610	628.4169	567.3486	550.1953 (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	35.6056	35.7320	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3737	3.3821	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9881	0.9803	0.9632	0.9206	0.8325	0.6919	0.5481	0.6036	0.8127	0.9439	0.9808	0.9900 (86)	
Tweekday	17.4557	17.7607	18.2697	18.9210	19.4975	19.8404	19.9482	19.9318	19.6916	18.9638	18.0882	17.3904	
Tweekend	19.7831	19.9180	20.1455	20.4413	20.7148	20.8948	20.9648	20.9506	20.8060	20.4558	20.0624	19.7531	
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	19.1219	19.3263	19.6812	20.1276	20.5598	20.8383	20.9456	20.9237	20.6972	20.1601	19.5361	19.0756 (87)	
Th 2	19.9758	19.9790	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)	
util rest of house	0.9856	0.9763	0.9552	0.9023	0.7921	0.6154	0.4384	0.4945	0.7526	0.9273	0.9761	0.9879 (89)	
Tweekday	17.4557	17.7607	18.2697	18.9210	19.4975	19.8404	19.9482	19.9318	19.6916	18.9638	18.0882	17.3904	
Tweekend	17.4557	17.7607	18.2697	18.9210	19.4975	19.8404	19.9482	19.9318	19.6916	18.9638	18.0882	17.3904	
MIT 2	17.4557	17.7607	18.2697	18.9210	19.4975	19.8404	19.9482	19.9318	19.6916	18.9638	18.0882	17.3904 (90)	
Living area fraction									fLA =	Living area / (4) =		0.1450 (91)	
MIT	17.6972	17.9877	18.4743	19.0959	19.6515	19.9851	20.0928	20.0756	19.8374	19.1372	18.2981	17.6347 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.6972	17.9877	18.4743	19.0959	19.6515	19.9851	20.0928	20.0756	19.8374	19.1372	18.2981	17.6347 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9773	0.9649	0.9392	0.8823	0.7769	0.6159	0.4513	0.5057	0.7427	0.9089	0.9648	0.9806 (94)
Useful gains	566.6870	639.3890	701.3683	741.5920	706.2931	554.6741	387.1738	399.9018	531.3133	571.1792	547.3684	539.5350 (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	1558.3036	1516.9070	1387.2498	1181.2127	921.1949	623.8712	404.6471	425.8274	664.6895	989.0511	1297.3240	1556.4337 (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	737.7628	589.6921	510.2959	316.5269	159.8869	0.0000	0.0000	0.0000	0.0000	310.8967	539.9680	756.5726 (98)
Space heating												3921.6018 (98)
Space heating per m2										(98) / (4) =		38.1256 (99)

8c. Space cooling requirement

Not applicable

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

[illegible]

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	1472.1437	0.5190	764.0426	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	995.6224	0.5190	516.7280	(264)
Space and water heating			1280.7706	(265)
Pumps and fans	69.9215	0.5190	36.2893	(267)
Energy for lighting	414.4463	0.5190	215.0976	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total CO2, kg/year			1019.3755	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.9100	(273)

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

DER		9.9100	ZC1
Total Floor Area	TFA	102.8600	
Assumed number of occupants	N	2.7645	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0288	ZC2
CO2 emissions from cooking, equation (L16)		1.8019	ZC3
Total CO2 emissions		26.7407	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.7407	ZC8

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1607 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4107 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4107 (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	0.5236	0.5134	0.5031	0.4518	0.4415	0.3902	0.3902	0.3799	0.4107	0.4415	0.4620	0.4826 (22b)
Effective ac	0.6371	0.6318	0.6266	0.6020	0.5975	0.5761	0.5761	0.5722	0.5843	0.5975	0.6067	0.6164 (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
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			20.2000	1.3258	26.7803		(27)
FP McCann System			51.4300	0.1300	6.6859		(28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.1800	21.9528		(29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.1300	6.6859		(30)
Total net area of external elements Aum, m ²			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.5469		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.9271 (36)
Total fabric heat loss						(33) + (36) =	78.4740 (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	52.3336	51.8963	51.4677	49.4544	49.0777	47.3241	47.3241	46.9994	47.9996	49.0777	49.8397	50.6364 (38)
Heat transfer coeff	130.8076	130.3703	129.9417	127.9284	127.5517	125.7981	125.7981	125.4734	126.4736	127.5517	128.3137	129.1104 (39)
Average = Sum(39)m / 12 =												127.9266 (39)
HLP	1.2717	1.2675	1.2633	1.2437	1.2401	1.2230	1.2230	1.2198	1.2296	1.2401	1.2475	1.2552 (40)
HLP (average)												1.2437 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)
Energy content (annual)	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629 (46)
Water storage loss:												200.0000 (47)
Store volume												1.6525 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
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	213.8183	188.4643	197.9388	177.4526	173.9075	155.4070	149.2652	163.7717	163.4767	184.0074	194.5520	208.6785 (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	213.8183	188.4643	197.9388	177.4526	173.9075	155.4070	149.2652	163.7717	163.4767	184.0074	194.5520	208.6785 (64)
Heat gains from water heating, kWh/month	94.9025	84.1683	89.6226	82.0429	81.6322	74.7128	73.4386	78.2620	77.3959	84.9904	87.7285	93.1935 (65)
Total per year (kWh/year) = Sum(64)m =												2170.7400 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599 (68)
Pumps, fans	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788 (71)
Total internal gains	127.5572	125.2505	120.4605	113.9485	109.7207	103.7677	98.7078	105.1909	107.4943	114.2344	121.8451	125.2601 (72)
	479.3620	477.1385	461.6344	436.4820	410.6821	386.0055	370.0876	376.4876	389.5051	414.8856	444.0684	466.2070 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					9.6000	11.2829	0.6300	0.7000	0.7700		33.1028 (75)	
Southeast					2.0300	36.7938		0.7000	0.7700		22.8267 (77)	
Southwest					6.6900	36.7938	0.6300	0.7000	0.7700		75.2269 (79)	
Northwest					1.8800	11.2829	0.6300	0.7000	0.7700		6.4826 (81)	
Solar gains	137.6390	247.5989	373.7009	521.5737	637.6388	656.5310	623.1849	533.0020	424.3433	283.0663	167.2544	116.2409 (83)
Total gains	617.0011	724.7374	835.3353	958.0557	1048.3208	1042.5365	993.2725	909.4895	813.8483	697.9519	611.3227	582.4479 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.6073	54.7905	54.9712	55.8364	56.0013	56.7819	56.7819	56.9288	56.4786	56.0013	55.6687	55.3252
alpha	4.6405	4.6527	4.6647	4.7224	4.7334	4.7855	4.7855	4.7953	4.7652	4.7334	4.7112	4.6883
util living area	0.9980	0.9953	0.9874	0.9577	0.8724	0.7064	0.5417	0.6064	0.8541	0.9767	0.9958	0.9985 (86)
MIT	19.5987	19.7685	20.0523	20.4341	20.7560	20.9382	20.9861	20.9769	20.8402	20.4208	19.9460	19.5778 (87)
Th 2	19.8631	19.8664	19.8697	19.8852	19.8881	19.9016	19.9016	19.9042	19.8964	19.8881	19.8822	19.8761 (88)
util rest of house	0.9973	0.9937	0.9827	0.9413	0.8240	0.6103	0.4144	0.4757	0.7807	0.9647	0.9940	0.9979 (89)
MIT 2	18.0047	18.2547	18.6690	19.2232	19.6505	19.8612	19.8967	19.8948	19.7676	19.2153	18.5256	17.9830 (90)
Living area fraction	18.2358	18.4741	18.8695	19.3987	19.8108	20.0173	20.0546	20.0517	19.9231	19.3900	18.7315	18.2142 (92)
MIT	18.2358	18.4741	18.8695	19.3987	19.8108	20.0173	20.0546	20.0517	19.9231	19.3900	18.7315	18.2142 (93)
Temperature adjustment												0.0000
adjusted MIT	18.2358	18.4741	18.8695	19.3987	19.8108	20.0173	20.0546	20.0517	19.9231	19.3900	18.7315	18.2142 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9957	0.9907	0.9768	0.9320	0.8201	0.6213	0.4328	0.4943	0.7829	0.9571	0.9911	0.9967 (94)
Ext temp.	614.3185	717.9722	815.9153	892.9199	859.7051	647.7447	429.8635	449.5351	637.1231	668.0278	605.9049	580.5012 (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	1822.9034	1769.6638	1607.3107	1343.0841	1034.5431	681.4873	434.5827	458.1878	736.4695	1121.1800	1492.4762	1809.3802 (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	899.1872	706.7367	588.7982	324.1182	130.0795	0.0000	0.0000	0.0000	0.0000	337.1452	638.3313	914.2860 (98)
Space heating per m2												4538.6824 (98)
												(98) / (4) = 44.1249 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4854.2057 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	899.1872	706.7367	588.7982	324.1182	130.0795	0.0000	0.0000	0.0000	0.0000	337.1452	638.3313	914.2860 (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)	961.6975	755.8682	629.7307	346.6505	139.1224	0.0000	0.0000	0.0000	0.0000	360.5831	682.7073	977.8459 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.8183	188.4643	197.9388	177.4526	173.9075	155.4070	149.2652	163.7717	163.4767	184.0074	194.5520	208.6785 (64)
Efficiency of water heater (217)m	88.2274	88.0154	87.5466	86.4013	84.0525	79.8000	79.8000	79.8000	79.8000	86.4092	87.7516	79.8000 (216)
Fuel for water heating, kWh/month	242.3492	214.1264	226.0954	205.3819	206.9036	194.7456	187.0492	205.2277	204.8580	212.9490	221.7078	236.3294 (219)
Water heating fuel used												2557.7230 (219)
Annual totals kWh/year												
Space heating fuel - main system												4854.2057 (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)												414.4463 (232)
Total delivered energy for all uses												7901.3750 (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	4854.2057	0.2160	1048.5084 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2557.7230	0.2160	552.4682 (264)
Space and water heating			1600.9766 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Total CO2, kg/m2/year			1854.9992 (272)
Emissions per m2 for space and water heating			15.5646 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.0912 (272b)
Emissions per m2 for pumps and fans			0.3784 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5646 * 1.55) + 2.0912 + 0.3784, rounded to 2 d.p.			26.5900 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1607 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3612 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3612 (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	0.4605	0.4515	0.4425	0.3973	0.3883	0.3431	0.3431	0.3341	0.3612	0.3883	0.4063	0.4244 (22b)
Effective ac	0.6060	0.6019	0.5979	0.5789	0.5754	0.5589	0.5589	0.5558	0.5652	0.5754	0.5826	0.5901 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.4000	1.1450	18.7786		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500 (28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880 (29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700 (30)
Total net area of external elements Aum(A, m ²)			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255		(33)
1F Timber			87.3300			9.0000	785.9700 (32c)
GF Masonry			52.2100			39.0000	2036.1900 (32c)
GF Timber			24.0700			9.0000	216.6300 (32c)
Internal Floor			51.4300			12.6000	648.0180 (32d)
Internal Ceiling			51.4300			9.0000	462.8700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14909.2860 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.9474 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546 (36)
Total fabric heat loss						(33) + (36) =	74.7801 (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	49.7826	49.4443	49.1128	47.5555	47.2642	45.9078	45.9078	45.6567	46.4303	47.2642	47.8536	48.4698 (38)
Heat transfer coeff	124.5627	124.2244	123.8929	122.3357	122.0443	120.6880	120.6880	120.4368	121.2104	122.0443	122.6337	123.2499 (39)
Average = Sum(39)m / 12 =												122.3343 (39)
HLP	1.2110	1.2077	1.2045	1.1893	1.1865	1.1733	1.1733	1.1709	1.1784	1.1865	1.1922	1.1982 (40)
HLP (average)												1.1893 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Energy content (annual)										Total =	Sum (45)m =	1571.1266 (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	34.6146	30.2741	31.2402	27.2360	26.1336	22.5513	20.8971	23.9797	24.2661	28.2798	30.8696	33.5224 (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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224 (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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788 (71)
Water heating gains (Table 5)	46.5250	45.0508	41.9895	37.8277	35.1258	31.3212	28.0875	32.2308	33.7029	38.0105	42.8744	45.0570 (72)
Total internal gains	395.3299	393.9388	380.1635	357.3612	333.0871	310.5590	296.4672	300.5274	312.7136	335.6616	362.0977	383.0038 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	5.8000	11.2829	0.4600	0.7000	0.7700	14.6029 (75)
Southeast	2.0300	36.7938	0.4600	0.7000	0.7700	16.6671 (77)
Southwest	6.6900	36.7938	0.4600	0.7000	0.7700	54.9276 (79)
Northwest	1.8800	11.2829	0.4600	0.7000	0.7700	4.7334 (81)
Northeast	3.8000	11.2829	0.4300	0.0000	0.7700	14.1960 (75)

Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542 (83)
Total gains	500.4568	584.1468	669.9991	766.0700	836.1371	829.8804	788.8632	719.4969	643.2354	553.8588	490.0439	471.6580 (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	33.2481	33.3386	33.4278	33.8533	33.9341	34.3155	34.3155	34.3871	34.1676	33.9341	33.7710	33.6022
alpha	3.2165	3.2226	3.2285	3.2569	3.2623	3.2877	3.2877	3.2925	3.2778	3.2623	3.2514	3.2401
util living area	0.9922	0.9865	0.9736	0.9399	0.8666	0.7385	0.5998	0.6589	0.8553	0.9612	0.9876	0.9936 (86)
MIT	18.8702	19.0836	19.4586	19.9716	20.4444	20.7833	20.9214	20.8914	20.6117	20.0024	19.3501	18.8382 (87)
Th 2	19.9112	19.9138	19.9164	19.9285	19.9308	19.9414	19.9414	19.9434	19.9373	19.9308	19.9262	19.9214 (88)
util rest of house	0.9905	0.9836	0.9675	0.9248	0.8302	0.6625	0.4820	0.5448	0.8013	0.9487	0.9844	0.9922 (89)
MIT 2	17.9627	18.1767	18.5504	19.0619	19.5106	19.8126	19.9101	19.8961	19.6767	19.1005	18.4522	17.9381 (90)
Living area fraction	18.0943	18.3082	18.6821	19.1937	19.6460	19.9533	20.0567	20.0403	19.8122	19.2313	18.5823	18.0686 (92)
Temperature adjustment	18.0943	18.3082	18.6821	19.1937	19.6460	19.9533	20.0567	20.0403	19.8122	19.2313	18.5823	18.0686 (93)
adjusted MIT	18.0943	18.3082	18.6821	19.1937	19.6460	19.9533	20.0567	20.0403	19.8122	19.2313	18.5823	18.0686 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	493.7101	571.0324	642.0239	698.4707	684.4996	550.6222	391.2967	400.3642	510.4824	519.3795	479.5984	466.3688 (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	1718.2499	1665.6237	1509.2713	1259.2901	969.7617	646.0777	417.1863	438.4305	692.3817	1053.3959	1408.1200	1709.3015 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	911.0576	735.5653	645.2321	403.7900	212.2350	0.0000	0.0000	0.0000	0.0000	397.3082	668.5356	924.7419 (98)
Space heating												4898.4657 (98)
Space heating per m2										(98) / (4) =		47.6226 (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
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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	1134.4670	893.0911	915.3198	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7463	0.8170	0.7800	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	846.7033	729.6869	713.9602	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1076.6736	1026.4196	947.2591	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	165.5786	220.7691	173.5744	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			559.9222	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	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	41.3947	55.1923	43.3936	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												139.9805	(107)
Energy for space heating												1.3609	(108)
Energy for space cooling												47.6226	(99)
Total												1.3609	(108)
Dwelling Fabric Energy Efficiency (DFEE)												48.9835	(109)
												49.0	(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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.9212 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1607 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4107 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4107 (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	0.5236	0.5134	0.5031	0.4518	0.4415	0.3902	0.3902	0.3799	0.4107	0.4415	0.4620	0.4826 (22b)
Effective ac	0.6371	0.6318	0.6266	0.6020	0.5975	0.5761	0.5761	0.5722	0.5843	0.5975	0.6067	0.6164 (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
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			20.2000	1.3258	26.7803		(27)
FP McCann System			51.4300	0.1300	6.6859		(28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.1800	21.9528		(29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.1300	6.6859		(30)
Total net area of external elements Aum, m ²			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5469		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.9271 (36)
Total fabric heat loss						(33) + (36) =	78.4740 (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	52.3336	51.8963	51.4677	49.4544	49.0777	47.3241	47.3241	46.9994	47.9996	49.0777	49.8397	50.6364 (38)
Heat transfer coeff	130.8076	130.3703	129.9417	127.9284	127.5517	125.7981	125.7981	125.4734	126.4736	127.5517	128.3137	129.1104 (39)
Average = Sum(39)m / 12 =												127.9266 (39)
HLP	1.2717	1.2675	1.2633	1.2437	1.2401	1.2230	1.2230	1.2198	1.2296	1.2401	1.2475	1.2552 (40)
HLP (average)												1.2437 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)
Energy content (annual)	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Distribution loss (46)m = 0.15 x (45)m												1571.1266 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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	(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	(59)
Heat gains from water heating, kWh/month	34.6146	30.2741	31.2402	27.2360	26.1336	22.5513	20.8971	23.9797	24.2661	28.2798	30.8696	(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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	46.5250	45.0508	41.9895	37.8277	35.1258	31.3212	28.0875	32.2308	33.7029	38.0105	42.8744	45.0570	(72)
Total internal gains	395.3299	393.9388	380.1635	357.3612	333.0871	310.5590	296.4672	300.5274	312.7136	335.6616	362.0977	383.0038	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W			
Northeast				9.6000	11.2829	0.6300	0.7000		0.7700	33.1028	(75)		
Southeast				2.0300	36.7938	0.6300	0.7000		0.7700	22.8267	(77)		
Southwest				6.6900	36.7938	0.6300	0.7000		0.7700	75.2269	(79)		
Northwest				1.8800	11.2829	0.6300	0.7000		0.7700	6.4826	(81)		
Solar gains	137.6390	247.5989	373.7009	521.5737	637.6388	656.5310	623.1849	533.0020	424.3433	283.0663	167.2544	116.2409	(83)
Total gains	532.9689	641.5377	753.8644	878.9350	970.7259	967.0900	919.6522	833.5294	737.0569	618.7279	529.3521	499.2447	(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	54.6073	54.7905	54.9712	55.8364	56.0013	56.7819	56.7819	56.9288	56.4786	56.0013	55.6687	55.3252		
alpha	4.6405	4.6527	4.6647	4.7224	4.7334	4.7855	4.7855	4.7953	4.7652	4.7334	4.7112	4.6883		
util living area	0.9989	0.9972	0.9916	0.9689	0.8971	0.7438	0.5796	0.6510	0.8883	0.9854	0.9977	0.9992	(86)	
MIT	19.5243	19.6956	19.9832	20.3749	20.7166	20.9227	20.9815	20.9688	20.8039	20.3560	19.8737	19.5037	(87)	
Th 2	19.8631	19.8664	19.8697	19.8852	19.8881	19.9016	19.9016	19.9042	19.8964	19.8881	19.8822	19.8761	(88)	
util rest of house	0.9985	0.9962	0.9884	0.9562	0.8544	0.6487	0.4461	0.5156	0.8243	0.9774	0.9967	0.9989	(89)	
MIT 2	18.5200	18.6935	18.9821	19.3781	19.6949	19.8660	19.8970	19.8952	19.7834	19.3671	18.8841	18.5097	(90)	
Living area fraction									fLA = Living area / (4) =			0.1450	(91)	
MIT	18.6656	18.8388	19.1272	19.5226	19.8430	20.0192	20.0542	20.0508	19.9314	19.5104	19.0276	18.6538	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6656	18.8388	19.1272	19.5226	19.8430	20.0192	20.0542	20.0508	19.9314	19.5104	19.0276	18.6538	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9949	0.9855	0.9508	0.8523	0.6599	0.4655	0.5351	0.8268	0.9736	0.9956	0.9985	(94)
Ext temp.	531.8657	638.2609	742.9025	835.7058	827.3330	638.2253	428.1110	446.0148	609.4002	602.3763	527.0178	498.4885	(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)
1879.1262	1817.2022	1640.8025	1358.9272	1038.6538	681.7194	434.5353	458.0834	737.5125	1136.5421	1530.4738	1866.1298	(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	1002.3618	792.2485	668.0376	376.7194	157.2227	0.0000	0.0000	0.0000	0.0000	397.4193	722.4883	1017.5251	(98)
Space heating												5134.0228	(98)
Space heating per m2												49.9127	(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	1182.5025	930.9062	953.5979	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8453	0.9089	0.8748	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	999.5201	846.0967	834.2025	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1237.0484	1179.2898	1080.5439	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													

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	0.0000	0.0000	0.0000	0.0000	0.0000	171.0204	247.8957	183.2780	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												602.1941 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	42.7551	61.9739	45.8195	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												150.5485 (107)
Space cooling per m2												1.4636 (108)
Energy for space heating												49.9127 (99)
Energy for space cooling												1.4636 (108)
Total												51.3763 (109)
Target Fabric Energy Efficiency (TFEE)												59.1 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.0720	Feb 41.0720	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8521	(39)
HLP	Jan 1.1263	Feb 1.1263	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1263	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)	Total = Sum (45)m =												1571.1266 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	212.2690	187.0650	196.3895	175.9533	172.3583	153.9077	147.7160	162.2224	161.9774	182.4582	193.0527	207.1292	(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	212.2690	187.0650	196.3895	175.9533	172.3583	153.9077	147.7160	162.2224	161.9774	182.4582	193.0527	207.1292	(64)
RHI water heating demand													2152.4986 (64)
Heat gains from water heating, kWh/month	93.6631	83.0489	88.3832	80.8435	80.3928	73.5133	72.1992	77.0226	76.1965	83.7510	86.5290	91.9541	(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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	125.8913	123.5846	118.7946	112.2826	108.0548	102.1018	97.0420	103.5250	105.8285	112.5685	120.1792	123.5942	(72)
Total internal gains	683.5596	678.7335	654.0308	615.5485	575.8591	540.4552	519.8463	528.8488	551.0649	589.7754	632.8477	665.7136	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					5.8000	12.9236	0.4600	0.7000			0.7700			16.7263 (75)
Southeast					2.0300	40.4699	0.4600	0.7000			0.7700			18.3323 (77)
Southwest					6.6900	40.4699	0.4600	0.7000			0.7700			60.4154 (79)
Northwest					1.8800	12.9236	0.4600	0.7000			0.7700			5.4216 (81)
Northeast					3.8000	12.9236	0.4300	0.0000			0.7700			16.2602 (75)
Solar gains	117.1558	191.3893	289.6772	423.1305	508.5556	562.0911	527.1112	458.0190	358.8903	234.8889	146.2082			97.7635 (83)
Total gains	800.7153	870.1228	943.7080	1038.6790	1084.4147	1102.5462	1046.9576	986.8679	909.9553	824.6643	779.0559	763.4771	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9654	0.9528	0.9208	0.8464	0.7079	0.4953	0.3369	0.3670	0.6443	0.8655	0.9450	0.9696	(86)
Tweekday	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	
Tweekend	20.0489	20.1504	20.3714	20.6381	20.8584	20.9705	20.9943	20.9924	20.9238	20.6661	20.3151	20.0198	
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	19.5322	19.6858	20.0298	20.4349	20.7815	20.9547	20.9912	20.9883	20.8810	20.4847	19.9306	19.4873	(87)
Th 2	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	(88)
util rest of house	0.9586	0.9437	0.9048	0.8148	0.6486	0.4051	0.2289	0.2540	0.5585	0.8303	0.9324	0.9635	(89)
Tweekday	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	
Tweekend	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	
MIT 2	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	(90)
Living area fraction	fLA = Living area / (4) =												0.1450 (91)
MIT	18.2666	18.4810	18.9467	19.4915	19.9143	20.0960	20.1239	20.1224	20.0316	19.5597	18.8325	18.2051	(92)
Temperature adjustment													0.0000
adjusted MIT	18.2666	18.4810	18.9467	19.4915	19.9143	20.0960	20.1239	20.1224	20.0316	19.5597	18.8325	18.2051	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9429	0.9258	0.8845	0.7972	0.6444	0.4159	0.2445	0.2702	0.5632	0.8129	0.9138	0.9489	(94)
Useful gains	755.0232	805.5693	834.7135	828.0049	698.8067	458.5368	255.9432	266.6388	512.5120	670.3881	711.8696	724.4734	(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													
	1525.3730	1492.2865	1337.7101	1111.1964	801.0312	474.5354	257.6383	269.0572	559.7529	922.1482	1254.9632	1518.2531	(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													
	573.1403	461.4740	374.2295	203.8979	76.0550	0.0000	0.0000	0.0000	0.0000	187.3095	391.0274	590.5721	(98)
Space heating												2857.7056	(98)
RHI space heating demand												2858	(98)

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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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.5351	Feb 41.1233	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	116.3152	115.9035	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8950	(39)
HLP	Jan 1.1308	Feb 1.1268	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1267	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy content (annual)	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	25.2720	(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	25.2720	(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													
212.2690	187.0650	196.3895	175.9533	172.3583	153.9077	147.7160	162.2224	161.9774	182.4582	193.0527	207.1292	207.1292	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings													-457.1528
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													
161.3758	142.2848	150.6859	138.3543	137.4492	125.1111	123.3475	132.7168	131.6097	144.9144	149.5589	157.9376	157.9376	(64)
Heat gains from water heating, kWh/month													
93.6631	83.0489	88.3832	80.8435	80.3928	73.5133	72.1992	77.0226	76.1965	83.7510	86.5290	91.9541	91.9541	(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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)													
-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)													
125.8913	123.5846	118.7946	112.2826	108.0548	102.1018	97.0420	103.5250	105.8285	112.5685	120.1792	123.5942	123.5942	(72)
Total internal gains													
683.5596	678.7335	654.0308	615.5485	575.8591	540.4552	519.8463	528.8488	551.0649	589.7754	632.8477	665.7136	665.7136	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast					5.8000	11.2829	0.4600	0.7000	0.7700	14.6029 (75)				
Southeast					2.0300	36.7938	0.4600	0.7000	0.7700	16.6671 (77)				
Southwest					6.6900	36.7938	0.4600	0.7000	0.7700	54.9276 (79)				
Northwest					1.8800	11.2829	0.4600	0.7000	0.7700	4.7334 (81)				
Northeast					3.8000	11.2829	0.4300	0.0000	0.7700	14.1960 (75)				
Solar gains		105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542	(83)
Total gains		788.6865	868.9415	943.8664	1024.2573	1078.9090	1059.7765	1012.2423	947.8183	881.5867	807.9726	760.7938	754.3678	(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	35.6056	35.7320	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3737	3.3821	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9711	0.9582	0.9323	0.8753	0.7713	0.6203	0.4778	0.5241	0.7327	0.8969	0.9566	0.9748	(86)
Tweekday	17.8383	18.1211	18.5804	19.1473	19.6217	19.8843	19.9596	19.9499	19.7868	19.2070	18.4242	17.7697	
Tweekend	19.9546	20.0808	20.2884	20.5505	20.7818	20.9252	20.9767	20.9678	20.8635	20.5728	20.2149	19.9227	
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	19.3865	19.5781	19.9017	20.2982	20.6633	20.8851	20.9641	20.9504	20.7869	20.3407	19.7741	19.3374	(87)
Th 2	19.9758	19.9790	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	
util rest of house	0.9655	0.9504	0.9191	0.8501	0.7245	0.5435	0.3771	0.4221	0.6642	0.8706	0.9470	0.9700	(89)
Tweekday	17.8383	18.1211	18.5804	19.1473	19.6217	19.8843	19.9596	19.9499	19.7868	19.2070	18.4242	17.7697	
Tweekend	17.8383	18.1211	18.5804	19.1473	19.6217	19.8843	19.9596	19.9499	19.7868	19.2070	18.4242	17.7697	
MIT 2	17.8383	18.1211	18.5804	19.1473	19.6217	19.8843	19.9596	19.9499	19.7868	19.2070	18.4242	17.7697	(90)
Living area fraction													
MIT	18.0627	18.3323	18.7719	19.3141	19.7727	20.0293	20.1052	20.0950	19.9318	19.3713	18.6199	17.9969	(92)
Temperature adjustment													0.0000
adjusted MIT	18.0627	18.3323	18.7719	19.3141	19.7727	20.0293	20.1052	20.0950	19.9318	19.3713	18.6199	17.9969	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9512	0.9333	0.8992	0.8305	0.7139	0.5475	0.3900	0.4343	0.6607	0.8512	0.9298	0.9568	(94)
Useful gains	750.2194	811.0209	848.7269	850.6701	770.2540	580.2799	394.8197	411.6169	582.4331	687.7475	707.3940	721.7499	(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	1600.8101	1556.8541	1421.7250	1206.4995	935.2361	629.0009	406.0900	428.0681	675.6236	1016.1782	1334.6034	1598.4013	(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	632.8395	501.1999	426.3106	256.1971	122.7467	0.0000	0.0000	0.0000	0.0000	244.3524	451.5908	652.2287	(98)
Space heating												3287.4657	(98)
Space heating per m2											(98) / (4) =	31.9606	(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 %)													266.3872	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1234.0932	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	632.8395	501.1999	426.3106	256.1971	122.7467	0.0000	0.0000	0.0000	0.0000	244.3524	451.5908	652.2287	(98)	
Space heating efficiency (main heating system 1)	266.3872	266.3872	266.3872	266.3872	266.3872	0.0000	0.0000	0.0000	0.0000	266.3872	266.3872	266.3872	(210)	
Space heating fuel (main heating system)	237.5638	188.1472	160.0342	96.1747	46.0783	0.0000	0.0000	0.0000	0.0000	91.7283	169.5242	244.8424	(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	161.3758	142.2848	150.6859	138.3543	137.4492	125.1111	123.3475	132.7168	131.6097	144.9144	149.5589	157.9376	(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	94.7708	83.5593	88.4930	81.2510	80.7195	73.4737	72.4380	77.9404	77.2901	85.1036	87.8311	92.7517	(219)	
Water heating fuel used												995.6224	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1234.0932	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)														
mechanical ventilation fans (SFP = 0.2302)													69.9215	(230a)
Total electricity for the above, kWh/year													69.9215	(231)
Electricity for lighting (calculated in Appendix L)													414.4463	(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												1726.0641	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1234.0932	13.1900	162.7769	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	995.6224	13.1900	131.3226	(247)
Mechanical ventilation fans	69.9215	13.1900	9.2226	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	414.4463	13.1900	54.6655	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			227.6679	(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] =	0.6467	(257)
SAP value		90.9786	
SAP rating (Section 12)		91	(258)
SAP band		B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1234.0932	0.5190	640.4944 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	995.6224	0.5190	516.7280 (264)
Space and water heating			1157.2224 (265)
Pumps and fans	69.9215	0.5190	36.2893 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			895.8273 (272)
CO2 emissions per m2			8.7100 (273)
EI value			91.8815
EI rating			92 (274)
EI band			A

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.6639 = 4.951$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.6639 = 0.1948$, stars = 5
Water heating energy efficiency	$13.19 / 1.7028 = 7.746$, stars = 3
Water heating environmental impact	$0.519 / 1.7028 = 0.3048$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.0720	Feb 41.0720	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8521	(39)
HLP	Jan 1.1263	Feb 1.1263	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1263	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)	Total = Sum (45)m =											1571.1266	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	212.2690	187.0650	196.3895	175.9533	172.3583	153.9077	147.7160	162.2224	161.9774	182.4582	193.0527	207.1292	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings	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	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	161.3758	142.2848	150.6859	138.3543	137.4492	125.1111	123.3475	132.7168	131.6097	144.9144	149.5589	157.9376	(64)
Heat gains from water heating, kWh/month	93.6631	83.0489	88.3832	80.8435	80.3928	73.5133	72.1992	77.0226	76.1965	83.7510	86.5290	91.9541	(65)
Total per year (kWh/year) = Sum (64)m =													1695.3458 (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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	125.8913	123.5846	118.7946	112.2826	108.0548	102.1018	97.0420	103.5250	105.8285	112.5685	120.1792	123.5942	(72)
Total internal gains	683.5596	678.7335	654.0308	615.5485	575.8591	540.4552	519.8463	528.8488	551.0649	589.7754	632.8477	665.7136	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					5.8000	12.9236	0.4600	0.7000	0.7700	16.7263 (75)		
Southeast					2.0300	40.4699	0.4600	0.7000	0.7700	18.3323 (77)		
Southwest					6.6900	40.4699	0.4600	0.7000	0.7700	60.4154 (79)		
Northwest					1.8800	12.9236	0.4600	0.7000	0.7700	5.4216 (81)		
Northeast					3.8000	12.9236	0.4300	0.0000	0.7700	16.2602 (75)		
Solar gains	117.1558	191.3893	289.6772	423.1305	508.5556	562.0911	527.1112	458.0190	358.8903	234.8889	146.2082	97.7635 (83)
Total gains	800.7153	870.1228	943.7080	1038.6790	1084.4147	1102.5462	1046.9576	986.8679	909.9553	824.6643	779.0559	763.4771 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9654	0.9528	0.9208	0.8464	0.7079	0.4953	0.3369	0.3670	0.6443	0.8655	0.9450	0.9696	(86)
Tweekday	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	
Tweekend	20.0489	20.1504	20.3714	20.6381	20.8584	20.9705	20.9943	20.9924	20.9238	20.6661	20.3151	20.0198	
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	19.5322	19.6858	20.0298	20.4349	20.7815	20.9547	20.9912	20.9883	20.8810	20.4847	19.9306	19.4873	(87)
Th 2	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	
util rest of house	0.9586	0.9437	0.9048	0.8148	0.6486	0.4051	0.2289	0.2540	0.5585	0.8303	0.9324	0.9635	(89)
Tweekday	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	
Tweekend	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	
MIT 2	18.0520	18.2767	18.7631	19.3316	19.7672	19.9505	19.9768	19.9756	19.8876	19.4029	18.6463	17.9877	(90)
Living area fraction	fLA = Living area / (4) =											0.1450	(91)
MIT	18.2666	18.4810	18.9467	19.4915	19.9143	20.0960	20.1239	20.1224	20.0316	19.5597	18.8325	18.2051	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2666	18.4810	18.9467	19.4915	19.9143	20.0960	20.1239	20.1224	20.0316	19.5597	18.8325	18.2051	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9429	0.9258	0.8845	0.7972	0.6444	0.4159	0.2445	0.2702	0.5632	0.8129	0.9138	0.9489	(94)
Useful gains	755.0232	805.5693	834.7135	828.0049	698.8067	458.5368	255.9432	266.6388	512.5120	670.3881	711.8696	724.4734	(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	1525.3730	1492.2865	1337.7101	1111.1964	801.0312	474.5354	257.6383	269.0572	559.7529	922.1482	1254.9632	1518.2531	(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	573.1403	461.4740	374.2295	203.8979	76.0550	0.0000	0.0000	0.0000	0.0000	187.3095	391.0274	590.5721	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 27.7825 (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 %)													266.3937 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1072.7376 (211)
Space heating requirement	573.1403	461.4740	374.2295	203.8979	76.0550	0.0000	0.0000	0.0000	0.0000	187.3095	391.0274	590.5721	(98)
Space heating efficiency (main heating system 1)	266.3937	266.3937	266.3937	266.3937	266.3937	0.0000	0.0000	0.0000	0.0000	266.3937	266.3937	266.3937	(210)
Space heating fuel (main heating system)	215.1478	173.2301	140.4798	76.5400	28.5498	0.0000	0.0000	0.0000	0.0000	70.3130	146.7855	221.6915	(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	161.3758	142.2848	150.6859	138.3543	137.4492	125.1111	123.3475	132.7168	131.6097	144.9144	149.5589	157.9376	(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	94.7708	83.5593	88.4930	81.2510	80.7195	73.4737	72.4380	77.9404	77.2901	85.1036	87.8311	92.7517	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1072.7376 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)													
mechanical ventilation fans (SFP = 0.2302)													69.9215 (230a)
Total electricity for the above, kWh/year													69.9215 (231)
Electricity for lighting (calculated in Appendix L)													414.4463 (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													1505.8551 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1072.7376	16.9600	181.9363	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	995.6224	16.9600	168.8576	(247)
Mechanical ventilation fans	69.9215	16.9600	11.8587	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	414.4463	16.9600	70.2901	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			255.3930	(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	1072.7376	0.5190	556.7508	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	995.6224	0.5190	516.7280	(264)
Space and water heating			1073.4789	(265)
Pumps and fans	69.9215	0.5190	36.2893	(267)
Energy for lighting	414.4463	0.5190	215.0976	(268)
Energy saving/generation technologies				
PV Unit	-1046.8728	0.5190	-543.3270	(269)
Total kg/year			781.5388	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1072.7376	3.0700	3293.3045 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	995.6224	3.0700	3056.5608 (264)
Space and water heating			6349.8653 (265)
Pumps and fans	69.9215	3.0700	214.6591 (267)
Energy for lighting	414.4463	3.0700	1272.3500 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			4622.9750 (272)
Primary energy kWh/m2/year			44.9443 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 91
Current environmental impact rating: A 92

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 67	-206 kg (26.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£67 2.01 kg/m²	A 93	A 94
Total Savings	£67 2.01 kg/m²		
Potential energy efficiency rating:		A 93	
Potential environmental impact rating:			A 94

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 £433	Potential £365	Saving £67
Electricity			
Space heating	£194	£194	-£0
Water heating	£169	£101	£68
Lighting	£70	£70	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£255	£187	£67
Total cost of uses	£255	£187	£68
Delivered energy	15 kWh/m²	11 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	8 kg/m²	6 kg/m²	2 kg/m²
Primary energy	45 kWh/m²	33 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.5351	Feb 41.1233	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	116.3152	115.9035	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8950	(39)
HLP	Jan 1.1308	Feb 1.1268	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1267	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy content (annual)	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	25.2720	(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	25.2720	(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	212.2690	187.0650	194.9938	169.1997	159.5639	141.3009	134.6890	150.1260	156.5745	181.0624	193.0527	207.1292	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings													-457.1528
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													1.6280 (H8)
Utilisation factor													0.4589 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													99.8562 (H14)
Volume ratio Veff/V													0.7511 (H15)
Solar storage volume factor													0.9428 (H16)
Solar input													-689.9742 (H17)
Solar input	-20.0079	-33.3874	-56.8626	-76.2070	-94.1474	-92.5619	-91.3386	-79.8030	-62.5018	-42.6813	-23.7322	-16.7432	(63)
Solar input (sum of months) = Sum(63)m =													-689.9742 (63)
Output from w/h	141.3679	108.8974	92.4276	55.3936	30.5075	19.9425	18.9820	40.8174	63.7050	100.8373	125.8266	141.1944	(64)
Total per year (kWh/year) = Sum(64)m =													939.8993 (64)
Heat gains from water heating, kWh/month	93.6631	83.0489	87.2666	75.4406	70.1573	63.4279	61.7777	67.3455	71.8742	82.6344	86.5290	91.9541	(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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	125.8913	123.5846	117.2938	104.7786	94.2975	88.0944	83.0345	90.5181	99.8253	111.0677	120.1792	123.5942	(72)
Total internal gains	683.5596	678.7335	652.5300	608.0445	562.1017	526.4477	505.8389	515.8419	545.0617	588.2746	632.8477	665.7136	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.8000	11.2829	0.4600	0.7000	0.7700	14.6029	(75)
Southeast	2.0300	36.7938	0.4600	0.7000	0.7700	16.6671	(77)
Southwest	6.6900	36.7938	0.4600	0.7000	0.7700	54.9276	(79)
Northwest	1.8800	11.2829	0.4600	0.7000	0.7700	4.7334	(81)
Northeast	3.8000	11.2829	0.4300	0.0000	0.7700	14.1960	(75)

Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542	(83)
Total gains	788.6865	868.9415	942.3656	1016.7533	1065.1517	1045.7691	998.2348	934.8113	875.5835	806.4718	760.7938	754.3678	(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	35.6056	35.7320	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3737	3.3821	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9711	0.9582	0.9325	0.8773	0.7763	0.6262	0.4835	0.5301	0.7355	0.8973	0.9566	0.9748	(86)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	17.8383	18.1211	18.5782	19.1390	19.6130	19.8811	19.9589	19.9488	19.7841	19.2052	18.4242	17.7697
Tweekend	19.9546	20.0808	20.2874	20.5465	20.7771	20.9230	20.9759	20.9667	20.8618	20.5719	20.2149	19.9227
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	19.3865	19.5781	19.9002	20.2918	20.6559	20.8817	20.9628	20.9486	20.7842	20.3393	19.7741	19.3374 (87)
Th 2	19.9758	19.9790	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)
util rest of house	0.9655	0.9504	0.9194	0.8523	0.7299	0.5493	0.3820	0.4274	0.6672	0.8711	0.9470	0.9700 (89)
Tweekday	17.8383	18.1211	18.5782	19.1390	19.6130	19.8811	19.9589	19.9488	19.7841	19.2052	18.4242	17.7697
Tweekend	17.8383	18.1211	18.5782	19.1390	19.6130	19.8811	19.9589	19.9488	19.7841	19.2052	18.4242	17.7697
MIT 2	17.8383	18.1211	18.5782	19.1390	19.6130	19.8811	19.9589	19.9488	19.7841	19.2052	18.4242	17.7697 (90)
Living area fraction									fLA = Living area / (4) =			0.1450 (91)
MIT	18.0627	18.3323	18.7698	19.3061	19.7642	20.0262	20.1044	20.0937	19.9290	19.3696	18.6199	17.9969 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0627	18.3323	18.7698	19.3061	19.7642	20.0262	20.1044	20.0937	19.9290	19.3696	18.6199	17.9969 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9512	0.9333	0.8995	0.8327	0.7189	0.5531	0.3950	0.4395	0.6635	0.8517	0.9298	0.9568 (94)
Useful gains	750.2194	811.0209	847.6846	846.6277	765.7188	578.4252	394.2835	410.8733	580.9178	686.8749	707.3940	721.7499 (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	1600.8101	1556.8541	1421.4812	1205.5708	934.2567	628.6348	405.9895	427.9273	675.3067	1015.9767	1334.6034	1598.4013 (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	632.8395	501.1999	426.9047	258.4390	125.3922	0.0000	0.0000	0.0000	0.0000	244.8518	451.5908	652.2287 (98)
Space heating												3293.4465 (98)
Space heating per m2										(98) / (4) =		32.0187 (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 %)												266.3872 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1236.3383 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	632.8395	501.1999	426.9047	258.4390	125.3922	0.0000	0.0000	0.0000	0.0000	244.8518	451.5908	652.2287 (98)
Space heating efficiency (main heating system 1)	266.3872	266.3872	266.3872	266.3872	266.3872	0.0000	0.0000	0.0000	0.0000	266.3872	266.3872	266.3872 (210)
Space heating fuel (main heating system)	237.5638	188.1472	160.2572	97.0163	47.0714	0.0000	0.0000	0.0000	0.0000	91.9158	169.5242	244.8424 (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	141.3679	108.8974	92.4276	55.3936	30.5075	19.9425	18.9820	40.8174	63.7050	100.8373	125.8266	141.1944 (64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (217)
Fuel for water heating, kWh/month	83.0209	63.9519	54.2798	32.5309	17.9161	11.7116	11.1475	23.9707	37.4119	59.2185	73.8940	82.9190 (219)
Water heating fuel used												551.9728 (219)
Annual totals kWh/year												
Space heating fuel - main system												1236.3383 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												119.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (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												1334.6596 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1236.3383	13.1900	163.0730 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	551.9728	13.1900	72.8052 (247)
Mechanical ventilation fans	69.9215	13.1900	9.2226 (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	414.4463	13.1900	54.6655 (250)
Additional standing charges			0.0000 (251)

Energy saving/generation technologies

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-988.0192	13.1900	-130.3197 (252)
Total energy cost			176.0416 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5001 (257)
SAP value		93.0243
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	1236.3383	0.5190	641.6596 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	551.9728	0.5190	286.4739 (264)
Space and water heating			928.1335 (265)
Pumps and fans	119.9215	0.5190	62.2393 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			692.6884 (272)
CO2 emissions per m2			6.7300 (273)
EI value			93.7224
EI rating			94 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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)
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.4000	1.1450	18.7786		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500 (28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880 (29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700 (30a)
Total net area of external elements Aum(A, m ²)			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255		(33)
1F Timber			87.3300			9.0000	785.9700 (32c)
GF Masonry			52.2100			39.0000	2036.1900 (32c)
GF Timber			24.0700			9.0000	216.6300 (32c)
Internal Floor			51.4300			12.6000	648.0180 (32d)
Internal Ceiling			51.4300			9.0000	462.8700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14909.2860 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.9474 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546 (36)
Total fabric heat loss						(33) + (36) =	74.7801 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0720	Feb 41.0720	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720 (38)
Heat transfer coeff	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521 (39)
Average = Sum(39)m / 12 =												115.8521 (39)
HLP	Jan 1.1263	Feb 1.1263	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263 (40)
HLP (average)												1.1263 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)	Total = Sum (45)m =											1571.1266	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	212.2690	187.0650	194.9938	169.1997	159.5639	141.3009	134.6890	150.1260	156.5745	181.0624	193.0527	207.1292	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings													-457.1528
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1140.0998 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1915.3676 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.7194 (H8)
Utilisation factor													0.4410 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													99.8562 (H14)
Volume ratio Veff/V													0.7511 (H15)
Solar storage volume factor													0.9428 (H16)
Solar input													-700.1924 (H17)
Solar input	-21.5516	-32.3920	-54.5522	-75.4078	-90.8164	-95.5803	-93.2852	-83.3043	-65.0193	-44.2314	-26.1965	-17.8556	(63)
Output from w/h	139.8242	109.8928	94.7380	56.1928	33.8385	16.9241	17.0354	37.3161	61.1875	99.2873	123.3624	140.0820	(64)
Heat gains from water heating, kWh/month	93.6631	83.0489	87.2666	75.4406	70.1573	63.4279	61.7777	67.3455	71.8742	82.6344	86.5290	91.9541	(65)
Total per year (kWh/year) = Sum (64)m =													
Solar input (sum of months) = Sum (63)m =													

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	125.8913	123.5846	117.2938	104.7786	94.2975	88.0944	83.0345	90.5181	99.8253	111.0677	120.1792	123.5942	(72)
Total internal gains	683.5596	678.7335	652.5300	608.0445	562.1017	526.4477	505.8389	515.8419	545.0617	588.2746	632.8477	665.7136	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				5.8000	12.9236	0.4600	0.7000	0.7700	16.7263 (75)			
Southeast				2.0300	40.4699	0.4600	0.7000	0.7700	18.3323 (77)			
Southwest				6.6900	40.4699	0.4600	0.7000	0.7700	60.4154 (79)			
Northwest				1.8800	12.9236	0.4600	0.7000	0.7700	5.4216 (81)			
Northeast				3.8000	12.9236	0.4300	0.0000	0.7700	16.2602 (75)			
Solar gains	117.1558	191.3893	289.6772	423.1305	508.5556	562.0911	527.1112	458.0190	358.8903	234.8889	146.2082	97.7635 (83)
Total gains	800.7153	870.1228	942.2072	1031.1750	1070.6574	1088.5388	1032.9501	973.8609	903.9521	823.1635	779.0559	763.4771 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9654	0.9528	0.9211	0.8486	0.7133	0.5007	0.3413	0.3716	0.6472	0.8660	0.9450	0.9696	(86)

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Tweekday	18.0520	18.2767	18.7610	19.3244	19.7614	19.9494	19.9767	19.9755	19.8862	19.4014	18.6463	17.9877
Tweekend	20.0489	20.1504	20.3704	20.6345	20.8549	20.9696	20.9941	20.9921	20.9227	20.6654	20.3151	20.0198
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	19.5322	19.6858	20.0283	20.4292	20.7761	20.9532	20.9909	20.9878	20.8793	20.4835	19.9306	19.4873 (87)
Th 2	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)
util rest of house	0.9586	0.9437	0.9052	0.8173	0.6542	0.4099	0.2319	0.2573	0.5614	0.8309	0.9324	0.9635 (89)
Tweekday	18.0520	18.2767	18.7610	19.3244	19.7614	19.9494	19.9767	19.9755	19.8862	19.4014	18.6463	17.9877
Tweekend	18.0520	18.2767	18.7610	19.3244	19.7614	19.9494	19.9767	19.9755	19.8862	19.4014	18.6463	17.9877
MIT 2	18.0520	18.2767	18.7610	19.3244	19.7614	19.9494	19.9767	19.9755	19.8862	19.4014	18.6463	17.9877 (90)
Living area fraction									fLA = Living area / (4) =			0.1450 (91)
MIT	18.2666	18.4810	18.9447	19.4846	19.9085	20.0949	20.1237	20.1222	20.0301	19.5582	18.8325	18.2051 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2666	18.4810	18.9447	19.4846	19.9085	20.0949	20.1237	20.1222	20.0301	19.5582	18.8325	18.2051 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9429	0.9258	0.8849	0.7995	0.6497	0.4206	0.2477	0.2737	0.5660	0.8135	0.9138	0.9489 (94)
Useful gains	755.0232	805.5693	833.7255	824.4653	695.5962	457.8563	255.8555	266.5178	511.6413	669.6365	711.8696	724.4734 (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	1525.3730	1492.2865	1337.4795	1110.3957	800.3647	474.4074	257.6215	269.0342	559.5798	921.9775	1254.9632	1518.2531 (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	573.1403	461.4740	374.7930	205.8699	77.9477	0.0000	0.0000	0.0000	0.0000	187.7417	391.0274	590.5721 (98)
Space heating per m2										(98) / (4) =		27.8297 (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 %)												266.3937 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1074.5622 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	573.1403	461.4740	374.7930	205.8699	77.9477	0.0000	0.0000	0.0000	0.0000	187.7417	391.0274	590.5721 (98)
Space heating efficiency (main heating system 1)	266.3937	266.3937	266.3937	266.3937	266.3937	0.0000	0.0000	0.0000	0.0000	266.3937	266.3937	266.3937 (210)
Space heating fuel (main heating system)	215.1478	173.2301	140.6914	77.2803	29.2604	0.0000	0.0000	0.0000	0.0000	70.4753	146.7855	221.6915 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	139.8242	109.8928	94.7380	56.1928	33.8385	16.9241	17.0354	37.3161	61.1875	99.2873	123.3624	140.0820 (64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (216)
Fuel for water heating, kWh/month	82.1143	64.5365	55.6366	33.0003	19.8723	9.9390	10.0043	21.9146	35.9335	58.3082	72.4468	82.2657 (219)
Water heating fuel used												545.9719 (219)
Annual totals kWh/year												1074.5622 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												119.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (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												1108.0291 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1074.5622	16.9600	182.2457 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	545.9719	16.9600	92.5968 (247)
Mechanical ventilation fans	69.9215	16.9600	11.8587 (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	414.4463	16.9600	70.2901 (250)
Additional standing charges			0.0000 (251)

Energy saving/generation technologies

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PV Unit	-1046.8728	16.9600	-177.5496 (252)
Total energy cost			187.9217 (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	1074.5622	0.5190	557.6978 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	545.9719	0.5190	283.3594 (264)
Space and water heating			841.0572 (265)
Pumps and fans	119.9215	0.5190	62.2393 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			575.0671 (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	1074.5622	3.0700	3298.9059 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	545.9719	3.0700	1676.1338 (264)
Space and water heating			4975.0397 (265)
Pumps and fans	119.9215	3.0700	368.1591 (267)
Energy for lighting	414.4463	3.0700	1272.3500 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			3401.6494 (272)
Primary energy kWh/m2/year			33.0707 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	144.9 (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	328.58 (P1)
Transmission heat loss coefficient	74.78 (37)
Summer heat loss coefficient	403.36 (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
North 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)
North 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	5.8000	98.8453	0.4600	0.7000	0.9000	149.5288
South East	2.0300	119.9223	0.4600	0.7000	0.9000	63.4946
South West	6.6900	119.9223	0.4600	0.7000	0.9000	209.2508
North West	1.8800	98.8453	0.4600	0.7000	0.9000	48.4679
North East	3.8000	98.8453	0.4300	0.0000	0.9000	145.3619

total: 616.1040

Solar gains	Jun 657	Jul 616	Aug 535	(P3/P4)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Internal gains	540	520	529	
Total summer gains	1197	1136	1064	(P5)
Summer gain/loss ratio	2.97	2.82	2.64	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 144.9)	0.99	0.99	0.99	
Threshold temperature	19.95	21.70	21.42	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			