

PREDICTED ENERGY ASSESSMENT

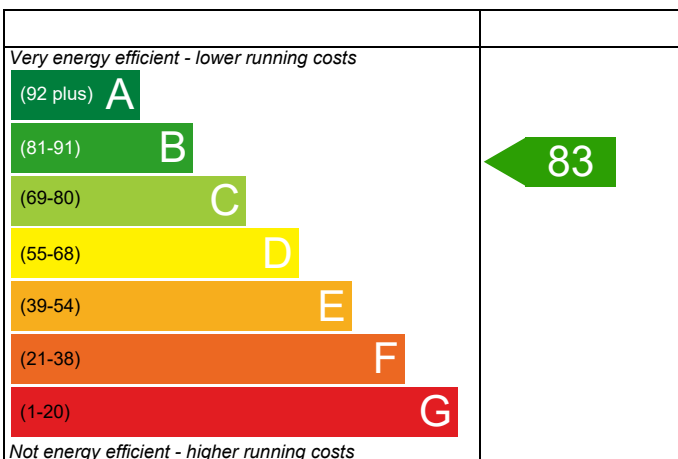
Shrivenham,
SN6

Dwelling type: House, Semi-Detached
Date of assessment: 03/08/2023
Produced by: Briary Energy Limited
Total floor area: 79.004 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

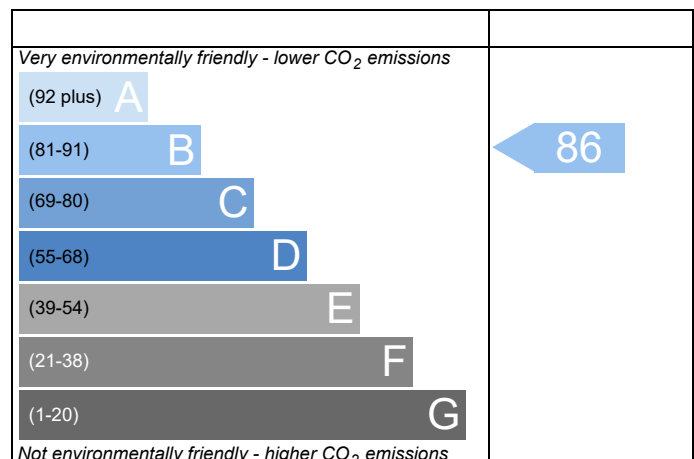


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	374 - PRJ012557			Issued on Date	03/08/2023
Assessment Reference	374	Prop Type Ref	VW0052.V2 SAN SD CL 4.6		
Property	Shrivenham, SN6				
SAP Rating	83 B	DER	17.98	TER	18.77
Environmental	86 B	% DER<TER	4.23		
CO ₂ Emissions (t/year)	1.23	DFEE	44.86	TFEE	50.92
General Requirements Compliance	Pass	% DFEE<TFEE	11.89		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.77 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.98 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.23 (max. 0.25)	0.23 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.30 (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: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Severn Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.36 m², No overhang
Windows facing South: 3.53 m², No overhang
Air change rate: 4.68 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.022 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3763 (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	0.4797	0.4703	0.4609	0.4139	0.4045	0.3574	0.3574	0.3480	0.3763	0.4045	0.4233	0.4421 (22b)
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
119.6239 (35)
3.6652 (36)
(33) + (36) = 48.0313 (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	38.9668	38.6837	38.4062	37.1029	36.8590	35.7239	35.7239	35.5137	36.1611	36.8590	37.3523	37.8681 (38)
Heat transfer coeff	86.9981	86.7150	86.4375	85.1342	84.8904	83.7552	83.7552	83.5450	84.1925	84.8904	85.3837	85.8994 (39)
Average = Sum(39)m / 12 =												85.1331 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1012	1.0976	1.0941	1.0776	1.0745	1.0601	1.0601	1.0575	1.0657	1.0745	1.0808	1.0873 (40)
HLP (average)												1.0776 (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
Average daily hot water use (litres/day)
2.4437 (42)
92.2377 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1451.2576 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6683	13.2271	14.6002	14.0794	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519 (61)
Total heat required for water heating calculated for each month											
165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (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 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373 (64)
Heat gains from water heating, kWh/month	53.6965	47.0628	48.8024	42.8847	41.3996	36.0946	33.8139	38.2805	38.5835	44.5145	48.1546 (65)
Total per year (kWh/year) = Sum(64)m =	1622.6927 (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	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.8787	20.3206	16.5259	12.5111	9.3522	7.8955	8.5314	11.0895	14.8842	18.8990	22.0579	23.5146	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3463	219.6017	213.9182	201.8188	186.5454	172.1906	162.6007	160.3453	166.0288	178.1282	193.4016	207.7564	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	72.1727	70.0339	65.5946	59.5621	55.6447	50.1314	45.4488	51.4523	53.5882	59.8313	66.8814	70.0461	(72)
Total internal gains	375.0531	372.6116	358.6940	336.5474	314.1977	292.8729	279.2363	285.5424	297.1566	319.5139	344.9963	363.9725	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3620	10.6334	0.4700	0.7200	0.7700	8.3836	(74)
South	3.5280	46.7521	0.4700	0.7200	0.7700	38.6806	(78)
Solar gains	47.0642	79.3704	107.9197	134.9327	153.9471	154.5249	148.2413 (83)
Total gains	422.1173	451.9820	466.6138	471.4801	468.1448	447.3978	427.4775 (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	30.1755	30.2740	30.3712	30.8362	30.9247	31.3439	31.3439	31.4227	31.1811	30.9247	30.7461	30.5615
alpha	3.0117	3.0183	3.0247	3.0557	3.0616	3.0896	3.0896	3.0948	3.0787	3.0616	3.0497	3.0374
util living area	0.9827	0.9773	0.9678	0.9480	0.9066	0.8189	0.6969	0.7222	0.8647	0.9474	0.9755	0.9848 (86)
MIT	18.8682	19.0378	19.3498	19.7935	20.2440	20.6471	20.8531	20.8299	20.5373	19.9700	19.3558	18.8447 (87)
Th 2	19.9999	20.0028	20.0057	20.0192	20.0217	20.0335	20.0335	20.0357	20.0290	20.0217	20.0166	20.0112 (88)
util rest of house	0.9797	0.9732	0.9616	0.9366	0.8821	0.7619	0.5921	0.6242	0.8202	0.9337	0.9704	0.9822 (89)
MIT 2	18.0441	18.2146	18.5263	18.9742	19.4139	19.7959	19.9618	19.9479	19.6977	19.1521	18.5417	18.0290 (90)
Living area fraction	fLA = Living area / (4) =											0.2256 (91)
MIT	18.2300	18.4003	18.7121	19.1591	19.6012	19.9879	20.1629	20.1469	19.8872	19.3366	18.7253	18.2130 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2300	18.4003	18.7121	19.1591	19.6012	19.9879	20.1629	20.1469	19.8872	19.3366	18.7253	18.2130 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9724	0.9645	0.9509	0.9238	0.8692	0.7587	0.6079	0.6371	0.8123	0.9213	0.9614	0.9755	(94)	
Useful gains	410.4657	435.9379	443.7188	435.5549	406.9087	339.4489	259.8704	266.9683	336.4461	374.8859	385.7064	394.4898	(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	1211.8873	1170.6778	1055.5853	873.3969	670.7347	451.2652	298.4101	313.0347	487.2347	741.6551	992.6145	1203.7090	(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	596.2577	493.7453	455.2286	315.2462	196.2866	0.0000	0.0000	0.0000	0.0000	272.8763	436.9739	602.0591	(98)	
Space heating												3368.6736	(98)	
Space heating per m2												(98) / (4) =	42.6393	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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												3602.8595 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	596.2577	493.7453	455.2286	315.2462	196.2866	0.0000	0.0000	0.0000	0.0000	272.8763	436.9739	602.0591 (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)	637.7088	528.0698	486.8756	337.1617	209.9321	0.0000	0.0000	0.0000	0.0000	291.8463	467.3517	643.9134 (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	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (64)
Efficiency of water heater (217)m	89.7862	89.7539	89.6836	89.5290	89.2086	87.3000	87.3000	87.3000	87.3000	89.4020	89.6670	87.3000 (216)
Fuel for water heating, kWh/month	183.9176	161.3570	167.6968	147.9632	143.6083	128.3269	120.5951	135.9956	136.9133	153.7905	165.4313	178.5715 (219)
Water heating fuel used												1824.1672 (219)
Annual totals kWh/year												
Space heating fuel - main system												3602.8595 (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)												404.0448 (232)
Total delivered energy for all uses												5906.0715 (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	3602.8595	0.2160	778.2176 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1824.1672	0.2160	394.0201 (264)
Space and water heating			1172.2378 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	404.0448	0.5190	209.6992 (268)
Total CO2, kg/year			1420.8620 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9800 (273)

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

DER		17.9800 ZC1
Total Floor Area	TFA	79.0040
Assumed number of occupants	N	2.4437
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.3023 ZC2
CO2 emissions from cooking, equation (L16)		2.2486 ZC3
Total CO2 emissions		36.5309 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		36.5309 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 191.9797 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1563 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4063 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3758 (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	0.4791	0.4697	0.4604	0.4134	0.4040	0.3570	0.3570	0.3476	0.3758	0.4040	0.4228	0.4416	(22b)				
Effective ac	0.6148	0.6103	0.6060	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5894	0.5975	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			4.2000	1.0000	4.2000		(26)					
TER Opening Type (Uw = 1.40)			6.8900	1.3258	9.1345		(27)					
Flr - Ground			39.5020	0.1300	5.1353		(28a)					
Brick	8.2800		8.2800	0.1800	1.4904		(29a)					
Clad	78.4860	11.0940	67.3920	0.1800	12.1306		(29a)					
Rf - Ins Joist	39.5020		39.5020	0.1300	5.1353		(30)					
Total net area of external elements Aum(A, m2)			165.7660				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	37.2259	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7849 (36)					
Total fabric heat loss						(33) + (36) =	46.0108 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.9488	Feb 38.6665	Mar 38.3897	Apr 37.0896	May 36.8463	Jun 35.7140	Jul 35.7140	Aug 35.5043	Sep 36.1501	Oct 36.8463	Nov 37.3384	Dec 37.8528 (38)
Heat transfer coeff	84.9597	84.6773	84.4005	83.1004	82.8571	81.7248	81.7248	81.5151	82.1609	82.8571	83.3492	83.8637 (39)
Average = Sum(39)m / 12 =												83.0992 (39)
HLP	Jan 1.0754	Feb 1.0718	Mar 1.0683	Apr 1.0519	May 1.0488	Jun 1.0344	Jul 1.0344	Aug 1.0318	Sep 1.0400	Oct 1.0488	Nov 1.0550	Dec 1.0615 (40)
HLP (average)												1.0518 (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												2.4437 (42)
Average daily hot water use (litres/day)												92.2377 (43)
Daily hot water use	Jan 101.4614	Feb 97.7719	Mar 94.0824	Apr 90.3929	May 86.7034	Jun 83.0139	Jul 83.0139	Aug 86.7034	Sep 90.3929	Oct 94.0824	Nov 97.7719	Dec 101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)
Energy content (annual)										Total = Sum(45)m =		1451.2576 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000 (57)
Combi loss	50.9589	45.0019	47.9434	44.5773	44.1831	40.9384	42.3030	44.1831	44.5773	47.9434	48.2163	50.9589	(61)
Total heat required for water heating calculated for each month	201.4233	176.5990	183.7398	162.9679	157.7817	138.9653	133.1394	148.4192	150.0583	170.8713	182.4017	196.6756	(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	201.4233	176.5990	183.7398	162.9679	157.7817	138.9653	133.1394	148.4192	150.0583	170.8713	182.4017	196.6756	(64)
Heat gains from water heating, kWh/month	62.7691	55.0065	57.1382	50.5092	48.8173	42.8286	40.7788	45.7043	46.2168	52.8594	56.6707	61.1905	(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	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0065	20.4342	16.6182	12.5811	9.4045	7.9397	8.5791	11.1514	14.9674	19.0046	22.1811	23.6460	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3463	219.6017	213.9182	201.8188	186.5454	172.1906	162.6007	160.3453	166.0288	178.1282	193.4016	207.7564	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	84.3671	81.8549	76.7986	70.1517	65.6147	59.4841	54.8103	61.4305	64.1899	71.0476	78.7094	82.2453	(72)
Total internal gains	387.3753	384.5462	369.9904	347.2069	324.2199	302.2697	288.6454	295.5826	307.8415	330.8357	356.9475	376.3031	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	3.3620				10.6334		0.6300		0.7000		0.7700		10.9255	
South	3.5280				46.7521		0.6300		0.7000		0.7700		50.4082 (78)	
Solar gains	61.3337	103.4348	140.6401	175.8432	200.6225	201.3756	193.1867	173.9715	152.5104	113.8980	73.2289	52.6654	(83)	
Total gains	448.7090	487.9810	510.6305	523.0501	524.8425	503.6453	481.8322	469.5541	460.3519	444.7337	430.1764	428.9684	(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	64.5764	64.7918	65.0042	66.0212	66.2151	67.1325	67.1325	67.3052	66.7761	66.2151	65.8241	65.4203	
alpha	5.3051	5.3195	5.3336	5.4014	5.4143	5.4755	5.4755	5.4870	5.4517	5.4143	5.3883	5.3614	
util living area	0.9985	0.9973	0.9945	0.9857	0.9564	0.8611	0.7014	0.7376	0.9183	0.9863	0.9970	0.9988	(86)
MIT	19.8301	19.9428	20.1360	20.4070	20.6747	20.8915	20.9737	20.9652	20.8251	20.4876	20.1173	19.8154	(87)
Th 2	20.0210	20.0239	20.0268	20.0403	20.0429	20.0547	20.0547	20.0569	20.0502	20.0429	20.0378	20.0324	(88)
util rest of house	0.9980	0.9963	0.9924	0.9796	0.9346	0.7897	0.5725	0.6146	0.8692	0.9792	0.9957	0.9984	(89)
MIT 2	18.4538	18.6207	18.9046	19.3075	19.6868	19.9693	20.0432	20.0400	19.8925	19.4275	18.8861	18.4407	(90)
Living area fraction	18.7643	18.9190	19.1824	19.5555	19.9097	20.1773	20.2532	20.2488	20.1029	19.6667	19.1639	18.7508	(92)
MIT	18.7643	18.9190	19.1824	19.5555	19.9097	20.1773	20.2532	20.2488	20.1029	19.6667	19.1639	18.7508	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.7643	18.9190	19.1824	19.5555	19.9097	20.1773	20.2532	20.2488	20.1029	19.6667	19.1639	18.7508	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9970	0.9948	0.9898	0.9753	0.9308	0.8005	0.6017	0.6420	0.8726	0.9753	0.9941	0.9976	(94)
Ext temp.	4.3400	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	1228.8845	1187.0897	1070.4042	885.4779	680.2326	455.8053	298.5539	313.7321	493.2063	751.2382	1005.5140	1220.2845	(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	581.4639	471.5137	420.3417	270.2413	142.6371	0.0000	0.0000	0.0000	0.0000	236.2225	416.0778	589.5016	(98)
Space heating												3127.9996	(98)
Space heating per m2												39.5929	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3349.0360 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	581.4639	471.5137	420.3417	270.2413	142.6371	0.0000	0.0000	0.0000	0.0000	236.2225	416.0778	589.5016	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	622.5524	504.8327	450.0446	289.3376	152.7164	0.0000	0.0000	0.0000	0.0000	252.9149	445.4794	631.1580	(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	201.4233	176.5990	183.7398	162.9679	157.7817	138.9653	133.1394	148.4192	150.0583	170.8713	182.4017	196.6756	(64)
Efficiency of water heater (217)m	87.5663	87.4044	87.0690	86.3159	84.7983	80.3000	80.3000	80.3000	80.3000	85.8668	87.0625	80.3000	(216)
Fuel for water heating, kWh/month	230.0237	202.0480	211.0278	188.8042	186.0671	173.0577	165.8024	184.8309	186.8721	198.9958	209.5066	224.4072	(219)
Water heating fuel used												2361.4437	(219)
Annual totals kWh/year													
Space heating fuel - main system												3349.0360	(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)												406.3026	(232)
Total delivered energy for all uses												6191.7823	(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	3349.0360	0.2160	723.3918 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2361.4437	0.2160	510.0718 (264)
Space and water heating			1233.4636 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	406.3026	0.5190	210.8711 (268)
Total CO2, kg/m2/year			1483.2597 (272)
Emissions per m2 for space and water heating			15.6127 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6691 (272b)
Emissions per m2 for pumps and fans			0.4927 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6127 * 1.00) + 2.6691 + 0.4927, rounded to 2 d.p.			18.7700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3763 (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	0.4797	0.4703	0.4609	0.4139	0.4045	0.3574	0.3574	0.3480	0.3763	0.4045	0.4233	0.4421 (22b)
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
119.6239 (35)
3.6652 (36)
(33) + (36) = 48.0313 (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	38.9668	38.6837	38.4062	37.1029	36.8590	35.7239	35.7239	35.5137	36.1611	36.8590	37.3523	37.8681 (38)
Heat transfer coeff	86.9981	86.7150	86.4375	85.1342	84.8904	83.7552	83.7552	83.5450	84.1925	84.8904	85.3837	85.8994 (39)
Average = Sum(39)m / 12 =												85.1331 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1012	1.0976	1.0941	1.0776	1.0745	1.0601	1.0601	1.0575	1.0657	1.0745	1.0808	1.0873 (40)
HLP (average)												1.0776 (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
Average daily hot water use (litres/day)
2.4437 (42)
92.2377 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1451.2576 (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	31.9737	27.9644	28.8567	25.1580	24.1397	20.8307	19.3027	22.1502	22.4147	26.1222	28.5144	30.9648 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.8787	20.3206	16.5259	12.5111	9.3522	7.8955	8.5314	11.0895	14.8842	18.8990	22.0579	23.5146	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3463	219.6017	213.9182	201.8188	186.5454	172.1906	162.6007	160.3453	166.0288	178.1282	193.4016	207.7564	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	(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)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	42.9754	41.6137	38.7859	34.9417	32.4458	28.9316	25.9445	29.7717	31.1315	35.1105	39.6033	41.6194	(72)
Total internal gains	342.8557	341.1914	328.8854	308.9270	287.9988	268.6731	256.7320	260.8619	271.7000	291.7930	314.7182	332.5457	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c	Access factor Table 6d		Gains W
North	3.3620				10.6334	0.4700			0.7200	0.7700		8.3836 (74)
South	3.5280				46.7521	0.4700			0.7200	0.7700		38.6806 (78)
Solar gains	47.0642	79.3704	107.9197	134.9327	153.9471	154.5249	148.2413	133.4965	117.0284	87.3992	56.1920	40.4126 (83)
Total gains	389.9200	420.5618	436.8051	443.8597	441.9459	423.1980	404.9733	394.3583	388.7284	379.1923	370.9102	372.9583 (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	30.1755	30.2740	30.3712	30.8362	30.9247	31.3439	31.3439	31.4227	31.1811	30.9247	30.7461	30.5615	
alpha	3.0117	3.0183	3.0247	3.0557	3.0616	3.0896	3.0896	3.0948	3.0787	3.0616	3.0497	3.0374	
util living area	0.9860	0.9812	0.9727	0.9551	0.9177	0.8363	0.7188	0.7459	0.8808	0.9557	0.9800	0.9878	(86)
MIT	18.8058	18.9780	19.2948	19.7457	20.2049	20.6211	20.8389	20.8123	20.5046	19.9221	19.2982	18.7832	(87)
Th 2	19.9999	20.0028	20.0057	20.0192	20.0217	20.0335	20.0335	20.0357	20.0290	20.0217	20.0166	20.0112	(88)
util rest of house	0.9835	0.9777	0.9674	0.9450	0.8954	0.7822	0.6152	0.6501	0.8398	0.9438	0.9758	0.9856	(89)
MIT 2	17.9824	18.1556	18.4726	18.9284	19.3782	19.7754	19.9536	19.9371	19.6702	19.1064	18.4851	17.9680	(90)
Living area fraction	18.1682	18.3411	18.6581	19.1128	19.5647	19.9662	20.1533	20.1345	19.8585	19.2904	18.6685	18.1519	(92)
Temperature adjustment	18.1682	18.3411	18.6581	19.1128	19.5647	19.9662	20.1533	20.1345	19.8585	19.2904	18.6685	18.1519	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	381.0331	407.9567	418.3311	414.0681	389.9712	329.1260	255.0808	260.8375	323.0027	353.4484	359.0035	365.4799	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1206.5046	1165.5492	1050.9150	869.4585	667.6365	449.4473	297.6080	312.0006	484.8190	737.7337	987.7643	1198.4580	(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	614.1508	509.1021	470.6424	327.8811	206.5829	0.0000	0.0000	0.0000	0.0000	285.9083	452.7077	619.7357	(98)
Space heating												3486.7111	(98)
Space heating per m2												44.1333	(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	787.2993	619.7888	634.9423	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6362	0.7189	0.7019	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	500.8981	445.5727	445.6943	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	587.2645	564.2094	553.8312	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	62.1838	88.2657	80.4539	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												230.9034 (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	15.5460	22.0664	20.1135	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												57.7259 (107)
Space cooling per m2												0.7307 (108)
Energy for space heating												44.1333 (99)
Energy for space cooling												0.7307 (108)
Total												44.8640 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1563 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4063 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3758 (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	0.4791	0.4697	0.4604	0.4134	0.4040	0.3570	0.3570	0.3476	0.3758	0.4040	0.4228	0.4416	(22b)				
Effective ac	0.6148	0.6103	0.6060	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5894	0.5975	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			4.2000	1.0000	4.2000		(26)					
TER Opening Type (Uw = 1.40)			6.8900	1.3258	9.1345		(27)					
Flr - Ground			39.5020	0.1300	5.1353		(28a)					
Brick	8.2800		8.2800	0.1800	1.4904		(29a)					
Clad	78.4860	11.0940	67.3920	0.1800	12.1306		(29a)					
Rf - Ins Joist	39.5020		39.5020	0.1300	5.1353		(30)					
Total net area of external elements Aum(A, m2)			165.7660				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	37.2259	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7849 (36)					
Total fabric heat loss						(33) + (36) =	46.0108 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.9488	Feb 38.6665	Mar 38.3897	Apr 37.0896	May 36.8463	Jun 35.7140	Jul 35.7140	Aug 35.5043	Sep 36.1501	Oct 36.8463	Nov 37.3384	Dec 37.8528 (38)
Heat transfer coeff	84.9597	84.6773	84.4005	83.1004	82.8571	81.7248	81.7248	81.5151	82.1609	82.8571	83.3492	83.8637 (39)
Average = Sum(39)m / 12 =												83.0992 (39)
HLP	Jan 1.0754	Feb 1.0718	Mar 1.0683	Apr 1.0519	May 1.0488	Jun 1.0344	Jul 1.0344	Aug 1.0318	Sep 1.0400	Oct 1.0488	Nov 1.0550	Dec 1.0615 (40)
HLP (average)												1.0518 (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												2.4437 (42)
Average daily hot water use (litres/day)												92.2377 (43)
Daily hot water use	Jan 101.4614	Feb 97.7719	Mar 94.0824	Apr 90.3929	May 86.7034	Jun 83.0139	Jul 83.0139	Aug 86.7034	Sep 90.3929	Oct 94.0824	Nov 97.7719	Dec 101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)
Energy content (annual)										Total = Sum(45)m =		1451.2576 (45)
Distribution loss (46)m = 0.15 x (45)m												
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	31.9737	27.9644	28.8567	25.1580	24.1397	20.8307	19.3027	22.1502	22.4147	26.1222	28.5144	30.9648 (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	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846	122.1846 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0065	20.4342	16.6182	12.5811	9.4045	7.9397	8.5791	11.1514	14.9674	19.0046	22.1811	23.6460 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3463	219.6017	213.9182	201.8188	186.5454	172.1906	162.6007	160.3453	166.0288	178.1282	193.4016	207.7564 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185	35.2185 (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)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476 (71)
Water heating gains (Table 5)	42.9754	41.6137	38.7859	34.9417	32.4458	28.9316	25.9445	29.7717	31.1315	35.1105	39.6033	41.6194 (72)
Total internal gains	342.9836	341.3049	328.9777	308.9969	288.0511	268.7172	256.7797	260.9239	271.7831	291.8986	314.8415	332.6771 (73)

6. Solar gains												

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W

North				3.3620	10.6334		0.6300		0.7000		0.7700	10.9255 (74)
South				3.5280	46.7521		0.6300		0.7000		0.7700	50.4082 (78)

Solar gains	61.3337	103.4348	140.6401	175.8432	200.6225	201.3756	193.1867	173.9715	152.5104	113.8980	73.2289	52.6654 (83)
Total gains	404.3173	444.7398	469.6178	484.8400	488.6736	470.0928	449.9664	434.8953	424.2935	405.7966	388.0704	385.3425 (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	64.5764	64.7918	65.0042	66.0212	66.2151	67.1325	67.1325	67.3052	66.7761	66.2151	65.8241	65.4203
alpha	5.3051	5.3195	5.3336	5.4014	5.4143	5.4755	5.4755	5.4870	5.4517	5.4143	5.3883	5.3614
util living area	0.9991	0.9983	0.9963	0.9898	0.9672	0.8869	0.7377	0.7770	0.9387	0.9910	0.9982	0.9993 (86)
MIT	19.7769	19.8913	20.0878	20.3638	20.6392	20.8712	20.9665	20.9550	20.7955	20.4434	20.0671	19.7630 (87)
Th 2	20.0210	20.0239	20.0268	20.0403	20.0429	20.0547	20.0547	20.0569	20.0502	20.0429	20.0378	20.0324 (88)
util rest of house	0.9988	0.9976	0.9948	0.9853	0.9498	0.8223	0.6083	0.6557	0.8982	0.9860	0.9974	0.9991 (89)
MIT 2	18.8980	19.0146	19.2129	19.4980	19.7678	19.9828	20.0443	20.0412	19.9194	19.5799	19.2015	18.8933 (90)
Living area fraction									fLA = Living area / (4) =			0.2256 (91)
MIT	19.0963	19.2124	19.4103	19.6934	19.9644	20.1832	20.2523	20.2474	20.1171	19.7747	19.3968	19.0895 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0963	19.2124	19.4103	19.6934	19.9644	20.1832	20.2523	20.2474	20.1171	19.7747	19.3968	19.0895 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9983	0.9969	0.9936	0.9831	0.9479	0.8327	0.6380	0.6831	0.9017	0.9841	0.9967	0.9987 (94)
Useful gains	403.6489	443.3772	466.6024	476.6491	463.2285	391.4436	287.0664	297.0913	382.6063	399.3599	386.7808	384.8546 (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	1257.0890	1211.9358	1089.6342	896.9317	684.7629	456.2869	298.4851	313.6194	494.3668	760.1913	1024.9280	1248.6885 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	634.9594	516.4714	463.5357	302.6035	164.8216	0.0000	0.0000	0.0000	0.0000	268.4586	459.4660	642.6924 (98)
Space heating												3453.0084 (98)
Space heating per m2										(98) / (4) =		43.7068 (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	768.2129	604.7633	619.5146	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7610	0.8538	0.8329	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	584.6350	516.3598	516.0214	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	642.1353	616.8622	601.2946	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	41.4002	74.7738	63.4433	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												179.6173 (104)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	10.3501	18.6934	15.8608	0.0000	0.0000	0.0000 (107)
Space cooling											44.9043 (107)
Space cooling per m2											0.5684 (108)
Energy for space heating											43.7068 (99)
Energy for space cooling											0.5684 (108)
Total											44.2751 (109)
Target Fabric Energy Efficiency (TFEE)											50.9 (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	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3763 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.3000	4.0000	3.9000	3.4000	3.4000	3.3000	3.5000	3.8000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.0750	1.0000	0.9750	0.8500	0.8500	0.8250	0.8750	0.9500	0.9500	1.0250 (22a)
Adj infilt rate	0.4233	0.4045	0.4045	0.3763	0.3669	0.3198	0.3198	0.3104	0.3292	0.3574	0.3574	0.3857 (22b)
Effective ac	0.5896	0.5818	0.5818	0.5708	0.5673	0.5511	0.5511	0.5482	0.5542	0.5639	0.5639	0.5744 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							119.6239 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6652 (36)
Total fabric heat loss							(33) + (36) = 48.0313 (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	37.3523	36.8590	36.8590	36.1611	35.9397	34.9167	34.9167	34.7289	35.1101	35.7239	35.7239	36.3882 (38)
Heat transfer coeff	85.3837	84.8904	84.8904	84.1925	83.9711	82.9480	82.9480	82.7603	83.1414	83.7552	83.7552	84.4195 (39)
Average = Sum(39)m / 12 =												83.9213 (39)
HLP	1.0808	1.0745	1.0745	1.0657	1.0629	1.0499	1.0499	1.0475	1.0524	1.0601	1.0601	1.0685 (40)
HLP (average)												1.0622 (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												2.4437 (42)
Average daily hot water use (litres/day)												92.2377 (43)
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1451.2576 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6683	13.2271	14.6002	14.0794	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541 (61)
Total heat required for water heating calculated for each month	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (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	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (64)
	Total per year (kWh/year) = Sum(64)m = 1622.6927 (64)											1623 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.6965	47.0628	48.8024	42.8847	41.3996	36.0946	33.8139	38.2805	38.5835	44.5145	48.1546	52.1143 (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	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1967	50.8016	41.3147	31.2779	23.3806	19.7389	21.3285	27.7236	37.2106	47.2474	55.1447	58.7864	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3975	327.7637	319.2809	301.2221	278.4260	257.0009	242.6876	239.3214	247.8042	265.8630	288.6591	310.0842	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	72.1727	70.0339	65.5946	59.5621	55.6447	50.1314	45.4488	51.4523	53.5882	59.8313	66.8814	70.0461	(72)
Total internal gains	557.7466	552.5789	530.1698	496.0417	461.4309	430.8508	413.4446	422.4770	442.5827	476.9214	514.6649	542.8964	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.3620	12.7802	0.4700	0.7200	0.7700		10.0763 (74)	
South					3.5280	54.3838	0.4700	0.7200	0.7700		44.9947 (78)	
Solar gains	55.0710	82.5872	109.9923	141.6074	155.9704	170.0549	157.6154	143.6377	126.5262	93.5111	64.7700	47.5680 (83)
Total gains	612.8176	635.1662	640.1621	637.6491	617.4012	600.9057	571.0600	566.1147	569.1088	570.4325	579.4349	590.4644 (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	30.7461	30.9247	30.9247	31.1811	31.2633	31.6489	31.6489	31.7207	31.5753	31.3439	31.3439	31.0972
alpha	3.0497	3.0616	3.0616	3.0787	3.0842	3.1099	3.1099	3.1147	3.1050	3.0896	3.0896	3.0731
util living area	0.9531	0.9447	0.9257	0.8906	0.8183	0.6744	0.5306	0.5439	0.7365	0.8771	0.9350	0.9575 (86)
MIT	19.3129	19.4474	19.7483	20.1161	20.5141	20.8243	20.9399	20.9344	20.7471	20.2984	19.7573	19.2828 (87)
Th 2	20.0166	20.0217	20.0217	20.0290	20.0313	20.0419	20.0419	20.0439	20.0399	20.0335	20.0335	20.0266 (88)
util rest of house	0.9456	0.9359	0.9128	0.8697	0.7784	0.5989	0.4217	0.4366	0.6715	0.8499	0.9231	0.9507 (89)
MIT 2	18.4936	18.6294	18.9249	19.2872	19.6633	19.9375	20.0179	20.0167	19.8763	19.4680	18.9448	18.4716 (90)
Living area fraction	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546 (91)
MIT	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	571.6370	585.7962	574.9818	545.5577	475.5041	364.8134	253.5001	259.3316	383.5511	477.6404	526.8376	554.1816	(95)
Ext temp.	4.6000	5.1000	6.9000	9.2000	12.2000	15.1000	17.0000	16.9000	14.5000	11.0000	7.4000	4.5000	(96)
Heat loss rate W	1202.0684	1164.1807	1036.5701	865.0121	642.8219	417.8546	267.5851	275.0733	463.3255	724.9326	982.2927	1194.9272	(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	469.0410	388.6743	343.4216	230.0071	124.4845	0.0000	0.0000	0.0000	0.0000	183.9854	327.9277	476.7147	(98)
Space heating												2544.2563	(98)
RHI space heating demand												2544	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3763 (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	0.4797	0.4703	0.4609	0.4139	0.4045	0.3574	0.3574	0.3480	0.3763	0.4045	0.4233	0.4421 (22b)
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							119.6239 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6652 (36)
Total fabric heat loss							(33) + (36) = 48.0313 (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	38.9668	38.6837	38.4062	37.1029	36.8590	35.7239	35.7239	35.5137	36.1611	36.8590	37.3523	37.8681 (38)
Heat transfer coeff	86.9981	86.7150	86.4375	85.1342	84.8904	83.7552	83.7552	83.5450	84.1925	84.8904	85.3837	85.8994 (39)
Average = Sum(39)m / 12 =												85.1331 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1012	1.0976	1.0941	1.0776	1.0745	1.0601	1.0601	1.0575	1.0657	1.0745	1.0808	1.0873 (40)
HLP (average)												1.0776 (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												2.4437 (42)
Average daily hot water use (litres/day)												92.2377 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1451.2576 (45)
Distribution loss (46)m = 0.15 x (45)m													
22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575	(46)	
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	14.6683	13.2271	14.6002	14.0794	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541 (61)	
Total heat required for water heating calculated for each month													
165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (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 (63)		
	Solar input (sum of months) = Sum(63)m =											0.0000 (63)	
Output from w/h													
165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (64)		
	Total per year (kWh/year) = Sum(64)m =											1622.6927 (64)	
Heat gains from water heating, kWh/month													
53.6965	47.0628	48.8024	42.8847	41.3996	36.0946	33.8139	38.2805	38.5835	44.5145	48.1546	52.1143 (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	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1967	50.8016	41.3147	31.2779	23.3806	19.7389	21.3285	27.7236	37.2106	47.2474	55.1447	58.7864	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3975	327.7637	319.2809	301.2221	278.4260	257.0009	242.6876	239.3214	247.8042	265.8630	288.6591	310.0842	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	72.1727	70.0339	65.5946	59.5621	55.6447	50.1314	45.4488	51.4523	53.5882	59.8313	66.8814	70.0461	(72)
Total internal gains	557.7466	552.5789	530.1698	496.0417	461.4309	430.8508	413.4446	422.4770	442.5827	476.9214	514.6649	542.8964	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	Gains W	
North				3.3620	10.6334		0.4700		0.7200	0.7700	8.3836 (74)	
South				3.5280	46.7521		0.4700		0.7200	0.7700	38.6806 (78)	
Solar gains	47.0642	79.3704	107.9197	134.9327	153.9471	154.5249	148.2413	133.4965	117.0284	87.3992	56.1920	40.4126 (83)
Total gains	604.8108	631.9493	638.0896	630.9744	615.3780	585.3757	561.6858	555.9734	559.6111	564.3207	570.8569	583.3090 (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	30.1755	30.2740	30.3712	30.8362	30.9247	31.3439	31.3439	31.4227	31.1811	30.9247	30.7461	30.5615
alpha	3.0117	3.0183	3.0247	3.0557	3.0616	3.0896	3.0896	3.0948	3.0787	3.0616	3.0497	3.0374
util living area	0.9570	0.9478	0.9318	0.8996	0.8384	0.7213	0.5814	0.6039	0.7687	0.8906	0.9413	0.9610 (86)
MIT	19.2050	19.3611	19.6441	20.0431	20.4335	20.7632	20.9127	20.8989	20.6870	20.2124	19.6575	19.1795 (87)
Th 2	19.9999	20.0028	20.0057	20.0192	20.0217	20.0335	20.0335	20.0357	20.0290	20.0217	20.0166	20.0112 (88)
util rest of house	0.9502	0.9394	0.9200	0.8804	0.8031	0.6538	0.4782	0.5047	0.7101	0.8664	0.9304	0.9547 (89)
MIT 2	18.3750	18.5307	18.8112	19.2099	19.5822	19.8829	19.9941	19.9875	19.8176	19.3778	18.8348	18.3584 (90)
Living area fraction	18.5623	18.7180	18.9991	19.3979	19.7742	20.0815	20.2013	20.1931	fLA = Living area / (4) =			0.2256 (91)
MIT	18.5623	18.7180	18.9991	19.3979	19.7742	20.0815	20.2013	20.1931	20.0137	19.5661	19.0204	18.5437 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5623	18.7180	18.9991	19.3979	19.7742	20.0815	20.2013	20.1931	20.0137	19.5661	19.0204	18.5437 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9376	0.9258	0.9054	0.8658	0.7928	0.6575	0.4975	0.5222	0.7091	0.8529	0.9167	0.9429 (94)
Useful gains	567.0976	585.0603	577.7184	546.3234	487.8766	384.8777	279.4281	290.3108	396.8204	481.3103	523.3108	549.9894 (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	1240.7921	1198.2321	1080.3891	893.7290	685.4259	459.1059	301.6291	316.8946	497.8916	761.1352	1017.8114	1232.1130 (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	501.2287	412.0515	373.9870	250.1321	146.9767	0.0000	0.0000	0.0000	0.0000	208.1897	356.0405	507.5000 (98)
Space heating												2756.1060 (98)
Space heating per m2												(98) / (4) = 34.8857 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 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													2947.7070 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	501.2287	412.0515	373.9870	250.1321	146.9767	0.0000	0.0000	0.0000	0.0000	208.1897	356.0405	507.5000	(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)	536.0734	440.6968	399.9861	267.5209	157.1943	0.0000	0.0000	0.0000	0.0000	222.6628	380.7920	542.7807	(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	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708	(64)
Efficiency of water heater (217)m	89.6853	89.6454	89.5585	89.3658	88.9810	87.3000	87.3000	87.3000	87.3000	89.1995	89.5348	87.3000	(216)
Fuel for water heating, kWh/month	184.1245	161.5522	167.9312	148.2333	143.9756	128.3269	120.5951	135.9956	136.9133	154.1396	165.6756	178.7650	(219)
Water heating fuel used												1826.2280	(219)
Annual totals kWh/year													
Space heating fuel - main system												2947.7070	(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)												404.0448	(232)
Total delivered energy for all uses												5252.9798	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2947.7070	3.4800	102.5802 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1826.2280	3.4800	63.5527 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	404.0448	13.1900	53.2935 (250)
Additional standing charges			120.0000 (251)
Total energy cost			349.3189 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1831 (257)
SAP value		83.4952
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2947.7070	0.2160	636.7047 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.2280	0.2160	394.4652 (264)
Space and water heating			1031.1700 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	404.0448	0.5190	209.6992 (268)
Total kg/year			1279.7942 (272)
CO2 emissions per m2			16.2000 (273)
EI value			86.1704
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8874 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8874 = 0.2434$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3763 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.3000	4.0000	3.9000	3.4000	3.4000	3.3000	3.5000	3.8000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.0750	1.0000	0.9750	0.8500	0.8500	0.8250	0.8750	0.9500	0.9500	1.0250 (22a)
Adj infilt rate	0.4233	0.4045	0.4045	0.3763	0.3669	0.3198	0.3198	0.3104	0.3292	0.3574	0.3574	0.3857 (22b)
Effective ac	0.5896	0.5818	0.5818	0.5708	0.5673	0.5511	0.5511	0.5482	0.5542	0.5639	0.5639	0.5744 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							119.6239 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6652 (36)
Total fabric heat loss							(33) + (36) = 48.0313 (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	37.3523	36.8590	36.8590	36.1611	35.9397	34.9167	34.9167	34.7289	35.1101	35.7239	35.7239	36.3882 (38)
Heat transfer coeff	85.3837	84.8904	84.8904	84.1925	83.9711	82.9480	82.9480	82.7603	83.1414	83.7552	83.7552	84.4195 (39)
Average = Sum(39)m / 12 =												83.9213 (39)
HLP	1.0808	1.0745	1.0745	1.0657	1.0629	1.0499	1.0499	1.0475	1.0524	1.0601	1.0601	1.0685 (40)
HLP (average)												1.0622 (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												2.4437 (42)
Average daily hot water use (litres/day)												92.2377 (43)
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1451.2576 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6683	13.2271	14.6002	14.0794	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519 (61)
Total heat required for water heating calculated for each month											
165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (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 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (64)
Heat gains from water heating, kWh/month											
53.6965	47.0628	48.8024	42.8847	41.3996	36.0946	33.8139	38.2805	38.5835	44.5145	48.1546	52.1143 (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	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1967	50.8016	41.3147	31.2779	23.3806	19.7389	21.3285	27.7236	37.2106	47.2474	55.1447	58.7864	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3975	327.7637	319.2809	301.2221	278.4260	257.0009	242.6876	239.3214	247.8042	265.8630	288.6591	310.0842	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	72.1727	70.0339	65.5946	59.5621	55.6447	50.1314	45.4488	51.4523	53.5882	59.8313	66.8814	70.0461	(72)
Total internal gains	557.7466	552.5789	530.1698	496.0417	461.4309	430.8508	413.4446	422.4770	442.5827	476.9214	514.6649	542.8964	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North					3.3620	12.7802	0.4700	0.7200	0.7700	10.0763
South					3.5280	54.3838	0.4700	0.7200	0.7700	44.9947 (78)
Solar gains	55.0710	82.5872	109.9923	141.6074	155.9704	170.0549	157.6154	143.6377	126.5262	93.5111 64.7700 47.5680 (83)
Total gains	612.8176	635.1662	640.1621	637.6491	617.4012	600.9057	571.0600	566.1147	569.1088	570.4325 579.4349 590.4644 (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	30.7461	30.9247	30.9247	31.1811	31.2633	31.6489	31.6489	31.7207	31.5753	31.3439	31.3439	31.0972
alpha	3.0497	3.0616	3.0616	3.0787	3.0842	3.1099	3.1099	3.1147	3.1050	3.0896	3.0896	3.0731
util living area	0.9531	0.9447	0.9257	0.8906	0.8183	0.6744	0.5306	0.5439	0.7365	0.8771	0.9350	0.9575 (86)
MIT	19.3129	19.4474	19.7483	20.1161	20.5141	20.8243	20.9399	20.9344	20.7471	20.2984	19.7573	19.2828 (87)
Th 2	20.0166	20.0217	20.0217	20.0290	20.0313	20.0419	20.0419	20.0439	20.0399	20.0335	20.0335	20.0266 (88)
util rest of house	0.9456	0.9359	0.9128	0.8697	0.7784	0.5989	0.4217	0.4366	0.6715	0.8499	0.9231	0.9507 (89)
MIT 2	18.4936	18.6294	18.9249	19.2872	19.6633	19.9375	20.0179	20.0167	19.8763	19.4680	18.9448	18.4716 (90)
Living area fraction	fLA = Living area / (4) =											0.2256 (91)
MIT	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9328	0.9223	0.8982	0.8556	0.7702	0.6071	0.4439	0.4581	0.6740	0.8373	0.9092	0.9386	(94)
Useful gains	571.6370	585.7962	574.9818	545.5577	475.5041	364.8134	253.5001	259.3316	383.5511	477.6404	526.8376	554.1816	(95)
Ext temp.	4.6000	5.1000	6.9000	9.2000	12.2000	15.1000	17.0000	16.9000	14.5000	11.0000	7.4000	4.5000	(96)
Heat loss rate W	1202.0684	1164.1807	1036.5701	865.0121	642.8219	417.8546	267.5851	275.0733	463.3255	724.9326	982.2927	1194.9272	(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	469.0410	388.6743	343.4216	230.0071	124.4845	0.0000	0.0000	0.0000	0.0000	183.9854	327.9277	476.7147	(98)
Space heating												2544.2563	(98)
Space heating per m2												(98) / (4) =	32.2041 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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												2721.1297 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	469.0410	388.6743	343.4216	230.0071	124.4845	0.0000	0.0000	0.0000	0.0000	183.9854	327.9277	476.7147 (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)	501.6481	415.6945	367.2959	245.9969	133.1385	0.0000	0.0000	0.0000	0.0000	196.7758	350.7248	509.8553 (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	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (64)
Efficiency of water heater (217)m	89.6444	89.6084	89.5008	89.3037	88.8482	87.3000	87.3000	87.3000	87.3000	89.1031	89.4785	87.3000 (216)
Fuel for water heating, kWh/month	184.2086	161.6191	168.0393	148.3365	144.1908	128.3269	120.5951	135.9956	136.9133	154.3064	165.7799	178.8404 (219)
Water heating fuel used												1827.1519 (219)
Annual totals kWh/year												2721.1297 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
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)												404.0448 (232)
Total delivered energy for all uses												5027.3264 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2721.1297	10.2300	278.3716 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1827.1519	10.2300	186.9176 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	404.0448	36.7200	148.3652 (250)
Additional standing charges			103.0000 (251)
Total energy cost			744.1945 (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	2721.1297	0.2160	587.7640 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1827.1519	0.2160	394.6648 (264)
Space and water heating			982.4288 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	404.0448	0.5190	209.6992 (268)
Total kg/year			1231.0531 (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	2721.1297	1.2200	3319.7783 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1827.1519	1.2200	2229.1253 (264)
Space and water heating			5548.9035 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	404.0448	3.0700	1240.4175 (268)
Primary energy kWh/year			7019.5710 (272)
Primary energy kWh/m2/year			88.8508 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E	Low energy lighting
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 80	-182 kg (14.8%)
U Solar photovoltaic panels	+ 10.8	-£ 685	-968 kg (92.3%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£80	2.31 kg/m²	B 85	B 88
Solar photovoltaic panels	£685	12.26 kg/m²	A 96	A 98
Total Savings	£766	14.57 kg/m²		

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Severn Valley):			
	Current	Potential	Saving
Electricity	£176	£194	-£18
Mains gas	£568	£470	£99
Space heating	£409	£409	£0
Water heating	£187	£107	£80
Lighting	£148	£148	£0
Generated (PV)	-£0	-£685	£685
Total cost of fuels	£744	-£21	£766
Total cost of uses	£744	-£21	£765
Delivered energy	64 kWh/m²	28 kWh/m²	35 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m²	16 kg/m²	1 kg/m²	15 kg/m²
Primary energy	89 kWh/m²	3 kWh/m²	85 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3763 (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	0.4797	0.4703	0.4609	0.4139	0.4045	0.3574	0.3574	0.3480	0.3763	0.4045	0.4233	0.4421 (22b)
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
119.6239 (35)
3.6652 (36)
(33) + (36) = 48.0313 (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	38.9668	38.6837	38.4062	37.1029	36.8590	35.7239	35.7239	35.5137	36.1611	36.8590	37.3523	37.8681 (38)
Heat transfer coeff	86.9981	86.7150	86.4375	85.1342	84.8904	83.7552	83.7552	83.5450	84.1925	84.8904	85.3837	85.8994 (39)
Average = Sum(39)m / 12 =												85.1331 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1012	1.0976	1.0941	1.0776	1.0745	1.0601	1.0601	1.0575	1.0657	1.0745	1.0808	1.0873 (40)
HLP (average)												1.0776 (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
Average daily hot water use (litres/day)
2.4437 (42)
92.2377 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1451.2576 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6683	13.2271	14.6002	14.0794	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541 (61)
Total heat required for water heating calculated for each month	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708 (62)
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												1.2497 (H8)
Utilisation factor												0.5508 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2377 (H14)
Volume ratio Veff/V												0.8131 (H15)
Solar storage volume factor												0.9586 (H16)
Solar input	-24.4151	-40.7417	-69.3878	-92.9934	-114.8855	-112.9507	-111.4580	-97.3814	-76.2692	-52.0829	-28.9598	-841.9566 (H17)
Solar input (sum of months) = Sum(63)m =												-841.9566 (63)
Output from w/h	140.7176	104.0825	81.0088	39.4766	13.2255	0.0000	0.0000	21.3427	43.2562	85.4089	119.3776	139.9395 (64)
Total per year (kWh/year) = Sum(64)m =												787.8359 (64)
Heat gains from water heating, kWh/month	53.6965	47.0628	48.8024	42.8847	41.3996	36.0946	33.8139	38.2805	38.5835	44.5145	48.1546	52.1143 (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	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1967	50.8016	41.3147	31.2779	23.3806	19.7389	21.3285	27.7236	37.2106	47.2474	55.1447	58.7864	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3975	327.7637	319.2809	301.2221	278.4260	257.0009	242.6876	239.3214	247.8042	265.8630	288.6591	310.0842	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	72.1727	70.0339	65.5946	59.5621	55.6447	50.1314	45.4488	51.4523	53.5882	59.8313	66.8814	70.0461	(72)
Total internal gains	557.7466	552.5789	530.1698	496.0417	461.4309	430.8508	413.4446	422.4770	442.5827	476.9214	514.6649	542.8964	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		FF	Access factor Table 6d		Gains W	
North				3.3620	10.6334	0.4700		0.7200			0.7700		8.3836 (74)	
South				3.5280	46.7521	0.4700		0.7200			0.7700		38.6806 (78)	
Solar gains	47.0642	79.3704	107.9197	134.9327	153.9471	154.5249	148.2413	133.4965	117.0284		87.3992	56.1920	40.4126 (83)	
Total gains	604.8108	631.9493	638.0896	630.9744	615.3780	585.3757	561.6858	555.9734	559.6111		564.3207	570.8569	583.3090 (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	30.1755	30.2740	30.3712	30.8362	30.9247	31.3439	31.3439	31.4227	31.1811	30.9247	30.7461	30.5615
alpha	3.0117	3.0183	3.0247	3.0557	3.0616	3.0896	3.0896	3.0948	3.0787	3.0616	3.0497	3.0374
util living area	0.9570	0.9478	0.9318	0.8996	0.8384	0.7213	0.5814	0.6039	0.7687	0.8906	0.9413	0.9610 (86)
MIT	19.2050	19.3611	19.6441	20.0431	20.4335	20.7632	20.9127	20.8989	20.6870	20.2124	19.6575	19.1795 (87)
Th 2	19.9999	20.0028	20.0057	20.0192	20.0217	20.0335	20.0335	20.0357	20.0290	20.0217	20.0166	20.0112 (88)
util rest of house	0.9502	0.9394	0.9200	0.8804	0.8031	0.6538	0.4782	0.5047	0.7101	0.8664	0.9304	0.9547 (89)
MIT 2	18.3750	18.5307	18.8112	19.2099	19.5822	19.8829	19.9941	19.9875	19.8176	19.3778	18.8348	18.3584 (90)
Living area fraction										fLA = Living area / (4) =		0.2256 (91)
MIT	18.5623	18.7180	18.9991	19.3979	19.7742	20.0815	20.2013	20.1931	20.0137	19.5661	19.0204	18.5437 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5623	18.7180	18.9991	19.3979	19.7742	20.0815	20.2013	20.1931	20.0137	19.5661	19.0204	18.5437 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9376	0.9258	0.9054	0.8658	0.7928	0.6575	0.4975	0.5222	0.7091	0.8529	0.9167	0.9429	(94)
Useful gains	567.0976	585.0603	577.7184	546.3234	487.8766	384.8777	279.4281	290.3108	396.8204	481.3103	523.3108	549.9894	(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	1240.7921	1198.2321	1080.3891	893.7290	685.4259	459.1059	301.6291	316.8946	497.8916	761.1352	1017.8114	1232.1130	(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	501.2287	412.0515	373.9870	250.1321	146.9767	0.0000	0.0000	0.0000	0.0000	208.1897	356.0405	507.5000	(98)
Space heating												2756.1060	(98)
Space heating per m2											(98) / (4) =	34.8857	(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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2947.7070	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	501.2287	412.0515	373.9870	250.1321	146.9767	0.0000	0.0000	0.0000	0.0000	208.1897	356.0405	507.5000	(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)	536.0734	440.6968	399.9861	267.5209	157.1943	0.0000	0.0000	0.0000	0.0000	222.6628	380.7920	542.7807	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	140.7176	104.0825	81.0088	39.4766	13.2255	0.0000	0.0000	21.3427	43.2562	85.4089	119.3776	139.9395	(64)	
Efficiency of water heater	89.7786	89.8359	89.9132	90.0501	90.2270	87.3000	87.3000	87.3000	87.3000	89.5452	89.6746	89.7886	(217)	
Fuel for water heating, kWh/month	156.7384	115.8584	90.0967	43.8385	14.6581	0.0000	0.0000	24.4475	49.5489	95.3808	133.1230	155.8544	(219)	
Water heating fuel used												879.5447	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2947.7070	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													404.0448	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)	
Total delivered energy for all uses													2629.0571	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2947.7070	3.4800	102.5802	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.5447	3.4800	30.6082	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	404.0448	13.1900	53.2935	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			95.1465	(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] =	0.3223	(257)
SAP value			95.5045	
SAP rating (Section 12)			96	(258)
SAP band			A	

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 FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2947.7070	0.2160	636.7047 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.5447	0.2160	189.9817 (264)
Space and water heating			826.6864 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	404.0448	0.5190	209.6992 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			204.8234 (272)
CO2 emissions per m2			2.5900 (273)
EI value			97.7867
EI rating			98 (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	39.5020 (1b)	x 2.3260 (2b)	= 91.8817 (1b) - (3b)
First floor	39.5020 (1c)	x 2.5340 (2c)	= 100.0981 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0040		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.9797 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1563 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4068 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3763 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.3000	4.0000	3.9000	3.4000	3.4000	3.3000	3.5000	3.8000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.0750	1.0000	0.9750	0.8500	0.8500	0.8250	0.8750	0.9500	0.9500	1.0250 (22a)
Adj infilt rate	0.4233	0.4045	0.4045	0.3763	0.3669	0.3198	0.3198	0.3104	0.3292	0.3574	0.3574	0.3857 (22b)
Effective ac	0.5896	0.5818	0.5818	0.5708	0.5673	0.5511	0.5511	0.5482	0.5542	0.5639	0.5639	0.5744 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2000	1.2000	5.0400		(26)
Windows (Uw = 1.30)			6.8900	1.2357	8.5143		(27)
Flr - Ground			39.5020	0.2273	8.9793	75.6000	2986.3512 (28a)
Brick	8.2800		8.2800	0.2400	1.9872	38.9500	322.5060 (29a)
Clad	78.4860	11.0940	67.3920	0.2300	15.5002	38.9500	2624.9184 (29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	9.0000	355.5180 (30)
Total net area of external elements Aum(A, m ²)			165.7660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3662		(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300 (32)
Stud			52.6653			7.4000	389.7232 (32c)
Stud			86.0394			7.4000	636.6918 (32c)
Internal Floor			39.5020			7.4000	292.3148 (32d)
Internal Ceiling			39.5020			7.4000	292.3148 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9450.7682 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							119.6239 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6652 (36)
Total fabric heat loss							(33) + (36) = 48.0313 (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	37.3523	36.8590	36.8590	36.1611	35.9397	34.9167	34.9167	34.7289	35.1101	35.7239	35.7239	36.3882 (38)
Heat transfer coeff	85.3837	84.8904	84.8904	84.1925	83.9711	82.9480	82.9480	82.7603	83.1414	83.7552	83.7552	84.4195 (39)
Average = Sum(39)m / 12 =												83.9213 (39)
HLP	1.0808	1.0745	1.0745	1.0657	1.0629	1.0499	1.0499	1.0475	1.0524	1.0601	1.0601	1.0685 (40)
HLP (average)												1.0622 (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												2.4437 (42)
Average daily hot water use (litres/day)												92.2377 (43)
Daily hot water use	101.4614	97.7719	94.0824	90.3929	86.7034	83.0139	83.0139	86.7034	90.3929	94.0824	97.7719	101.4614 (44)
Energy conte	150.4644	131.5971	135.7964	118.3906	113.5986	98.0270	90.8364	104.2361	105.4810	122.9279	134.1854	145.7167 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum (45)m =	1451.2576 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5697	19.7396	20.3695	17.7586	17.0398	14.7040	13.6255	15.6354	15.8221	18.4392	20.1278	21.8575	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6683	13.2271	14.6002	14.0794	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541	(61)
Total heat required for water heating calculated for each month													
	165.1327	144.8242	150.3966	132.4700	128.1110	112.0294	105.2795	118.7241	119.5253	137.4918	148.3373	160.3708	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-27.7331	-41.1710	-68.4978	-93.8689	-111.2461	-118.4959	-113.0933	-100.4980	-79.6743	-54.0916	-32.4137	-864.1196	(63)
Output from w/h													
	137.3996	103.6532	81.8989	38.6010	16.8649	0.0000	0.0000	18.2262	39.8511	83.4002	115.9236	137.0347	(64)
Heat gains from water heating, kWh/month													
	53.6965	47.0628	48.8024	42.8847	41.3996	36.0946	33.8139	38.2805	38.5835	44.5145	48.1546	52.1143	(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	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	146.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1967	50.8016	41.3147	31.2779	23.3806	19.7389	21.3285	27.7236	37.2106	47.2474	55.1447	58.7864	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3975	327.7637	319.2809	301.2221	278.4260	257.0009	242.6876	239.3214	247.8042	265.8630	288.6591	310.0842	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	52.1058	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	-97.7476	(71)
Water heating gains (Table 5)	72.1727	70.0339	65.5946	59.5621	55.6447	50.1314	45.4488	51.4523	53.5882	59.8313	66.8814	70.0461	(72)
Total internal gains	557.7466	552.5789	530.1698	496.0417	461.4309	430.8508	413.4446	422.4770	442.5827	476.9214	514.6649	542.8964	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.3620	12.7802	0.4700		0.7200		0.7700		10.0763 (74)
South				3.5280	54.3838	0.4700		0.7200		0.7700		44.9947 (78)
Solar gains	55.0710	82.5872	109.9923	141.6074	155.9704	170.0549	157.6154	143.6377	126.5262	93.5111	64.7700	47.5680 (83)
Total gains	612.8176	635.1662	640.1621	637.6491	617.4012	600.9057	571.0600	566.1147	569.1088	570.4325	579.4349	590.4644 (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	30.7461	30.9247	30.9247	31.1811	31.2633	31.6489	31.6489	31.7207	31.5753	31.3439	31.3439	31.0972	
alpha	3.0497	3.0616	3.0616	3.0787	3.0842	3.1099	3.1099	3.1147	3.1050	3.0896	3.0896	3.0731	
util living area	0.9531	0.9447	0.9257	0.8906	0.8183	0.6744	0.5306	0.5439	0.7365	0.8771	0.9350	0.9575	(86)
MIT	19.3129	19.4474	19.7483	20.1161	20.5141	20.8243	20.9399	20.9344	20.7471	20.2984	19.7573	19.2828	(87)
Th 2	20.0166	20.0217	20.0217	20.0290	20.0313	20.0419	20.0419	20.0439	20.0399	20.0335	20.0335	20.0266	(88)
util rest of house	0.9456	0.9359	0.9128	0.8697	0.7784	0.5989	0.4217	0.4366	0.6715	0.8499	0.9231	0.9507	(89)
MIT 2	18.4936	18.6294	18.9249	19.2872	19.6633	19.9375	20.0179	20.0167	19.8763	19.4680	18.9448	18.4716	(90)
Living area fraction	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546	(91)
MIT	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546	(92)
Temperature adjustment	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546	(93)
adjusted MIT	18.6784	18.8139	19.1107	19.4742	19.8553	20.1375	20.2259	20.2237	20.0727	19.6554	19.1281	18.6546	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9328	0.9223	0.8982	0.8556	0.7702	0.6071	0.4439	0.4581	0.6740	0.8373	0.9092	0.9386	(94)
Useful gains	571.6370	585.7962	574.9818	545.5577	475.5041	364.8134	253.5001	259.3316	383.5511	477.6404	526.8376	554.1816	(95)
Ext temp.	4.6000	5.1000	6.9000	9.2000	12.2000	15.1000	17.0000	16.9000	14.5000	11.0000	7.4000	4.5000	(96)
Heat loss rate W	1202.0684	1164.1807	1036.5701	865.0121	642.8219	417.8546	267.5851	275.0733	463.3255	724.9326	982.2927	1194.9272	(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	469.0410	388.6743	343.4216	230.0071	124.4845	0.0000	0.0000	0.0000	0.0000	183.9854	327.9277	476.7147	(98)
Space heating												2544.2563	(98)
Space heating per m2											(98) / (4) =	32.2041	(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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2721.1297	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	469.0410	388.6743	343.4216	230.0071	124.4845	0.0000	0.0000	0.0000	0.0000	183.9854	327.9277	476.7147	(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)	501.6481	415.6945	367.2959	245.9969	133.1385	0.0000	0.0000	0.0000	0.0000	196.7758	350.7248	509.8553	(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	137.3996	103.6532	81.8989	38.6010	16.8649	0.0000	0.0000	18.2262	39.8511	83.4002	115.9236	137.0347	(64)	
Efficiency of water heater	89.7546	89.8069	89.8657	90.0258	90.1059	87.3000	87.3000	87.3000	87.3000	89.4770	89.6418	89.7653	(217)	
Fuel for water heating, kWh/month	153.0837	115.4178	91.1347	42.8778	18.7168	0.0000	0.0000	20.8776	45.6484	93.2086	129.3187	152.6588	(219)	
Water heating fuel used												862.9428	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2721.1297	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													404.0448	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1166 * 0.80) =									-1866.0756				-1866.0756	(233)
Total delivered energy for all uses													2247.0417	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2721.1297	10.2300	278.3716	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	862.9428	10.2300	88.2791	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	404.0448	36.7200	148.3652	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1866.0756	36.7200	-685.2230	(252)
Total energy cost			-21.3071	(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	2721.1297	0.2160	587.7640	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	862.9428	0.2160	186.3957	(264)
Space and water heating			774.1597	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	404.0448	0.5190	209.6992	(268)
Energy saving/generation technologies				
PV Unit	-1866.0756	0.5190	-968.4932	(269)
Total kg/year			80.2407	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 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	2721.1297	1.2200	3319.7783 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	862.9428	1.2200	1052.7903 (264)
Space and water heating			4372.5685 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	404.0448	3.0700	1240.4175 (268)
Energy saving/generation technologies			
PV Unit	-1866.0756	3.0700	-5728.8521 (269)
Primary energy kWh/year			267.8839 (272)
Primary energy kWh/m2/year			3.3908 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	119.6 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.68 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	296.49 (P1)
Transmission heat loss coefficient	48.03 (37)
Summer heat loss coefficient	344.52 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.3620	82.4373	0.4700	0.7200	0.7650	64.5737
South	3.5280	113.6726	0.4700	0.7200	0.7650	93.4370
total:						158.0107

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	171	158	144	
Total summer gains	428	410	419	(P5)
Summer gain/loss ratio	1.74	1.65	1.64	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 119.6)	1.16	1.16	1.16	
Threshold temperature	17.90	19.51	19.50	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	374 - PRJ012557			Issued on Date	03/08/2023
Assessment Reference	374	Prop Type Ref	VW0052.V2 SAN SD CL 4.6		
Property	Shrivenham, SN6				
SAP Rating	83 B	DER	17.98	TER	18.77
Environmental	86 B	% DER<TER	4.23		
CO ₂ Emissions (t/year)	1.23	DFEE	44.86	TFEE	50.92
General Requirements Compliance	Pass	% DFEE<TFEE	11.89		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.77	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.98	kgCO ₂ /m ²	Pass
	-0.79 (-4.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.92	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.86	kWh/m ² /yr	
	-6.0 (-11.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.23 (max. 0.25)	0.23 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.26 (max. 2.00)	1.30 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Severn Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

3.36 m², No overhang

Windows facing South

3.53 m², No overhang

Air change rate

4.68 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Thermal bridging y-value

0.022

W/m²K