

PREDICTED ENERGY ASSESSMENT

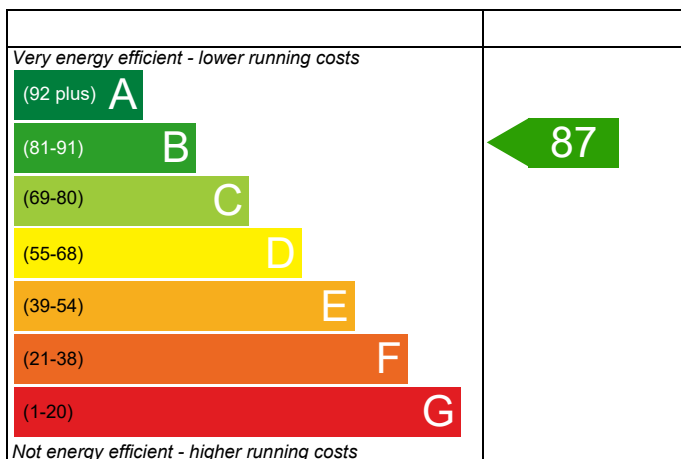
001 - PRJ012480

Dwelling type: House, Semi-Detached
Date of assessment: 10/06/2022
Produced by: Scott Binstead
Total floor area: 134.48 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

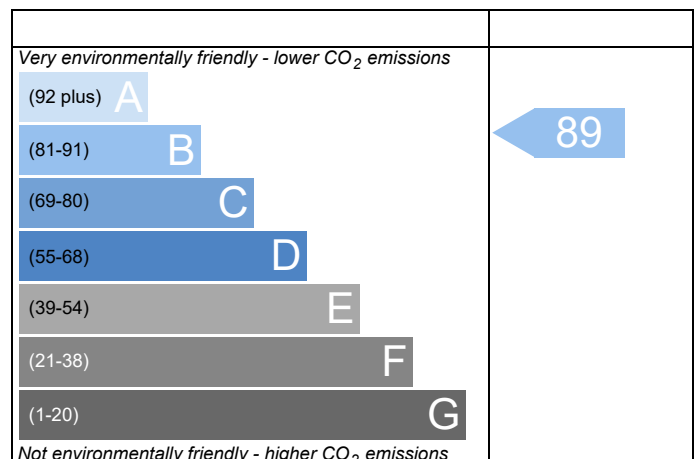


England

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	001 - PRJ012480				Issued on Date	10/06/2022
Assessment Reference	001 S	Prop Type Ref	PRJ012480			
Property	001 - PRJ012480					
SAP Rating	87 B	DER	12.53	TER	15.79	
Environmental	89 B	% DER<TER	20.65			
CO ₂ Emissions (t/year)	1.38	DFEE	40.49	TFEE	51.57	
General Requirements Compliance	Pass	% DFEE<TFEE	21.49			
Assessor Details	Chris Nicholls, , Tel: ,				Assessor ID	U903-0001
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 134 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) 15.79 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.53 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)40.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 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 ESPl 35

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: Time and temperature zone control 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

Continuous extract system (decentralised)

Specific fan power: 0.1900 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North East: 4.67 m², No overhang

Windows facing South East: 3.44 m², No overhang

Windows facing South West: 9.30 m², No overhang

Air change rate: 4.21 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value 0.11 W/m²K

External wall U-value 0.08 W/m²K

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Roof U-value 0.11 W/m²K

Roof U-value 0.08 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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (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) =		0.2317 (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	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
Wl - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)
Total net area of external elements Aum(A, m ²)			259.0420				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6090		(33)
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8000			18.0000	1400.4000 (32d)
Internal Ceiling			77.8000			5.8200	452.7960 (32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	17509.5352 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		130.2018 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		24.0519 (36)
Total fabric heat loss	(33) + (36) =	79.6609 (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	59.5298	58.8976	58.2653	55.1041	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	55.7364	57.0008 (38)
Heat transfer coeff	139.1906	138.5584	137.9262	134.7650	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	135.3972	136.6617 (39)
Average = Sum(39)m / 12 =												135.6576 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0350	1.0303	1.0256	1.0021	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	1.0068	1.0162 (40)
HLP (average)												1.0088 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7084
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2357	25.0787	20.3954	15.4406	11.5420	9.7443	10.5290	13.6860	18.3694	23.3241	27.2227	29.0204 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	480.8671	478.4663	460.8987	432.3309	402.7561	374.7761	356.9511	363.6795	378.6751	407.4791	440.5537	465.9023 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains
				m2	Table 6a	Specific data		Specific data		factor		W
					W/m2	or Table 6b		or Table 6c		Table 6d		
Northeast				4.6650	11.2829	0.7600		0.7200		0.7700		19.9597 (75)
Southeast				3.4400	36.7938	0.7600		0.7200		0.7700		47.9969 (77)
Southwest				9.3030	36.7938	0.7600		0.7200		0.7700		129.8008 (79)
Northeast				0.9200	17.4137	0.7600		0.7200		1.0000		7.8898 (82)
Southwest				1.8400	38.2331	0.7600		0.7200		1.0000		34.6454 (82)
Solar gains	240.2925	424.9789	620.2957	829.0622	980.5094	995.3578	950.5665	834.8121	692.4658	480.4304	290.7371	203.7128 (83)
Total gains	721.1597	903.4452	1081.1944	1261.3931	1383.2655	1370.1339	1307.5176	1198.4916	1071.1409	887.9095	731.2908	669.6151 (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	34.9432	35.1026	35.2635	36.0907	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	35.9222	35.5898
alpha	3.3295	3.3402	3.3509	3.4060	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.3948	3.3727
util living area	0.9859	0.9704	0.9372	0.8606	0.7323	0.5726	0.4348	0.4878	0.7144	0.9102	0.9749	0.9888 (86)
MIT	19.1227	19.4222	19.8488	20.3594	20.7231	20.9123	20.9740	20.9614	20.8106	20.3084	19.6281	19.0882 (87)
Th 2	20.0542	20.0581	20.0620	20.0816	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0777	20.0698 (88)
util rest of house	0.9833	0.9651	0.9260	0.8363	0.6882	0.5055	0.3508	0.4007	0.6524	0.8890	0.9696	0.9868 (89)
MIT 2	17.5259	17.9618	18.5762	19.3037	19.7859	20.0097	20.0692	20.0600	19.9047	19.2511	18.2762	17.4853 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.0638	18.4538	19.0049	19.6593	20.1016	20.3137	20.3740	20.3636	20.2099	19.6073	18.7316	18.0252 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.9138	18.3038	18.8549	19.5093	19.9516	20.1637	20.2240	20.2136	20.0599	19.4573	18.5816	17.8752 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9748	0.9516	0.9077	0.8188	0.6813	0.5116	0.3640	0.4134	0.6506	0.8711	0.9575	0.9796	(94)
Useful gains	702.9726	859.7325	981.3542	1032.8758	942.3580	700.9228	475.8923	495.4808	696.8412	773.4295	700.2280	655.9791	(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	1894.9112	1857.2067	1704.0612	1429.7597	1107.6244	746.8285	486.4570	511.9118	800.0036	1188.9278	1554.5733	1868.8817	(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	886.8023	670.3027	537.6940	285.7564	122.9582	0.0000	0.0000	0.0000	0.0000	309.1307	615.1286	902.3995	(98)
Space heating												4330.1724	(98)
Space heating per m2										(98) / (4) =		32.1994	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4784.7208 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	886.8023	670.3027	537.6940	285.7564	122.9582	0.0000	0.0000	0.0000	0.0000	309.1307	615.1286	902.3995	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	979.8920	740.6659	594.1370	315.7529	135.8654	0.0000	0.0000	0.0000	0.0000	341.5809	679.7001	997.1266	(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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)
Efficiency of water heater (217)m	90.0978	90.0433	89.9292	89.6349	89.0335	87.3000	87.3000	87.3000	87.3000	89.6507	89.9883	87.3000	(216)
Fuel for water heating, kWh/month	136.5057	119.5479	125.2170	113.9385	112.6976	102.6012	99.8102	110.1545	110.0979	120.1682	125.5148	132.7797	(219)
Water heating fuel used												1409.0333	(219)
Annual totals kWh/year													
Space heating fuel - main system												4784.7208	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)													
mechanical ventilation fans (SFP = 0.2378)													95.9333 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													170.9333 (231)
Electricity for lighting (calculated in Appendix L)													498.6511 (232)
Total delivered energy for all uses													6863.3385 (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	4784.7208	0.2160	1033.4997 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1409.0333	0.2160	304.3512 (264)
Space and water heating			1337.8509 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6511	0.5190	258.7999 (268)
Total CO2, kg/year			1685.3652 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5300 (273)

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

DER			12.5300 ZC1
Total Floor Area		TFA	134.4800
Assumed number of occupants		N	2.9057
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.3534 ZC2
CO2 emissions from cooking, equation (L16)			1.4035 ZC3
Total CO2 emissions			27.2869 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			27.2869 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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (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) =		0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3689	0.3260	0.3260	0.3174	0.3431	0.3689	0.3860	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933		(27a)
Flr - Ground			56.6800	0.1300	7.3684		(28a)
Wl - Brick	122.0100	19.5080	102.5020	0.1800	18.4504		(29a)
Wl - Stud Ashlar	17.7300		17.7300	0.1800	3.1914		(29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1300	3.9143		(30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553		(30)
Rf - Ashlar behind Stud	23.9400		23.9400	0.1300	3.1122		(30)
Total net area of external elements Aum(A, m ²)			259.0420				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3667		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.9270 (36)
Total fabric heat loss						(33) + (36) =	83.2937 (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	65.0154	64.6099	64.2123	62.3451	61.9958	60.3695	60.3695	60.0683	60.9959	61.9958	62.7025	63.4414 (38)
Heat transfer coeff	148.3091	147.9035	147.5060	145.6388	145.2894	143.6631	143.6631	143.3620	144.2896	145.2894	145.9962	146.7350 (39)
Average = Sum(39)m / 12 =												145.6371 (39)
HLP	1.1028	1.0998	1.0969	1.0830	1.0804	1.0683	1.0683	1.0660	1.0729	1.0804	1.0856	1.0911 (40)
HLP (average)												1.0830 (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												2.9057 (42)
Average daily hot water use (litres/day)												103.2114 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy conte	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9177 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	50.9589	46.0274	50.9589	49.3151	49.4397	45.8089	47.3359	49.4397	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	219.3244	193.2810	202.9114	181.7909	176.5534	155.4984	148.9793	166.0770	167.3454	188.5119	199.4649	214.0119 (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	219.3244	193.2810	202.9114	181.7909	176.5534	155.4984	148.9793	166.0770	167.3454	188.5119	199.4649	214.0119 (64)
Heat gains from water heating, kWh/month	68.7213	60.4687	63.2639	56.3770	54.6252	47.9240	45.6304	51.1418	51.5739	58.4761	62.2536	66.9549 (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	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3970	25.2220	20.5119	15.5288	11.6080	9.7999	10.5892	13.7642	18.4743	23.4574	27.3782	29.1862	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	(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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	(71)
Water heating gains (Table 5)	92.3673	89.9831	85.0322	78.3014	73.4210	66.5611	61.3312	68.7390	71.6304	78.5969	86.4633	89.9931	(72)
Total internal gains	493.3934	490.9789	473.3935	444.8095	414.7129	386.0302	368.2185	375.6567	391.1825	420.0022	453.0849	478.4374	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.6650	11.2829	0.6300	0.7000	0.7700	16.0859 (75)
Southeast	3.4400	36.7938	0.6300	0.7000	0.7700	38.6817 (77)
Southwest	9.3030	36.7938	0.6300	0.7000	0.7700	104.6092 (79)
Northeast	0.9200	17.4137	0.6300	0.7000	1.0000	6.3586 (82)
Southwest	1.8400	38.2331	0.6300	0.7000	1.0000	27.9214 (82)

Solar gains	193.6568	342.4995	499.9094	668.1587	790.2132	802.1798	766.0815	672.7926	558.0727	387.1890	234.3111	164.1764	(83)
Total gains	687.0503	833.4783	973.3028	1112.9682	1204.9261	1188.2100	1134.3000	1048.4493	949.2553	807.1912	687.3961	642.6138	(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	62.9691	63.1418	63.3119	64.1236	64.2778	65.0055	65.0055	65.1420	64.7232	64.2778	63.9667	63.6446	
alpha	5.1979	5.2095	5.2208	5.2749	5.2852	5.3337	5.3337	5.3428	5.3149	5.2852	5.2644	5.2430	
util living area	0.9991	0.9973	0.9910	0.9654	0.8849	0.7183	0.5461	0.6083	0.8610	0.9827	0.9978	0.9994	(86)
MIT	19.7389	19.9075	20.1719	20.5138	20.7984	20.9532	20.9910	20.9846	20.8737	20.4923	20.0506	19.7131	(87)
Th 2	19.9985	20.0010	20.0034	20.0148	20.0169	20.0268	20.0268	20.0287	20.0230	20.0169	20.0126	20.0081	(88)
util rest of house	0.9988	0.9963	0.9877	0.9521	0.8421	0.6305	0.4311	0.4902	0.7944	0.9738	0.9969	0.9991	(89)
MIT 2	18.3044	18.5526	18.9390	19.4359	19.8162	19.9952	20.0234	20.0221	19.9187	19.4138	18.7706	18.2736	(90)
Living area fraction	18.7876	19.0090	19.3543	19.7990	20.1471	20.3179	20.3494	20.3464	20.2404	19.7771	19.2018	18.7585	(92)
MIT	18.7876	19.0090	19.3543	19.7990	20.1471	20.3179	20.3494	20.3464	20.2404	19.7771	19.2018	18.7585	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.7876	19.0090	19.3543	19.7990	20.1471	20.3179	20.3494	20.3464	20.2404	19.7771	19.2018	18.7585	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9949	0.9848	0.9485	0.8485	0.6584	0.4701	0.5302	0.8112	0.9710	0.9957	0.9987	(94)
Useful gains	685.8025	829.2658	958.4980	1055.6677	1022.4028	782.2712	533.2692	555.9150	770.0806	783.7436	684.4716	641.7868	(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	2148.6428	2086.7699	1896.0905	1587.3117	1227.2715	821.4553	538.6447	565.7572	885.9911	1333.3384	1766.8183	2136.2429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1088.3532	845.0428	697.5688	382.7837	152.4224	0.0000	0.0000	0.0000	0.0000	408.8985	779.2896	1111.8754	(98)
Space heating												5466.2343	(98)
Space heating per m2												40.6472	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)

93.4000 (206)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

Space heating requirement

5852.4993 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1088.3532	845.0428	697.5688	382.7837	152.4224	0.0000	0.0000	0.0000	0.0000	408.8985	779.2896	1111.8754	(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)	1165.2604	904.7567	746.8617	409.8327	163.1931	0.0000	0.0000	0.0000	0.0000	437.7928	834.3572	1190.4447	(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	219.3244	193.2810	202.9114	181.7909	176.5534	155.4984	148.9793	166.0770	167.3454	188.5119	199.4649	214.0119	(64)
Efficiency of water heater (217)m	88.5324	88.3319	87.9085	86.8813	84.6837	80.3000	80.3000	80.3000	80.3000	86.9491	88.1407	88.6012	(216)
Fuel for water heating, kWh/month	247.7336	218.8123	230.8212	209.2406	208.4858	193.6468	185.5284	206.8207	208.4003	216.8073	226.3029	241.5451	(219)
Water heating fuel used												2594.1450	(219)
Annual totals kWh/year													
Space heating fuel - main system												5852.4993	(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)												501.4999	(232)
Total delivered energy for all uses												9023.1441	(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	5852.4993	0.2160	1264.1398 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2594.1450	0.2160	560.3353 (264)
Space and water heating			1824.4752 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	501.4999	0.5190	260.2784 (268)
Total CO2, kg/m2/year			2123.6786 (272)
Emissions per m2 for space and water heating			13.5669 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9354 (272b)
Emissions per m2 for pumps and fans			0.2894 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5669 * 1.00) + 1.9354 + 0.2894, rounded to 2 d.p.			15.7900 (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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3714 (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) =		0.3436 (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	0.4381	0.4295	0.4209	0.3779	0.3694	0.3264	0.3264	0.3178	0.3436	0.3694	0.3865	0.4037 (22b)
Effective ac	0.5960	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Floor - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
W1 - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)
W1 - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)
Total net area of external elements Aum(A, m ²)			259.0420				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.6090			(33)
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8000			18.0000	1400.4000 (32d)
Internal Ceiling			77.8000			5.8200	452.7960 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				17509.5352 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							130.2018 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.0519 (36)
Total fabric heat loss			(33) + (36) =				79.6609 (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	65.0436	64.6370	64.2383	62.3661	62.0158	60.3851	60.3851	60.0832	61.0132	62.0158	62.7244	63.4653 (38)
Heat transfer coeff	144.7045	144.2978	143.8992	142.0269	141.6767	140.0460	140.0460	139.7440	140.6741	141.6767	142.3853	143.1261 (39)
Average = Sum(39)m / 12 =												142.0253 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0760	1.0730	1.0700	1.0561	1.0535	1.0414	1.0414	1.0391	1.0461	1.0535	1.0588	1.0643 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy												2.9057 (42)
Average daily hot water use (litres/day)												103.2114 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy conte	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9177 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7777	31.2914	32.2899	28.1511	27.0117	23.3090	21.5992	24.7854	25.0815	29.2300	31.9068	34.6488 (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	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2357	25.0787	20.3954	15.4406	11.5420	9.7443	10.5290	13.6860	18.3694	23.3241	27.2227	29.0204 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	48.0883	46.5646	43.4004	39.0988	36.3060	32.3736	29.0312	33.3138	34.8353	39.2877	44.3151	46.5709 (72)
Total internal gains	445.9531	444.4170	428.6452	402.5187	374.5319	348.7871	332.8584	337.1533	351.2826	377.5597	407.7811	431.8495 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast						4.6650	11.2829	0.7600	0.7200	0.7700	19.9597 (75)	
Southeast						3.4400	36.7938	0.7600	0.7200	0.7700	47.9969 (77)	
Southwest						9.3030	36.7938	0.7600	0.7200	0.7700	129.8008 (79)	
Northeast						0.9200	17.4137	0.7600	0.7200	1.0000	7.8898 (82)	
Southwest						1.8400	38.2331	0.7600	0.7200	1.0000	34.6454 (82)	

Solar gains	240.2925	424.9789	620.2957	829.0622	980.5094	995.3578	950.5665	834.8121	692.4658	480.4304	290.7371	203.7128 (83)
Total gains	686.2457	869.3960	1048.9409	1231.5809	1355.0413	1344.1449	1283.4248	1171.9653	1043.7483	857.9902	698.5182	635.5622 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6117	33.7064	33.7998	34.2453	34.3300	34.7297	34.7297	34.8048	34.5747	34.3300	34.1591	33.9823
alpha	3.2408	3.2471	3.2533	3.2830	3.2887	3.3153	3.3153	3.3203	3.3050	3.2887	3.2773	3.2655
util living area	0.9878	0.9739	0.9439	0.8751	0.7560	0.5966	0.4572	0.5121	0.7391	0.9218	0.9784	0.9904 (86)
MIT	19.0020	19.3017	19.7377	20.2592	20.6607	20.8905	20.9659	20.9504	20.7690	20.2103	19.5033	18.9530 (87)
Th 2	20.0205	20.0229	20.0254	20.0368	20.0390	20.0490	20.0490	20.0508	20.0451	20.0390	20.0346	20.0301 (88)
util rest of house	0.9855	0.9691	0.9335	0.8519	0.7118	0.5266	0.3670	0.4193	0.6767	0.9021	0.9737	0.9886 (89)
MIT 2	18.1835	18.4820	18.9120	19.4212	19.7880	19.9848	20.0351	20.0291	19.8944	19.3873	18.6929	18.1418 (90)
Living area fraction	18.4592	18.7581	19.1901	19.7035	20.0820	20.2899	20.3486	20.3394	20.1890	19.6645	18.9659	18.4151 (92)
MIT	18.4592	18.7581	19.1901	19.7035	20.0820	20.2899	20.3486	20.3394	20.1890	19.6645	18.9659	18.4151 (93)
Temperature adjustment	18.4592	18.7581	19.1901	19.7035	20.0820	20.2899	20.3486	20.3394	20.1890	19.6645	18.9659	18.4151 (93)
adjusted MIT	18.4592	18.7581	19.1901	19.7035	20.0820	20.2899	20.3486	20.3394	20.1890	19.6645	18.9659	18.4151 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9806	0.9611	0.9226	0.8428	0.7139	0.5452	0.3963	0.4487	0.6870	0.8929	0.9668	0.9845 (94)
Ext temp.	672.9392	835.5395	967.7355	1037.9649	967.4294	732.8114	508.6168	525.8152	717.0459	766.1090	675.3219	625.7115 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2048.8992	1999.6941	1826.1013	1534.3910	1187.5329	796.8409	524.9801	550.5112	856.5639	1284.2296	1689.5228	2034.5458 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1023.7142	782.3119	638.6242	357.4268	163.7570	0.0000	0.0000	0.0000	0.0000	385.4817	730.2247	1048.1727 (98)
Space heating per m ²												5129.7132 (98)
												(98) / (4) = 38.1448 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1316.4323	1036.3403	1062.0545	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8463	0.8983	0.8725	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.1313	930.8930	926.6474	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1649.3566	1577.8916	1456.3353	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	385.3623	481.3670	394.0878	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												1260.8170	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	96.3406	120.3417	98.5219	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												315.2043	(107)
Energy for space heating												2.3439	(108)
Energy for space cooling												38.1448	(99)
Total												2.3439	(108)
Dwelling Fabric Energy Efficiency (DFEE)												40.4887	(109)
												40.5	(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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (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) =		0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3689	0.3260	0.3260	0.3174	0.3431	0.3689	0.3860	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933		(27a)
Flr - Ground			56.6800	0.1300	7.3684		(28a)
Wl - Brick	122.0100	19.5080	102.5020	0.1800	18.4504		(29a)
Wl - Stud Ashlar	17.7300		17.7300	0.1800	3.1914		(29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1300	3.9143		(30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553		(30)
Rf - Ashlar behind Stud	23.9400		23.9400	0.1300	3.1122		(30)
Total net area of external elements Aum(A, m ²)			259.0420				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3667		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.9270 (36)
Total fabric heat loss						(33) + (36) =	83.2937 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.0154	Feb 64.6099	Mar 64.2123	Apr 62.3451	May 61.9958	Jun 60.3695	Jul 60.3695	Aug 60.0683	Sep 60.9959	Oct 61.9958	Nov 62.7025	Dec 63.4414 (38)
Heat transfer coeff	148.3091	147.9035	147.5060	145.6388	145.2894	143.6631	143.6631	143.3620	144.2896	145.2894	145.9962	146.7350 (39)
Average = Sum(39)m / 12 =												145.6371 (39)
HLP	Jan 1.1028	Feb 1.0998	Mar 1.0969	Apr 1.0830	May 1.0804	Jun 1.0683	Jul 1.0683	Aug 1.0660	Sep 1.0729	Oct 1.0804	Nov 1.0856	Dec 1.0911 (40)
HLP (average)												1.0830 (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												2.9057 (42)
Average daily hot water use (litres/day)												103.2114 (43)
Daily hot water use	Jan 113.5326	Feb 109.4041	Mar 105.2757	Apr 101.1472	May 97.0187	Jun 92.8903	Jul 92.8903	Aug 97.0187	Sep 101.1472	Oct 105.2757	Nov 109.4041	Dec 113.5326 (44)
Energy conte	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9177 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7777	31.2914	32.2899	28.1511	27.0117	23.3090	21.5992	24.7854	25.0815	29.2300	31.9068	34.6488 (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	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3970	25.2220	20.5119	15.5288	11.6080	9.7999	10.5892	13.7642	18.4743	23.4574	27.3782	29.1862	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	(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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	(71)
Water heating gains (Table 5)	48.0883	46.5646	43.4004	39.0988	36.3060	32.3736	29.0312	33.3138	34.8353	39.2877	44.3151	46.5709	(72)
Total internal gains	446.1144	444.5603	428.7617	402.6069	374.5979	348.8427	332.9185	337.2314	351.3875	377.6930	407.9367	432.0153	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					4.6650	11.2829	0.6300	0.7000			0.7700			16.0859 (75)
Southeast					3.4400	36.7938	0.6300	0.7000			0.7700			38.6817 (77)
Southwest					9.3030	36.7938	0.6300	0.7000			0.7700			104.6092 (79)
Northeast					0.9200	17.4137	0.6300	0.7000			1.0000			6.3586 (82)
Southwest					1.8400	38.2331	0.6300	0.7000			1.0000			27.9214 (82)
Solar gains	193.6568	342.4995	499.9094	668.1587	790.2132	802.1798	766.0815	672.7926	558.0727	387.1890	234.3111	164.1764	(83)	
Total gains	639.7713	787.0598	928.6711	1070.7656	1164.8110	1151.0226	1099.0000	1010.0241	909.4602	764.8820	642.2478	596.1917	(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	62.9691	63.1418	63.3119	64.1236	64.2778	65.0055	65.0055	65.1420	64.7232	64.2778	63.9667	63.6446	
alpha	5.1979	5.2095	5.2208	5.2749	5.2852	5.3337	5.3337	5.3428	5.3149	5.2852	5.2644	5.2430	
util living area	0.9993	0.9979	0.9927	0.9704	0.8962	0.7349	0.5620	0.6280	0.8771	0.9863	0.9984	0.9996	(86)
MIT	19.7057	19.8752	20.1418	20.4887	20.7827	20.9479	20.9897	20.9822	20.8598	20.4648	20.0191	19.6805	(87)
Th 2	19.9985	20.0010	20.0034	20.0148	20.0169	20.0268	20.0268	20.0287	20.0230	20.0169	20.0126	20.0081	(88)
util rest of house	0.9991	0.9972	0.9900	0.9586	0.8559	0.6474	0.4445	0.5077	0.8144	0.9791	0.9977	0.9994	(89)
MIT 2	18.8087	18.9800	19.2471	19.5960	19.8674	20.0024	20.0241	20.0234	19.9422	19.5788	19.1332	18.7912	(90)
Living area fraction									fLA = Living area / (4) =			0.3369	(91)
MIT	19.1109	19.2815	19.5485	19.8967	20.1757	20.3209	20.3494	20.3464	20.2513	19.8773	19.4316	19.0908	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1109	19.2815	19.5485	19.8967	20.1757	20.3209	20.3494	20.3464	20.2513	19.8773	19.4316	19.0908	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	639.0264	784.2613	917.8556	1024.6375	1005.6064	777.6559	532.4601	554.2172	755.9579	747.8346	640.4277	595.7133	(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	2196.5892	2127.0803	1924.7307	1601.5505	1231.4285	821.8819	538.6509	565.7597	887.5735	1347.8906	1800.3706	2184.9961	(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	1158.8267	902.3744	749.1151	415.3774	168.0117	0.0000	0.0000	0.0000	0.0000	446.4417	835.1589	1182.4264	(98)
Space heating												5857.7322	(98)
Space heating per m2										(98) / (4) =		43.5584	(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	1350.4336	1063.1073	1089.5511	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8657	0.9276	0.9002	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1169.0950	986.1310	980.7720	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1431.9654	1370.2403	1273.7727	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	189.2667	285.7773	217.9925	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												693.0366 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	47.3167	71.4443	54.4981	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												173.2591 (107)
Space cooling per m2												1.2884 (108)
Energy for space heating												43.5584 (99)
Energy for space cooling												1.2884 (108)
Total												44.8468 (109)
Target Fabric Energy Efficiency (TFEE)												51.6 (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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							5.0100					
Infiltration rate							0.2505	(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) =	0.2317 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)					
Total net area of external elements Aum(A, m2)			259.0420				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6090		(33)					
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17509.5352 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							130.2018 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.0519 (36)					
Total fabric heat loss						(33) + (36) =	79.6609 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5711	Feb 54.5711	Mar 54.5711	Apr 54.5711	May 54.5711	Jun 54.5711	Jul 54.5711	Aug 54.5711	Sep 54.5711	Oct 54.5711	Nov 54.5711	Dec 54.5711 (38)
Heat transfer coeff	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319 (39)
Average = Sum(39)m / 12 =												134.2319 (39)
HLP	Jan 0.9982	Feb 0.9982	Mar 0.9982	Apr 0.9982	May 0.9982	Jun 0.9982	Jul 0.9982	Aug 0.9982	Sep 0.9982	Oct 0.9982	Nov 0.9982	Dec 0.9982 (40)
HLP (average)												0.9982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (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	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (64)
RHI water heating demand	1789.7340 (64)											
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5892	62.6967	50.9884	38.6015	28.8551	24.3607	26.3226	34.2151	45.9234	58.3103	68.0567	72.5511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3496	713.7621	685.2664	640.9574	595.0459	554.5112	531.2777	541.1927	567.1164	611.6616	661.0729	698.9762 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					4.6650	12.9236	0.7600	0.7200	0.7700	22.8619 (75)		
Southeast					3.4400	40.4699	0.7600	0.7200	0.7700	52.7922 (77)		
Southwest					9.3030	40.4699	0.7600	0.7200	0.7700	142.7692 (79)		
Northeast					0.9200	20.0668	0.7600	0.7200	1.0000	9.0919 (82)		
Southwest					1.8400	43.0236	0.7600	0.7200	1.0000	38.9864 (82)		

Solar gains	266.5017	424.8253	614.7270	850.8034	983.6844	1070.0283	1010.2882	904.9611	745.2697	513.3754	330.4721	223.6764 (83)
Total gains	985.8513	1138.5874	1299.9935	1491.7608	1578.7303	1624.5396	1541.5659	1446.1538	1312.3861	1125.0370	991.5451	922.6526 (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	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340
alpha	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156
util living area	0.9602	0.9369	0.8838	0.7731	0.6089	0.4011	0.2677	0.2937	0.5482	0.8157	0.9317	0.9668 (86)
MIT	19.6026	19.8228	20.2038	20.6038	20.8675	20.9769	20.9959	20.9944	20.9304	20.5951	20.0338	19.5383 (87)
Th 2	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849 (88)
util rest of house	0.9534	0.9265	0.8649	0.7387	0.5549	0.3320	0.1897	0.2112	0.4751	0.7783	0.9184	0.9610 (89)
MIT 2	18.2382	18.5520	19.0881	19.6278	19.9557	20.0694	20.0835	20.0828	20.0294	19.6310	18.8586	18.1464 (90)
Living area fraction	18.6978	18.9801	19.4639	19.9566	20.2628	20.3751	20.3908	20.3898	20.3329	19.9558	19.2544	18.6153 (92)
MIT	18.6978	18.9801	19.4639	19.9566	20.2628	20.3751	20.3908	20.3898	20.3329	19.9558	19.2544	18.6153 (92)
Temperature adjustment	18.5478	18.8301	19.3139	19.8066	20.1128	20.2251	20.2408	20.2398	20.1829	19.8058	19.1044	-0.1500
adjusted MIT	18.5478	18.8301	19.3139	19.8066	20.1128	20.2251	20.2408	20.2398	20.1829	19.8058	19.1044	18.4653 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.9382	0.9085	0.8461	0.7272	0.5566	0.3428	0.2031	0.2254	0.4833	0.7653	0.9003	0.9471 (94)
Useful gains	924.9521	1034.4399	1099.9884	1084.8029	878.7989	556.9033	313.1178	325.9160	634.2954	860.9630	892.7234	873.8224 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1805.1188	1775.8963	1599.2279	1329.7798	954.7698	567.1441	314.2126	327.5055	668.8696	1101.4747	1490.5702	1794.0464 (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	654.8441	498.2587	371.4342	176.3834	56.5224	0.0000	0.0000	0.0000	0.0000	178.9407	430.4497	684.6466 (98)
Space heating												3051.4798 (98)
RHI space heating demand												3051 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (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) =		0.2317 (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	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
Wl - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)
Total net area of external elements Aum(A, m ²)			259.0420				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6090		(33)
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8000			18.0000	1400.4000 (32d)
Internal Ceiling			77.8000			5.8200	452.7960 (32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	17509.5352 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		130.2018 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		24.0519 (36)
Total fabric heat loss	(33) + (36) =	79.6609 (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	59.5298	58.8976	58.2653	55.1041	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	55.7364	57.0008 (38)
Heat transfer coeff	139.1906	138.5584	137.9262	134.7650	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	135.3972	136.6617 (39)
Average = Sum(39)m / 12 =												135.6576 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0350	1.0303	1.0256	1.0021	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	1.0068	1.0162 (40)
HLP (average)												1.0088 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1623.9177 (45)											
Water storage loss:	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7084
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5892	62.6967	50.9884	38.6015	28.8551	24.3607	26.3226	34.2151	45.9234	58.3103	68.0567	72.5511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3496	713.7621	685.2664	640.9574	595.0459	554.5112	531.2777	541.1927	567.1164	611.6616	661.0729	698.9762 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					4.6650	11.2829	0.7600	0.7200	0.7700	19.9597 (75)		
Southeast					3.4400	36.7938	0.7600	0.7200	0.7700	47.9969 (77)		
Southwest					9.3030	36.7938	0.7600	0.7200	0.7700	129.8008 (79)		
Northeast					0.9200	17.4137	0.7600	0.7200	1.0000	7.8898 (82)		
Southwest					1.8400	38.2331	0.7600	0.7200	1.0000	34.6454 (82)		
Solar gains	240.2925	424.9789	620.2957	829.0622	980.5094	995.3578	950.5665	834.8121	692.4658	480.4304	290.7371	203.7128 (83)
Total gains	959.6421	1138.7410	1305.5621	1470.0196	1575.5553	1549.8691	1481.8441	1376.0048	1259.5822	1092.0921	951.8100	902.6889 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.9432	35.1026	35.2635	36.0907	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	35.9222	35.5898
alpha	3.3295	3.3402	3.3509	3.4060	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.3948	3.3727
util living area	0.9684	0.9452	0.9014	0.8113	0.6766	0.5187	0.3880	0.4322	0.6436	0.8578	0.9486	0.9735 (86)
MIT	19.3768	19.6550	20.0396	20.4853	20.7855	20.9352	20.9816	20.9733	20.8641	20.4597	19.8509	19.3417 (87)
Th 2	20.0542	20.0581	20.0620	20.0816	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0777	20.0698 (88)
util rest of house	0.9631	0.9363	0.8855	0.7825	0.6307	0.4547	0.3114	0.3524	0.5802	0.8289	0.9387	0.9690 (89)
MIT 2	17.8924	18.2934	18.8411	19.4678	19.8578	20.0304	20.0741	20.0681	19.9598	19.4507	18.5931	17.8519 (90)
Living area fraction	18.3924	18.7521	19.2448	19.8106	20.1703	20.3352	20.3798	20.3730	20.2644	19.7906	19.0168	18.3537 (92)
Temperature adjustment	18.2424	18.6021	19.0948	19.6606	20.0203	20.1852	20.2298	20.2230	20.1144	19.6406	18.8668	18.2037 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9491	0.9186	0.8659	0.7677	0.6273	0.4619	0.3238	0.3648	0.5824	0.8125	0.9218	0.9565	(94)
Useful gains	910.8190	1046.0120	1130.4665	1128.6069	988.3431	715.9487	479.8556	501.9492	733.5291	887.2818	877.4084	863.3956	(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													
	1940.6534	1898.5344	1737.1559	1450.1460	1116.8540	749.7118	487.2318	513.1716	807.3251	1213.5319	1593.1953	1913.7748	(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													
	766.1968	572.8951	451.3769	231.5081	95.6121	0.0000	0.0000	0.0000	0.0000	242.7301	515.3666	781.4821	(98)
Space heating													
Space heating per m2												3657.1679	(98)
											(98) / (4) =	27.1949	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4041.0695	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	766.1968	572.8951	451.3769	231.5081	95.6121	0.0000	0.0000	0.0000	0.0000	242.7301	515.3666	781.4821	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	846.6263	633.0332	498.7590	255.8101	105.6488	0.0000	0.0000	0.0000	0.0000	268.2100	569.4658	863.5162	(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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)	
Efficiency of water heater	90.0435	89.9783	89.8425	89.4958	88.8326	87.3000	87.3000	87.3000	87.3000	89.4916	89.9076	87.3000	(216)	
(217)m	136.5880	119.6342	125.3379	114.1156	112.9525	102.6012	99.8102	110.1545	110.0979	120.3819	125.6275	132.8559	(217)	
Fuel for water heating, kWh/month												1410.1573	(219)	
Water heating fuel used														
Annual totals kWh/year														
Space heating fuel - main system													4041.0695	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)														
mechanical ventilation fans (SFP = 0.2378)														95.9333 (230a)
central heating pump														30.0000 (230c)
main heating flue fan														45.0000 (230e)
Total electricity for the above, kWh/year														170.9333 (231)
Electricity for lighting (calculated in Appendix L)														498.6511 (232)
Total delivered energy for all uses														6120.8111 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4041.0695	3.4800	140.6292 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1410.1573	3.4800	49.0735 (247)
Mechanical ventilation fans	95.9333	13.1900	12.6536 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	498.6511	13.1900	65.7721 (250)
Additional standing charges			120.0000 (251)
Total energy cost			398.0209 (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] =	0.9314 (257)
SAP value		87.0069
SAP rating (Section 12)		B (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	4041.0695	0.2160	872.8710 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1410.1573	0.2160	304.5940 (264)
Space and water heating			1177.4650 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6511	0.5190	258.7999 (268)
Total kg/year			1524.9793 (272)

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Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

CO2 emissions per m2	11.3400 (273)
EI value	88.6145
EI rating	89 (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	$3.48 / 0.8890 = 3.914$, stars = 5
Water heating environmental impact	$0.216 / 0.8890 = 0.2430$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							5.0100					
Infiltration rate							0.2505	(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) =	0.2317 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)					
Total net area of external elements Aum(A, m2)			259.0420				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6090		(33)					
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17509.5352 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							130.2018 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.0519 (36)					
Total fabric heat loss						(33) + (36) =	79.6609 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5711	Feb 54.5711	Mar 54.5711	Apr 54.5711	May 54.5711	Jun 54.5711	Jul 54.5711	Aug 54.5711	Sep 54.5711	Oct 54.5711	Nov 54.5711	Dec 54.5711 (38)
Heat transfer coeff	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319 (39)
Average = Sum(39)m / 12 =												134.2319 (39)
HLP	Jan 0.9982	Feb 0.9982	Mar 0.9982	Apr 0.9982	May 0.9982	Jun 0.9982	Jul 0.9982	Aug 0.9982	Sep 0.9982	Oct 0.9982	Nov 0.9982	Dec 0.9982 (40)
HLP (average)												0.9982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1623.9177 (45)											
Water storage loss:	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7084
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5892	62.6967	50.9884	38.6015	28.8551	24.3607	26.3226	34.2151	45.9234	58.3103	68.0567	72.5511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3496	713.7621	685.2664	640.9574	595.0459	554.5112	531.2777	541.1927	567.1164	611.6616	661.0729	698.9762 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					4.6650	12.9236	0.7600	0.7200			0.7700			22.8619 (75)		
Southeast					3.4400	40.4699	0.7600	0.7200			0.7700			52.7922 (77)		
Southwest					9.3030	40.4699	0.7600	0.7200			0.7700			142.7692 (79)		
Northeast					0.9200	20.0668	0.7600	0.7200			1.0000			9.0919 (82)		
Southwest					1.8400	43.0236	0.7600	0.7200			1.0000			38.9864 (82)		
Solar gains					266.5017	424.8253	614.7270	850.8034	983.6844	1070.0283	1010.2882	904.9611	745.2697	513.3754	330.4721	223.6764 (83)
Total gains					985.8513	1138.5874	1299.9935	1491.7608	1578.7303	1624.5396	1541.5659	1446.1538	1312.3861	1125.0370	991.5451	922.6526 (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	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340
alpha	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156
util living area	0.9602	0.9369	0.8838	0.7731	0.6089	0.4011	0.2677	0.2937	0.5482	0.8157	0.9317	0.9668 (86)
MIT	19.6026	19.8228	20.2038	20.6038	20.8675	20.9769	20.9959	20.9944	20.9304	20.5951	20.0338	19.5383 (87)
Th 2	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849 (88)
util rest of house	0.9534	0.9265	0.8649	0.7387	0.5549	0.3320	0.1897	0.2112	0.4751	0.7783	0.9184	0.9610 (89)
MIT 2	18.2382	18.5520	19.0881	19.6278	19.9557	20.0694	20.0835	20.0828	20.0294	19.6310	18.8586	18.1464 (90)
Living area fraction	18.6978	18.9801	19.4639	19.9566	20.2628	20.3751	20.3908	20.3898	20.3329	19.9558	19.2544	18.6153 (92)
Temperature adjustment	18.5478	18.8301	19.3139	19.8066	20.1128	20.2251	20.2408	20.2398	20.1829	19.8058	19.1044	18.4653 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9382	0.9085	0.8461	0.7272	0.5566	0.3428	0.2031	0.2254	0.4833	0.7653	0.9003	0.9471 (94)
Unst fuel gains	924.9521	1034.4399	1099.9884	1084.8029	878.7989	556.9033	313.1178	325.9160	634.2954	860.9630	892.7234	873.8224 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1805.1188	1775.8963	1599.2279	1329.7798	954.7698	567.1441	314.2126	327.5055	668.8696	1101.4747	1490.5702	1794.0464 (97)
Month fractl	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	654.8441	498.2587	371.4342	176.3834	56.5224	0.0000	0.0000	0.0000	0.0000	178.9407	430.4497	684.6466 (98)
Space heating												3051.4798 (98)
Space heating per m2											(98) / (4) =	22.6910 (99)

Not applicable

Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)		
mechanical ventilation fans (SFP = 0.2378)	95.9333	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	170.9333	(231)
Electricity for lighting (calculated in Appendix L)	498.6511	(232)
Total delivered energy for all uses	5453.1501	(238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3371.8008	3.6300	122.3964 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.7649	3.6300	51.2471 (247)
Mechanical ventilation fans	95.9333	19.4400	18.6494 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	498.6511	19.4400	96.9378 (250)
Additional standing charges			95.0000 (251)
Total energy cost			398.8106 (255)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3371.8008	0.2160	728.3090 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7649	0.2160	304.9412 (264)
Space and water heating			1033.2502 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6511	0.5190	258.7999 (268)
Total kg/year			1380.7645 (272)

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year	
Space heating - main system 1	3371.8008	1.2200	4113.5970	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1411.7649	1.2200	1722.3532	(264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			5835.9502 (265)
Pumps and fans	170.9333	3.0700	524.7651 (267)
Energy for lighting	498.6511	3.0700	1530.8589 (268)
Primary energy kWh/year			7891.5742 (272)
Primary energy kWh/m ² /year			58.6821 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 7.4	-£ 355	-947 kg (68.6%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.6	-£ 18	-140 kg (10.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£355 7.04 kg/m ²	A 94	A 95
Total Savings	£355 7.04 kg/m ²		

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£130	£130	£0
Mains gas	£269	£269	£0
Space heating	£251	£251	£0
Water heating	£51	£51	£0
Lighting	£97	£97	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£399	£44	£355
Total cost of uses	£399	£44	£355
Delivered energy	41 kWh/m ²	27 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	0.4 tonnes	0.9 tonnes
CO2 emissions per m ²	10 kg/m ²	3 kg/m ²	7 kg/m ²
Primary energy	59 kWh/m ²	17 kWh/m ²	42 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (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) =				0.2317 (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	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
Wl - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)
Total net area of external elements Aum(A, m ²)			259.0420				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6090		(33)
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8000			18.0000	1400.4000 (32d)
Internal Ceiling			77.8000			5.8200	452.7960 (32e)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		17509.5352 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.2018 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.0519 (36)
Total fabric heat loss					(33) + (36) =		79.6609 (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	59.5298	58.8976	58.2653	55.1041	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	55.7364	57.0008 (38)
Heat transfer coeff	139.1906	138.5584	137.9262	134.7650	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	135.3972	136.6617 (39)
Average = Sum(39)m / 12 =												135.6576 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0350	1.0303	1.0256	1.0021	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	1.0068	1.0162 (40)
HLP (average)												1.0088 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	20.2548											
Water storage loss:	22.0880											
Total storage loss	22.0880											
If cylinder contains dedicated solar storage	0.0000											
Combi loss	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	-534.7084											
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5892	62.6967	50.9884	38.6015	28.8551	24.3607	26.3226	34.2151	45.9234	58.3103	68.0567	72.5511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3496	713.7621	685.2664	640.9574	595.0459	554.5112	531.2777	541.1927	567.1164	611.6616	661.0729	698.9762 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast											4.6650	11.2829	0.7600	0.7200	0.7700	19.9597 (75)	
Southeast											3.4400	36.7938	0.7600	0.7200	0.7700	47.9969 (77)	
Southwest											9.3030	36.7938	0.7600	0.7200	0.7700	129.8008 (79)	
Northeast											0.9200	17.4137	0.7600	0.7200	1.0000	7.8898 (82)	
Southwest											1.8400	38.2331	0.7600	0.7200	1.0000	34.6454 (82)	
Solar gains	240.2925	424.9789	620.2957	829.0622	980.5094	995.3578	950.5665	834.8121	692.4658	480.4304	290.7371	203.7128 (83)					
Total gains	959.6421	1138.7410	1305.5621	1470.0196	1575.5553	1549.8691	1481.8441	1376.0048	1259.5822	1092.0921	951.8100	902.6889 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.9432	35.1026	35.2635	36.0907	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	35.9222	35.5898
alpha	3.3295	3.3402	3.3509	3.4060	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.3948	3.3727
util living area	0.9684	0.9452	0.9014	0.8113	0.6766	0.5187	0.3880	0.4322	0.6436	0.8578	0.9486	0.9735 (86)
MIT	19.3768	19.6550	20.0396	20.4853	20.7855	20.9352	20.9816	20.9733	20.8641	20.4597	19.8509	19.3417 (87)
Th 2	20.0542	20.0581	20.0620	20.0816	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0777	20.0698 (88)
util rest of house	0.9631	0.9363	0.8855	0.7825	0.6307	0.4547	0.3114	0.3524	0.5802	0.8289	0.9387	0.9690 (89)
MIT 2	17.8924	18.2934	18.8411	19.4678	19.8578	20.0304	20.0741	20.0681	19.9598	19.4507	18.5931	17.8519 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3924	18.7521	19.2448	19.8106	20.1703	20.3352	20.3798	20.3730	20.2644	19.7906	19.0168	18.3537 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.2424	18.6021	19.0948	19.6606	20.0203	20.1852	20.2298	20.2230	20.1144	19.6406	18.8668	18.2037 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9491	0.9186	0.8659	0.7677	0.6273	0.4619	0.3238	0.3648	0.5824	0.8125	0.9218	0.9565	(94)
Useful gains	910.8190	1046.0120	1130.4665	1128.6069	988.3431	715.9487	479.8556	501.9492	733.5291	887.2818	877.4084	863.3956	(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	1940.6534	1898.5344	1737.1559	1450.1460	1116.8540	749.7118	487.2318	513.1716	807.3251	1213.5319	1593.1953	1913.7748	(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	766.1968	572.8951	451.3769	231.5081	95.6121	0.0000	0.0000	0.0000	0.0000	242.7301	515.3666	781.4821	(98)
Space heating												3657.1679	(98)
Space heating per m2											(98) / (4) =	27.1949	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4041.0695	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	766.1968	572.8951	451.3769	231.5081	95.6121	0.0000	0.0000	0.0000	0.0000	242.7301	515.3666	781.4821	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	846.6263	633.0332	498.7590	255.8101	105.6488	0.0000	0.0000	0.0000	0.0000	268.2100	569.4658	863.5162	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)	
Efficiency of water heater	90.0435	89.9783	89.8425	89.4958	88.8326	87.3000	87.3000	87.3000	87.3000	89.4916	89.9076	90.0617	(217)	
Fuel for water heating, kWh/month	136.5880	119.6342	125.3379	114.1156	112.9525	102.6012	99.8102	110.1545	110.0979	120.3819	125.6275	132.8559	(219)	
Water heating fuel used												1410.1573	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4041.0695	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)														
mechanical ventilation fans (SFP = 0.2378)													95.9333	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													170.9333	(231)
Electricity for lighting (calculated in Appendix L)													498.6511	(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												4393.5717	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4041.0695	3.4800	140.6292	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1410.1573	3.4800	49.0735	(247)
Mechanical ventilation fans	95.9333	13.1900	12.6536	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	498.6511	13.1900	65.7721	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			170.1980	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.3983	(257)
SAP value			94.4440	
SAP rating (Section 12)			94	(258)
SAP band			A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4041.0695	0.2160	872.8710	(261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1410.1573	0.2160	304.5940 (264)
Space and water heating			1177.4650 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6511	0.5190	258.7999 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			628.5420 (272)
CO2 emissions per m2			4.6700 (273)
EI value			95.3073
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2e)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e) ... (1n)	134.4800		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	330.7339 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							5.0100					
Infiltration rate							0.2505	(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) =	0.2317 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5080	102.5020	0.1100	11.2752	7.6200	781.0652 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9400		23.9400	0.0800	1.9152	7.6200	182.4228 (30)					
Total net area of external elements Aum(A, m2)			259.0420				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	55.6090		(33)					
Party Wall			63.6750	0.0000	0.0000	54.0300	3440.3603 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			30.1558			54.0300	1629.3172 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			17509.5352 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							130.2018 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.0519 (36)					
Total fabric heat loss						(33) + (36) =	79.6609 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5711	Feb 54.5711	Mar 54.5711	Apr 54.5711	May 54.5711	Jun 54.5711	Jul 54.5711	Aug 54.5711	Sep 54.5711	Oct 54.5711	Nov 54.5711	Dec 54.5711 (38)
Heat transfer coeff	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	134.2319	(39)
Average = Sum(39)m / 12 =												134.2319 (39)
HLP	Jan 0.9982	Feb 0.9982	Mar 0.9982	Apr 0.9982	May 0.9982	Jun 0.9982	Jul 0.9982	Aug 0.9982	Sep 0.9982	Oct 0.9982	Nov 0.9982	Dec 0.9982 (40)
HLP (average)												0.9982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9057 (42)
Average daily hot water use (litres/day)													103.2114 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326	(44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1623.9177 (45)
Water storage loss:	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479	(61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009	(62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487	eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7084
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521	(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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5892	62.6967	50.9884	38.6015	28.8551	24.3607	26.3226	34.2151	45.9234	58.3103	68.0567	72.5511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	(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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	(71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238	(72)
Total internal gains	719.3496	713.7621	685.2664	640.9574	595.0459	554.5112	531.2777	541.1927	567.1164	611.6616	661.0729	698.9762	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					4.6650	12.9236	0.7600	0.7200			0.7700			22.8619 (75)		
Southeast					3.4400	40.4699	0.7600	0.7200			0.7700			52.7922 (77)		
Southwest					9.3030	40.4699	0.7600	0.7200			0.7700			142.7692 (79)		
Northeast					0.9200	20.0668	0.7600	0.7200			1.0000			9.0919 (82)		
Southwest					1.8400	43.0236	0.7600	0.7200			1.0000			38.9864 (82)		
Solar gains					266.5017	424.8253	614.7270	850.8034	983.6844	1070.0283	1010.2882	904.9611	745.2697	513.3754	330.4721	223.6764 (83)
Total gains					985.8513	1138.5874	1299.9935	1491.7608	1578.7303	1624.5396	1541.5659	1446.1538	1312.3861	1125.0370	991.5451	922.6526 (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	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	36.2340	
alpha	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	3.4156	
util living area	0.9602	0.9369	0.8838	0.7731	0.6089	0.4011	0.2677	0.2937	0.5482	0.8157	0.9317	0.9668	(86)
MIT	19.6026	19.8228	20.2038	20.6038	20.8675	20.9769	20.9959	20.9944	20.9304	20.5951	20.0338	19.5383	(87)
Th 2	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	20.0849	(88)
util rest of house	0.9534	0.9265	0.8649	0.7387	0.5549	0.3320	0.1897	0.2112	0.4751	0.7783	0.9184	0.9610	(89)
MIT 2	18.2382	18.5520	19.0881	19.6278	19.9557	20.0694	20.0835	20.0828	20.0294	19.6310	18.8586	18.1464	(90)
Living area fraction	18.6978	18.9801	19.4639	19.9566	20.2628	20.3751	20.3908	20.3898	20.3329	19.9558	19.2544	18.6153	(91)
MIT	18.6978	18.9801	19.4639	19.9566	20.2628	20.3751	20.3908	20.3898	20.3329	19.9558	19.2544	18.6153	(92)
Temperature adjustment	18.5478	18.8301	19.3139	19.8066	20.1128	20.2251	20.2408	20.2398	20.1829	19.8058	19.1044	18.4653	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9382	0.9085	0.8461	0.7272	0.5566	0.3428	0.2031	0.2254	0.4833	0.7653	0.9003	0.9471	(94)
Useful gains	924.9521	1034.4399	1099.9884	1084.8029	878.7989	556.9033	313.1178	325.9160	634.2954	860.9630	892.7234	873.8224	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
Month fracti	1805.1188	1775.8963	1599.2279	1329.7798	954.7698	567.1441	314.2126	327.5055	668.8696	1101.4747	1490.5702	1794.0464	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	654.8441	498.2587	371.4342	176.3834	56.5224	0.0000	0.0000	0.0000	0.0000	178.9407	430.4497	684.6466	(98)
Space heating per m2												3051.4798	(98)
											(98) / (4) =	22.6910	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3371.8008	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	654.8441	498.2587	371.4342	176.3834	56.5224	0.0000	0.0000	0.0000	0.0000	178.9407	430.4497	684.6466	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	723.5846	550.5621	410.4245	194.8988	62.4557	0.0000	0.0000	0.0000	0.0000	197.7246	475.6350	756.5156	(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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)	
Efficiency of water heater	89.9785	89.9145	89.7348	89.2997	88.4267	87.3000	87.3000	87.3000	87.3000	89.2703	89.8157	87.3000	(216)	
Fuel for water heating, kWh/month	136.6866	119.7192	125.4883	114.3662	113.4711	102.6012	99.8102	110.1545	110.0979	120.6804	125.7560	132.9334	(219)	
Water heating fuel used												1411.7649	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3371.8008	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)														
mechanical ventilation fans (SFP = 0.2378)													95.9333	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													170.9333	(231)
Electricity for lighting (calculated in Appendix L)													498.6511	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)	
Total delivered energy for all uses												3628.9905	(238)	

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3371.8008	3.6300	122.3964 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.7649	3.6300	51.2471 (247)
Mechanical ventilation fans	95.9333	19.4400	18.6494 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	498.6511	19.4400	96.9378 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	19.4400	-354.6166 (252)
Total energy cost			44.1940 (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	3371.8008	0.2160	728.3090 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7649	0.2160	304.9412 (264)
Space and water heating			1033.2502 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6511	0.5190	258.7999 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			434.0256 (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	3371.8008	1.2200	4113.5970	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1411.7649	1.2200	1722.3532	(264)
Space and water heating			5835.9502	(265)
Pumps and fans	170.9333	3.0700	524.7651	(267)
Energy for lighting	498.6511	3.0700	1530.8589	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	3.0700	-5600.1701	(269)
Primary energy kWh/year			2291.4041	(272)
Primary energy kWh/m2/year			17.0390	(273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	130.2 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	459.43	(P1)
Transmission heat loss coefficient	79.66	(37)
Summer heat loss coefficient	539.09	(P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	0.850	0.90	1.000	0.765 (P8)
North East	0.850	1.00	1.000	0.850 (P8)
South East	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
South West	0.850	1.00	1.000	0.850 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.6650	98.8453	0.7600	0.7200	0.7650	173.7231
South East	3.4400	119.9223	0.7600	0.7200	0.7650	155.4206
South West	9.3030	119.9223	0.7600	0.7200	0.7650	420.3133
North East	0.9200	171.0993	0.7600	0.7200	0.8500	65.8937
South West	1.8400	196.8859	0.7600	0.7200	0.8500	151.6492

total: 966.9999

	Jun	Jul	Aug	
Solar gains	1024	967	867	(P3)
Internal gains	552	528	538	
Total summer gains	1575	1495	1406	(P5)

Summer gain/loss ratio	2.92	2.77	2.61	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 130.2)	1.09	1.09	1.09	
Threshold temperature	20.01	21.76	21.50	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	001 - PRJ012480				Issued on Date	10/06/2022
Assessment Reference	001 S			Prop Type Ref	PRJ012480	
Property	001 - PRJ012480					
SAP Rating	87 B	DER	12.53	TER	15.79	
Environmental	89 B	% DER<TER	20.65			
CO ₂ Emissions (t/year)	1.38	DFEE	40.49	TFEE	51.57	
General Requirements Compliance	Pass	% DFEE<TFEE	21.49			
Assessor Details	Chris Nicholls , Tel: ,				Assessor ID	U903-0001
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)	15.79	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.53	kgCO ₂ /m ²	Pass
	-3.26 (-20.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.57	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	40.49	kWh/m ² /yr	
	-11.1 (-21.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

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

Continuous extract system (decentralised)

Specific fan power

0.1900 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

4.67 m², No overhang

Windows facing South East

3.44 m², No overhang

Windows facing South West

9.30 m², No overhang

Air change rate

4.21 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

External wall U-value

0.11

W/m²K

External wall U-value

0.08

W/m²K

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.08

W/m²K

PREDICTED ENERGY ASSESSMENT

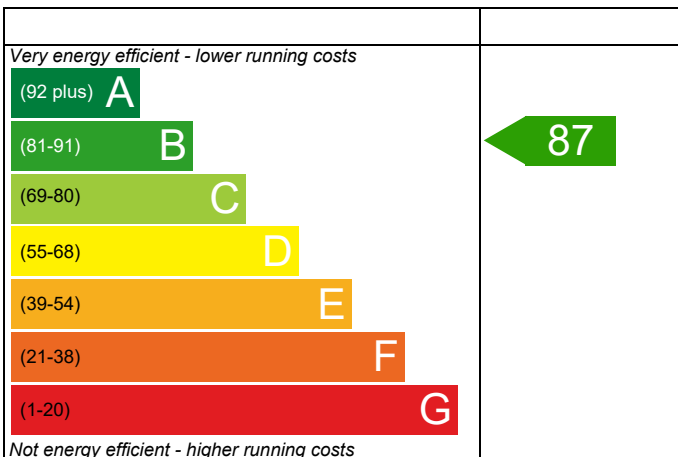
002 - PRJ012480

Dwelling type: House, Semi-Detached
Date of assessment: 10/06/2022
Produced by: Scott Binstead
Total floor area: 134.5 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

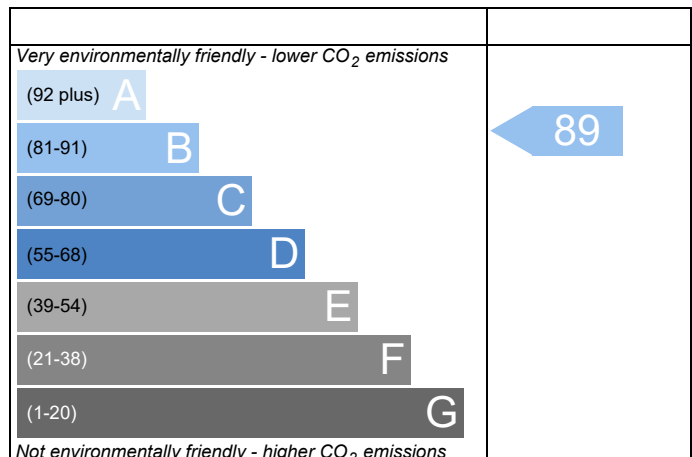


England

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	002 - PRJ012480				Issued on Date	10/06/2022
Assessment Reference	002 S	Prop Type Ref	PRJ012480			
Property	002 - PRJ012480					
SAP Rating	87 B	DER	12.57	TER	15.94	
Environmental	89 B	% DER<TER	21.13			
CO ₂ Emissions (t/year)	1.38	DFEE	39.90	TFEE	51.59	
General Requirements Compliance	Pass	% DFEE<TFEE	22.66			
Assessor Details	Chris Nicholls, , Tel: ,				Assessor ID	U903-0001
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 135 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) 15.94 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.57 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)39.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	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 ESPl 35

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: Time and temperature zone control 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

Continuous extract system (decentralised)

Specific fan power:	0.1900 0.1800	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North East: 4.67 m², No overhang

Windows facing South West: 9.30 m², No overhang

Air change rate: 4.21 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.11 W/m ² K
External wall U-value	0.08 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.08 W/m ² K

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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50													5.0100
Infiltration rate													0.2505 (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) =							0.2317 (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													
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5399	58.9075	58.2752	55.1134	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	55.7458	57.0105 (38)
	133.4392	132.8069	132.1745	129.0128	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	129.6451	130.9098 (39)
Average = Sum(39)m / 12 =												129.9055 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9921	0.9874	0.9827	0.9592	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9639	0.9733 (40)
Days in month												0.9658 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.3506	26.0689	21.2007	16.0503	11.9978	10.1290	10.9448	14.2264	19.0947	24.2451	28.2976	30.1663 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	482.0069	479.4816	461.7284	432.9637	403.2332	375.1806	357.3855	364.2384	379.4196	408.4206	441.6509	467.0720 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.6650	11.2829		0.7600		0.7200		0.7700		19.9597 (75)
Southwest			9.3030	36.7938		0.7600		0.7200		0.7700		129.8008 (79)
Northeast			0.9200	17.4137		0.7600		0.7200		1.0000		7.8898 (82)
Southwest			1.8400	38.2331		0.7600		0.7200		1.0000		34.6454 (82)

Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	674.3026	822.7041	970.1615	1123.4226	1228.4954	1216.4138	1159.3595	1062.8751	950.7617	798.4928	674.8988	629.7095 (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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.3287	36.5017	36.6763	37.5752	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.3919	37.0307
alpha	3.4219	3.4334	3.4451	3.5050	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.4928	3.4687
util living area	0.9883	0.9765	0.9503	0.8855	0.7676	0.6093	0.4668	0.5223	0.7505	0.9270	0.9795	0.9906 (86)
MIT	19.1545	19.4206	19.8215	20.3241	20.6990	20.9031	20.9712	20.9571	20.7933	20.2878	19.6401	19.1277 (87)
Th 2	20.0899	20.0938	20.0978	20.1175	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1135	20.1056 (88)
util rest of house	0.9861	0.9723	0.9412	0.8647	0.7267	0.5431	0.3813	0.4344	0.6924	0.9093	0.9751	0.9889 (89)
MIT 2	17.5945	17.9832	18.5633	19.2857	19.7897	20.0356	20.1029	20.0923	19.9191	19.2505	18.3172	17.5654 (90)
Living area fraction	18.1199	18.4673	18.9871	19.6354	20.0960	20.3278	20.3953	20.3836	20.2136	19.5999	18.7628	18.0916 (92)
MIT	18.1199	18.4673	18.9871	19.6354	20.0960	20.3278	20.3953	20.3836	20.2136	19.5999	18.7628	18.0916 (92)
Temperature adjustment	17.9699	18.3173	18.8371	19.4854	19.9460	20.1778	20.2453	20.2336	20.0636	19.4499	18.6128	-0.1500
adjusted MIT	17.9699	18.3173	18.8371	19.4854	19.9460	20.1778	20.2453	20.2336	20.0636	19.4499	18.6128	17.9416 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Utilisation	0.9788	0.9608	0.9248	0.8471	0.7177	0.5476	0.3939	0.4462	0.6882	0.8922	0.9648	0.9828 (94)
Useful gains	660.0183	790.4777	897.2301	951.6247	881.7320	666.1682	456.6196	474.2764	654.3351	712.4183	651.1095	618.8765 (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	1824.1010	1781.9093	1630.6441	1365.6527	1059.4375	716.6327	468.3501	492.5351	766.1973	1137.0280	1492.5749	1798.9075 (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	866.0776	666.2421	545.6600	298.1002	132.2129	0.0000	0.0000	0.0000	0.0000	315.9096	605.8551	877.9431 (98)
Space heating												4308.0005 (98)
Space heating per m2												32.0297 (99)

(98) / (4) =

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4760.2215 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	866.0776	666.2421	545.6600	298.1002	132.2129	0.0000	0.0000	0.0000	0.0000	315.9096	605.8551	877.9431 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	956.9918	736.1791	602.9392	329.3924	146.0916	0.0000	0.0000	0.0000	0.0000	349.0714	669.4531	970.1029 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater	90.0894	90.0409	89.9361	89.6613	89.0910	87.3000	87.3000	87.3000	87.3000	89.6642	89.9817	87.3000 (216)
Fuel for water heating, kWh/month	136.5194	119.5520	125.2084	113.9057	112.6258	102.6020	99.8109	110.1554	110.0987	120.1511	125.5250	132.7947 (219)
Water heating fuel used												1408.9492 (219)
Annual totals kWh/year												
Space heating fuel - main system												4760.2215 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)												
mechanical ventilation fans (SFP = 0.2378)												95.9495 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												170.9495 (231)
Electricity for lighting (calculated in Appendix L)												518.3405 (232)
Total delivered energy for all uses												6858.4607 (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	4760.2215	0.2160	1028.2078 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1408.9492	0.2160	304.3330 (264)
Space and water heating			1332.5409 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Total CO2, kg/year			1690.2824 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5700 (273)

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

DER			12.5700 ZC1
Total Floor Area		TFA	134.5000
Assumed number of occupants		N	2.9058
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.3525 ZC2
CO2 emissions from cooking, equation (L16)			1.4033 ZC3
Total CO2 emissions			27.3257 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			27.3257 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1209 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3709	(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) =	0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3688	0.3259	0.3259	0.3174	0.3431	0.3688	0.3860	0.4031 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			13.9700	1.3258	18.5208			(27)				
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933			(27a)				
Flr - Ground			56.6800	0.1300	7.3684			(28a)				
Wl - Brick	122.1600	16.0680	106.0920	0.1800	19.0966			(29a)				
Wl - Stud Ashlar	17.7200		17.7200	0.1800	3.1896			(29a)				
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1300	3.9182			(30)				
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553			(30)				
Rf - Ashlar behind Stud	23.9200		23.9200	0.1300	3.1096			(30)				
Total net area of external elements Aum(A, m2)			259.1920					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.4518			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.3200 (36)				
Total fabric heat loss						(33) + (36) =		78.7718 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.0253	Feb 64.6197	Mar 64.2221	Apr 62.3548	May 62.0055	Jun 60.3791	Jul 60.3791	Aug 60.0779	Sep 61.0055	Oct 62.0055	Nov 62.7122	Dec 63.4511 (38)
Heat transfer coeff	143.7970	143.3915	142.9939	141.1266	140.7772	139.1508	139.1508	138.8496	139.7773	140.7772	141.4840	142.2229 (39)
Average = Sum(39)m / 12 =												141.1249 (39)
HLP	Jan 1.0691	Feb 1.0661	Mar 1.0632	Apr 1.0493	May 1.0467	Jun 1.0346	Jul 1.0346	Aug 1.0323	Sep 1.0392	Oct 1.0467	Nov 1.0519	Dec 1.0574 (40)
HLP (average)												1.0493 (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												2.9058 (42)
Average daily hot water use (litres/day)												103.2125 (43)
Daily hot water use	Jan 113.5337	Feb 109.4052	Mar 105.2767	Apr 101.1482	May 97.0197	Jun 92.8912	Jul 92.8912	Aug 97.0197	Sep 101.1482	Oct 105.2767	Nov 109.4052	Dec 113.5337 (44)
Energy conte	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9343 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	50.9589	46.0274	50.9589	49.3151	49.4402	45.8094	47.3364	49.4402	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	219.3262	193.2825	202.9129	181.7923	176.5552	155.5000	148.9808	166.0787	167.3466	188.5133	199.4665	214.0136 (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	219.3262	193.2825	202.9129	181.7923	176.5552	155.5000	148.9808	166.0787	167.3466	188.5133	199.4665	214.0136 (64)
Heat gains from water heating, kWh/month	68.7218	60.4692	63.2644	56.3774	54.6258	47.9245	45.6309	51.1424	51.5743	58.4766	62.2541	66.9554 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	29.5342	26.2320	21.3333	16.1507	12.0728	10.1924	11.0132	14.3154	19.2141	24.3967	28.4746	30.3550 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943 (68)
Pumps, fans	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Total internal gains	92.3681	89.9839	85.0329	78.3020	73.4218	66.5618	61.3318	68.7397	71.6309	78.5975	86.4640	89.9938 (72)
	494.5555	492.0140	474.2393	445.4544	415.1993	386.4426	368.6614	376.2266	391.9415	420.9621	454.2035	479.6300 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Northeast				4.6650	11.2829		0.6300		0.7000	0.7700	16.0859 (75)	
Southwest				9.3030	36.7938		0.6300		0.7000	0.7700	104.6092 (79)	
Northeast				0.9200	17.4137		0.6300		0.7000	1.0000	6.3586 (82)	
Southwest				1.8400	38.2331		0.6300		0.7000	1.0000	27.9214 (82)	
Solar gains	154.9751	276.6102	409.7569	556.4554	665.0962	677.9676	646.3277	563.0460	460.4567	314.3674	187.9794	131.0730 (83)
Total gains	649.5306	768.6242	883.9962	1001.9098	1080.2954	1064.4101	1014.9890	939.2726	852.3981	735.3295	642.1829	610.7030 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	64.9546	65.1383	65.3194	66.1837	66.3479	67.1234	67.1234	67.2690	66.8226	66.3479	66.0165	65.6735	65.6735
util living area	5.3303	5.3426	5.3546	5.4122	5.4232	5.4749	5.4749	5.4846	5.4548	5.4232	5.4011	5.3782	5.3782
MIT	0.9993	0.9981	0.9940	0.9762	0.9130	0.7615	0.5876	0.6514	0.8922	0.9880	0.9984	0.9995	0.9995 (86)
MIT 2	19.7581	19.9070	20.1524	20.4810	20.7702	20.9429	20.9887	20.9808	20.8547	20.4751	20.0576	19.7365	19.7365 (87)
Th 2	20.0261	20.0286	20.0310	20.0425	20.0446	20.0546	20.0546	20.0565	20.0508	20.0446	20.0403	20.0358	20.0358 (88)
util rest of house	0.9991	0.9975	0.9918	0.9665	0.8774	0.6769	0.4694	0.5319	0.8345	0.9816	0.9977	0.9993	0.9993 (89)
MIT 2	18.3524	18.5719	18.9315	19.4131	19.8082	20.0144	20.0502	20.0480	19.9251	19.4111	18.8010	18.3278	18.3278 (90)
Living area fraction	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022	18.8022 (92)
MIT	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022	18.8022 (93)
Temperature adjustment													0.0000
adjusted MIT	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022	18.8022 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9965	0.9896	0.9630	0.8812	0.7031	0.5095	0.5724	0.8478	0.9791	0.9969	0.9990	0.9990 (94)
Ext temp.	648.6453	765.9218	874.7644	964.8845	951.9571	748.4204	517.1864	537.6312	722.6801	719.9562	640.1871	610.1060	610.1060 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000 (96)
Month fracti	2088.7770	2024.9082	1836.4238	1534.4341	1187.0587	796.9343	524.0784	550.1444	857.9756	1290.8505	1715.3870	2076.7739	2076.7739 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1071.4580	846.0389	715.4746	410.0757	174.9156	0.0000	0.0000	0.0000	0.0000	424.7453	774.1439	1091.2009	1091.2009 (98)
Space heating per m2													5508.0529 (98)
													(98) / (4) = 40.9521 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5897.2730 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1071.4580	846.0389	715.4746	410.0757	174.9156	0.0000	0.0000	0.0000	0.0000	424.7453	774.1439	1091.2009	(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)	1147.1713	905.8233	766.0327	439.0533	187.2758	0.0000	0.0000	0.0000	0.0000	454.7595	828.8478	1168.3093	(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	219.3262	193.2825	202.9129	181.7923	176.5552	155.5000	148.9808	166.0787	167.3466	188.5133	199.4665	214.0136	(64)
Efficiency of water heater (217)m	88.5084	88.3338	87.9557	87.0375	85.0277	80.3000	80.3000	80.3000	80.3000	87.0349	88.1290	80.3000	(216)
Fuel for water heating, kWh/month	247.8026	218.8092	230.6990	208.8666	207.6443	193.6488	185.5303	206.8228	208.4018	216.5951	226.3345	241.6232	(219)
Water heating fuel used												2592.7783	(219)
Annual totals kWh/year													
Space heating fuel - main system												5897.2730	(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)												521.5826	(232)
Total delivered energy for all uses												9086.6338	(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	5897.2730	0.2160	1273.8110	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2592.7783	0.2160	560.0401	(264)
Space and water heating			1833.8511	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	521.5826	0.5190	270.7014	(268)
Total CO2, kg/m2/year			2143.4774	(272)
Emissions per m2 for space and water heating			13.6346	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0126	(272b)
Emissions per m2 for pumps and fans			0.2894	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6346 * 1.00) + 2.0126 + 0.2894, rounded to 2 d.p.			15.9400	(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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3714 (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) =				0.3436 (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	0.4380	0.4295	0.4209	0.3779	0.3693	0.3264	0.3264	0.3178	0.3436	0.3693	0.3865	0.4037 (22b)
Effective ac	0.5959	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Floor - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
W1 - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)
W1 - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)
Total net area of external elements Aum(A, m ²)			259.1920				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.4441			(33)
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8300			18.0000	1400.9400 (32d)
Internal Ceiling			77.8300			5.8200	452.9706 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				17451.6367 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7519 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)
Total fabric heat loss			(33) + (36) =				73.8993 (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	65.0535	64.6468	64.2482	62.3758	62.0255	60.3947	60.3947	60.0927	61.0229	62.0255	62.7342	63.4751 (38)
Heat transfer coeff	138.9528	138.5461	138.1475	136.2751	135.9248	134.2941	134.2941	133.9921	134.9222	135.9248	136.6335	137.3744 (39)
Average = Sum(39)m / 12 =												136.2735 (39)
HLP	1.0331	1.0301	1.0271	1.0132	1.0106	0.9985	0.9985	0.9962	1.0031	1.0106	1.0159	1.0214 (40)
HLP (average)												1.0132 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy													2.9058 (42)
Average daily hot water use (litres/day)													103.2125 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337	(44)
Energy conte	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547	(45)
Energy content (annual)													Total = Sum(45)m = 1623.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.7780	31.2917	32.2902	28.1514	27.0119	23.3093	21.5995	24.7857	25.0817	29.2303	31.9072	34.6491	(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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.3506	26.0689	21.2007	16.0503	11.9978	10.1290	10.9448	14.2264	19.0947	24.2451	28.2976	30.1663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	(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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	(71)
Water heating gains (Table 5)	48.0888	46.5650	43.4009	39.0992	36.3064	32.3740	29.0315	33.3141	34.8357	39.2881	44.3155	46.5714	(72)
Total internal gains	447.0926	445.4321	429.4747	403.1512	375.0088	349.1914	333.2926	337.7119	352.0268	378.5009	408.8780	433.0189	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.6650	11.2829	0.7600	0.7200	0.7700		19.9597 (75)	
Southwest					9.3030	36.7938	0.7600	0.7200	0.7700		129.8008 (79)	
Northeast					0.9200	17.4137	0.7600	0.7200	1.0000		7.8898 (82)	
Southwest					1.8400	38.2331	0.7600	0.7200	1.0000		34.6454 (82)	

Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	639.3883	788.6546	937.9077	1093.6102	1200.2710	1190.4247	1135.2665	1036.3486	923.3690	768.5731	642.1259	595.6564 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.8872	34.9896	35.0906	35.5727	35.6644	36.0975	36.0975	36.1788	35.9294	35.6644	35.4794	35.2881	
alpha	3.3258	3.3326	3.3394	3.3715	3.3776	3.4065	3.4065	3.4119	3.3953	3.3776	3.3653	3.3525	
util living area	0.9900	0.9796	0.9562	0.8989	0.7911	0.6352	0.4919	0.5492	0.7756	0.9374	0.9826	0.9921	(86)
MIT	19.0311	19.2972	19.7068	20.2183	20.6305	20.8781	20.9617	20.9443	20.7471	20.1857	19.5125	18.9896	(87)
Th 2	20.0558	20.0583	20.0608	20.0723	20.0745	20.0846	20.0846	20.0865	20.0807	20.0745	20.0701	20.0656	(88)
util rest of house	0.9881	0.9758	0.9479	0.8793	0.7507	0.5665	0.4001	0.4559	0.7179	0.9213	0.9788	0.9906	(89)
MIT 2	18.2386	18.5045	18.9102	19.4139	19.7958	20.0112	20.0684	20.0612	19.9111	19.3934	18.7288	18.2044	(90)
Living area fraction	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	20.1927	19.6602	18.9927	18.4688	(91)
MIT	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	20.1927	19.6602	18.9927	18.4688	(92)
Temperature adjustment	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	20.1927	19.6602	18.9927	18.4688	(93)
adjusted MIT	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	20.1927	19.6602	18.9927	18.4688	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9840	0.9690	0.9382	0.8698	0.7508	0.5838	0.4296	0.4850	0.7257	0.9124	0.9729	0.9871	(94)
Ext temp.	629.1341	764.2450	879.9321	951.1758	901.1856	694.9357	487.7642	502.6292	670.0773	701.2513	624.7512	587.9676	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1973.8964	1921.8384	1751.5013	1469.6994	1138.6309	765.9050	506.1943	530.4238	822.0386	1231.5114	1624.9441	1960.1728	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1000.5031	777.9027	648.4475	373.3370	176.6593	0.0000	0.0000	0.0000	0.0000	394.5135	720.1389	1020.9207	(98)
													5112.4226 (98)
													(98) / (4) = 38.0106 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1262.3642	993.7761	1018.3397	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8280	0.8851	0.8569	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1045.2754	879.5725	872.5832	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1470.2022	1405.2790	1298.5476	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	305.9473	391.1257	316.9175	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			1013.9904	(104)
Intermittency factor (Table 10b)												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	76.4868	97.7814	79.2294	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												253.4976	(107)
Energy for space heating												1.8847	(108)
Energy for space cooling												38.0106	(99)
Total												1.8847	(108)
Dwelling Fabric Energy Efficiency (DFEE)												39.8953	(109)
												39.9	(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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (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) =		0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3688	0.3259	0.3259	0.3174	0.3431	0.3688	0.3860	0.4031 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933		(27a)
Flr - Ground			56.6800	0.1300	7.3684		(28a)
Wl - Brick	122.1600	16.0680	106.0920	0.1800	19.0966		(29a)
Wl - Stud Ashlar	17.7200		17.7200	0.1800	3.1896		(29a)
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1300	3.9182		(30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553		(30)
Rf - Ashlar behind Stud	23.9200		23.9200	0.1300	3.1096		(30)
Total net area of external elements Aum(A, m ²)			259.1920				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.4518		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.3200 (36)
Total fabric heat loss						(33) + (36) =	78.7718 (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	65.0253	64.6197	64.2221	62.3548	62.0055	60.3791	60.3791	60.0779	61.0055	62.0055	62.7122	63.4511 (38)
Heat transfer coeff	143.7970	143.3915	142.9939	141.1266	140.7772	139.1508	139.1508	138.8496	139.7773	140.7772	141.4840	142.2229 (39)
Average = Sum(39)m / 12 =												141.1249 (39)
HLP	1.0691	1.0661	1.0632	1.0493	1.0467	1.0346	1.0346	1.0323	1.0392	1.0467	1.0519	1.0574 (40)
HLP (average)												1.0493 (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												2.9058 (42)
Average daily hot water use (litres/day)												103.2125 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy conte	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9343 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7780	31.2917	32.2902	28.1514	27.0119	23.3093	21.5995	24.7857	25.0817	29.2303	31.9072	34.6491 (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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5342	26.2320	21.3333	16.1507	12.0728	10.1924	11.0132	14.3154	19.2141	24.3967	28.4746	30.3550	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	(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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	(71)
Water heating gains (Table 5)	48.0888	46.5650	43.4009	39.0992	36.3064	32.3740	29.0315	33.3141	34.8357	39.2881	44.3155	46.5714	(72)
Total internal gains	447.2762	445.5952	429.6073	403.2516	375.0839	349.2547	333.3611	337.8009	352.1462	378.6526	409.0550	433.2076	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.6650	11.2829	0.6300	0.7000	0.7700	16.0859 (75)			
Southwest				9.3030	36.7938	0.6300	0.7000	0.7700	104.6092 (79)			
Northeast				0.9200	17.4137	0.6300	0.7000	1.0000	6.3586 (82)			
Southwest				1.8400	38.2331	0.6300	0.7000	1.0000	27.9214 (82)			
Solar gains	154.9751	276.6102	409.7569	556.4554	665.0962	677.9676	646.3277	563.0460	460.4567	314.3674	187.9794	131.0730 (83)
Total gains	602.2513	722.2054	839.3642	959.7070	1040.1800	1027.2223	979.6887	900.8469	812.6029	693.0200	597.0344	564.2805 (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	64.9546	65.1383	65.3194	66.1837	66.3479	67.1234	67.1234	67.2690	66.8226	66.3479	66.0165	65.6735	
alpha	5.3303	5.3426	5.3546	5.4122	5.4232	5.4749	5.4749	5.4846	5.4548	5.4232	5.4011	5.3782	
util living area	0.9995	0.9986	0.9953	0.9801	0.9235	0.7795	0.6062	0.6739	0.9076	0.9908	0.9989	0.9997	(86)
MIT	19.7247	19.8744	20.1217	20.4544	20.7519	20.9359	20.9869	20.9775	20.8383	20.4467	20.0258	19.7036	(87)
Th 2	20.0261	20.0286	20.0310	20.0425	20.0446	20.0546	20.0546	20.0565	20.0508	20.0446	20.0403	20.0358	(88)
util rest of house	0.9994	0.9981	0.9935	0.9719	0.8908	0.6961	0.4856	0.5527	0.8548	0.9858	0.9984	0.9996	(89)
MIT 2	18.8500	19.0015	19.2499	19.5874	19.8680	20.0232	20.0510	20.0495	19.9530	19.5846	19.1624	18.8368	(90)
Living area fraction	19.1446	19.2955	19.5435	19.8794	20.1657	20.3306	20.3662	20.3620	20.2512	19.8750	19.4532	19.1287	(91)
MIT	19.1446	19.2955	19.5435	19.8794	20.1657	20.3306	20.3662	20.3620	20.2512	19.8750	19.4532	19.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1446	19.2955	19.5435	19.8794	20.1657	20.3306	20.3662	20.3620	20.2512	19.8750	19.4532	19.1287	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	601.7423	720.4854	832.9041	931.0500	931.6034	742.0904	516.0018	535.1944	705.2560	682.3611	595.8448	563.9477	(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	2134.6153	2064.1913	1865.1457	1549.4887	1191.7810	797.4193	524.0747	550.1273	859.7911	1305.7048	1747.7815	2123.2062	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating kWh	1140.4575	902.9704	767.9878	445.2758	193.5722	0.0000	0.0000	0.0000	0.0000	463.7677	829.3944	1160.0884	(98)
Space heating												5903.5141	(98)
Space heating per m2												43.8923	(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	1308.0178	1029.7161	1055.2573	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8389	0.9103	0.8787	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1097.2873	937.3613	927.2744	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1287.7927	1231.3561	1146.9027	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	137.1639	218.7321	163.4034	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												519.2995 (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	34.2910	54.6830	40.8509	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.8249 (107)
Space cooling per m2												0.9652 (108)
Energy for space heating												43.8923 (99)
Energy for space cooling												0.9652 (108)
Total												44.8575 (109)
Target Fabric Energy Efficiency (TFEE)												51.6 (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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													5.0100
Number of sides sheltered													0.2505 (18)
													1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2317 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)	
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)	
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5803	Feb 54.5803	Mar 54.5803	Apr 54.5803	May 54.5803	Jun 54.5803	Jul 54.5803	Aug 54.5803	Sep 54.5803	Oct 54.5803	Nov 54.5803	Dec 54.5803 (38)
Heat transfer coeff	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797 (39)
Average = Sum(39)m / 12 =												128.4797 (39)
HLP	Jan 0.9552	Feb 0.9552	Mar 0.9552	Apr 0.9552	May 0.9552	Jun 0.9552	Jul 0.9552	Aug 0.9552	Sep 0.9552	Oct 0.9552	Nov 0.9552	Dec 0.9552 (40)
HLP (average)												0.9552 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)	Total = Sum(45)m = 1623.9343 (45)											
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (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	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1789.7507 (64)											
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast	4.6650				12.9236		0.7600		0.7200		0.7700		22.8619 (75)
Southwest	9.3030				40.4699		0.7600		0.7200		0.7700		142.7692 (79)
Northeast	0.9200				20.0668		0.7600		0.7200		1.0000		9.0919 (82)
Southwest	1.8400				43.0236		0.7600		0.7200		1.0000		38.9864 (82)
Solar gains	213.7095	343.9299	505.2151	710.2799	829.5156	905.8080	853.8518	759.0259	616.5315	417.8891	265.7027	178.9231	(83)
Total gains	935.8832	1060.2049	1192.5312	1352.7958	1425.7326	1461.3106	1386.1966	1301.5972	1185.4897	1031.8836	929.4959	880.7994	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311
alpha	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154
util living area	0.9641	0.9449	0.8991	0.7986	0.6384	0.4256	0.2848	0.3121	0.5765	0.8354	0.9392	0.9698 (86)
MIT	19.6370	19.8327	20.1932	20.5868	20.8594	20.9755	20.9958	20.9941	20.9263	20.5868	20.0472	19.5795 (87)
Th 2	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208 (88)
util rest of house	0.9579	0.9358	0.8824	0.7668	0.5858	0.3557	0.2052	0.2281	0.5043	0.8010	0.9272	0.9645 (89)
MIT 2	18.3121	18.5919	19.1019	19.6380	19.9814	20.1040	20.1193	20.1185	20.0606	19.6513	18.9035	18.2298 (90)
Living area fraction	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
Temperature adjustment	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	-0.1500
adjusted MIT	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	18.5344 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9440	0.9192	0.8643	0.7543	0.5862	0.3660	0.2183	0.2419	0.5113	0.7873	0.9103	0.9517 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Useful gains	883.4774	974.5667	1030.6712	1020.3707	835.7887	534.8719	302.6435	314.8367	606.1824	812.4115	846.1622	838.2364	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
Month fracti	1735.5431	1703.6117	1531.4115	1272.9219	915.6873	545.7171	303.7865	316.5012	642.6783	1055.6370	1431.1010	1726.0431	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281	(98)
RHI space heating demand												3000.3312	(98)
												3000	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans					= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =		0.0000 (8)
Pressure test										Yes		
Measured/design AP50												5.0100
Infiltration rate												0.2505 (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) =		0.2317 (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												
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:											0.5000 (23a)	
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5399	58.9075	58.2752	55.1134	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	55.7458	57.0105 (38)
Average = Sum(39)m / 12 =	133.4392	132.8069	132.1745	129.0128	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	129.6451	130.9098 (39)
												129.9055 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9921	0.9874	0.9827	0.9592	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9639	0.9733 (40)
Days in month												0.9658 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					4.6650	11.2829	0.7600	0.7200			0.7700	19.9597 (75)
Southwest					9.3030	36.7938	0.7600	0.7200			0.7700	129.8008 (79)
Northeast					0.9200	17.4137	0.7600	0.7200			1.0000	7.8898 (82)
Southwest					1.8400	38.2331	0.7600	0.7200			1.0000	34.6454 (82)

Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	914.4695	1059.4975	1195.7491	1332.9748	1421.4792	1396.7358	1334.3188	1241.2079	1140.3003	1004.0667	897.0411	864.5137 (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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.3287	36.5017	36.6763	37.5752	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.3919	37.0307
alpha	3.4219	3.4334	3.4451	3.5050	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.4928	3.4687
util living area	0.9715	0.9526	0.9156	0.8350	0.7067	0.5473	0.4115	0.4571	0.6723	0.8744	0.9541	0.9758 (86)
MIT	19.4167	19.6643	20.0263	20.4653	20.7725	20.9309	20.9806	20.9718	20.8567	20.4524	19.8722	19.3890 (87)
Th 2	20.0899	20.0938	20.0978	20.1175	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1135	20.1056 (88)
util rest of house	0.9666	0.9448	0.9017	0.8089	0.6628	0.4836	0.3340	0.3768	0.6109	0.8483	0.9452	0.9717 (89)
MIT 2	17.9735	18.3317	18.8499	19.4724	19.8762	20.0616	20.1090	20.1026	19.9861	19.4706	18.6485	17.9436 (90)
Living area fraction	18.4596	18.7805	19.2461	19.8068	20.1781	20.3544	20.4026	20.3953	20.2794	19.8013	19.0607	18.4304 (92)
MIT	18.4596	18.7805	19.2461	19.8068	20.1781	20.3544	20.4026	20.3953	20.2794	19.8013	19.0607	18.4304 (92)
Temperature adjustment	18.3096	18.6305	19.0961	19.6568	20.0281	20.2044	20.2526	20.2453	20.1294	19.6513	18.9107	-0.1500
adjusted MIT	18.3096	18.6305	19.0961	19.6568	20.0281	20.2044	20.2526	20.2453	20.1294	19.6513	18.9107	18.2804 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Utilisation	0.9538	0.9286	0.8830	0.7934	0.6578	0.4899	0.3459	0.3885	0.6116	0.8319	0.9296	0.9602 (94)
Useful gains	872.2417	983.8758	1055.9036	1057.6132	935.1131	684.2861	461.4882	482.1953	697.3549	835.2481	833.9328	830.1356 (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	1869.4264	1823.5112	1664.8846	1387.7614	1069.9913	720.0493	469.2815	494.0459	774.6499	1162.9020	1531.1973	1843.2653 (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	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685 (98)
Space heating												3596.8517 (98)
Space heating per m2											(98) / (4) =	26.7424 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3974.4218 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	819.7850	623.4641	500.6430	262.6594	110.8833	0.0000	0.0000	0.0000	0.0000	269.3640	554.7298	832.8933 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater												87.3000 (216)
(217)m	90.0307	89.9716	89.8444	89.5139	88.8713	87.3000	87.3000	87.3000	87.3000	89.4946	89.8948	90.0478 (217)
Fuel for water heating, kWh/month	136.6084	119.6440	125.3361	114.0933	112.9042	102.6020	99.8109	110.1554	110.0987	120.3788	125.6463	132.8773 (219)
Water heating fuel used												1410.1556 (219)
Annual totals kWh/year												
Space heating fuel - main system												3974.4218 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)												
mechanical ventilation fans (SFP = 0.2378)												95.9495 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												170.9495 (231)
Electricity for lighting (calculated in Appendix L)												518.3405 (232)
Total delivered energy for all uses												6073.8674 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3974.4218	3.4800	138.3099 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1410.1556	3.4800	49.0734 (247)
Mechanical ventilation fans	95.9495	13.1900	12.6557 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	518.3405	13.1900	68.3691 (250)
Additional standing charges			120.0000 (251)
Total energy cost			398.3006 (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] =	0.9320 (257)
SAP value		86.9992
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3974.4218	0.2160	858.4751 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1410.1556	0.2160	304.5936 (264)
Space and water heating			1163.0687 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Total kg/year			1520.8102 (272)
CO2 emissions per m2			11.3100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value 88.6469
EI rating 89 (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	$3.48 / 0.8891 = 3.914$, stars = 5
Water heating environmental impact	$0.216 / 0.8891 = 0.2430$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							5.0100					
Infiltration rate							0.2505	(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) =	0.2317 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5803	Feb 54.5803	Mar 54.5803	Apr 54.5803	May 54.5803	Jun 54.5803	Jul 54.5803	Aug 54.5803	Sep 54.5803	Oct 54.5803	Nov 54.5803	Dec 54.5803 (38)
Heat transfer coeff	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797 (39)
Average = Sum(39)m / 12 =												128.4797 (39)
HLP	Jan 0.9552	Feb 0.9552	Mar 0.9552	Apr 0.9552	May 0.9552	Jun 0.9552	Jul 0.9552	Aug 0.9552	Sep 0.9552	Oct 0.9552	Nov 0.9552	Dec 0.9552 (40)
HLP (average)												0.9552 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast	4.6650				12.9236		0.7600		0.7200		0.7700		22.8619 (75)
Southwest	9.3030				40.4699		0.7600		0.7200		0.7700		142.7692 (79)
Northeast	0.9200				20.0668		0.7600		0.7200		1.0000		9.0919 (82)
Southwest	1.8400				43.0236		0.7600		0.7200		1.0000		38.9864 (82)

Solar gains	213.7095	343.9299	505.2151	710.2799	829.5156	905.8080	853.8518	759.0259	616.5315	417.8891	265.7027	178.9231	83)
Total gains	935.8832	1060.2049	1192.5312	1352.7958	1425.7326	1461.3106	1386.1966	1301.5972	1185.4897	1031.8836	929.4959	880.7994	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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311
alpha	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154
util living area	0.9641	0.9449	0.8991	0.7986	0.6384	0.4256	0.2848	0.3121	0.5765	0.8354	0.9392	0.9698 (86)
MIT	19.6370	19.8327	20.1932	20.5868	20.8594	20.9755	20.9958	20.9941	20.9263	20.5868	20.0472	19.5795 (87)
Th 2	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208 (88)
util rest of house	0.9579	0.9358	0.8824	0.7668	0.5858	0.3557	0.2052	0.2281	0.5043	0.8010	0.9272	0.9645 (89)
MIT 2	18.3121	18.5919	19.1019	19.6380	19.9814	20.1040	20.1193	20.1185	20.0606	19.6513	18.9035	18.2298 (90)
Living area fraction	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
MIT	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	-0.1500
Temperature adjustment												18.5344 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Utilisation	0.9440	0.9192	0.8643	0.7543	0.5862	0.3660	0.2183	0.2419	0.5113	0.7873	0.9103	0.9517 (94)
Useful gains	883.4774	974.5667	1030.6712	1020.3707	835.7887	534.8719	302.6435	314.8367	606.1824	812.4115	846.1622	838.2364 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1735.5431	1703.6117	1531.4115	1272.9219	915.6873	545.7171	303.7865	316.5012	642.6783	1055.6370	1431.1010	1726.0431 (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	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating												3000.3312 (98)
Space heating per m2											(98) / (4) =	22.3073 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3315.2831 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	700.4827	541.3461	411.6583	200.9247	65.6846	0.0000	0.0000	0.0000	0.0000	199.9555	465.3657	729.8653 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater	89.9642	89.9063	89.7365	89.3224	88.4637	87.3000	87.3000	87.3000	87.3000	89.2788	89.8039	89.9941 (216)
Fuel for water heating, kWh/month	136.7094	119.7309	125.4868	114.3379	113.4244	102.6020	99.8109	110.1554	110.0987	120.6698	125.7736	132.9567 (219)
Water heating fuel used												1411.7566 (219)
Annual totals kWh/year												
Space heating fuel - main system												3315.2831 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)	
mechanical ventilation fans (SFP = 0.2378)	95.9495 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	170.9495 (231)
Electricity for lighting (calculated in Appendix L)	518.3405 (232)
Total delivered energy for all uses	5416.3297 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3315.2831	3.6300	120.3448 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.7566	3.6300	51.2468 (247)
Mechanical ventilation fans	95.9495	19.4400	18.6526 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	518.3405	19.4400	100.7654 (250)
Additional standing charges			95.0000 (251)
Total energy cost			400.5895 (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	3315.2831	0.2160	716.1011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	0.2160	304.9394 (264)
Space and water heating			1021.0406 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Total kg/year			1378.7821 (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	3315.2831	1.2200	4044.6454 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	1.2200	1722.3430 (264)
Space and water heating			5766.9884 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Pumps and fans	170.9495	3.0700	524.8150 (267)
Energy for lighting	518.3405	3.0700	1591.3053 (268)
Primary energy kWh/year			7883.1087 (272)
Primary energy kWh/m ² /year			58.6105 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 7.4	-£ 355	-947 kg (68.7%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.6	-£ 18	-140 kg (10.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£355	7.04 kg/m ²	A 94 A 95
Total Savings	£355	7.04 kg/m ²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£134	£134	£0
Mains gas	£267	£267	£0
Space heating	£249	£249	£0
Water heating	£51	£51	£0
Lighting	£101	£101	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£401	£46	£355
Total cost of uses	£401	£46	£355
Delivered energy	40 kWh/m ²	27 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	0.4 tonnes	0.9 tonnes
CO2 emissions per m ²	10 kg/m ²	3 kg/m ²	7 kg/m ²
Primary energy	59 kWh/m ²	17 kWh/m ²	42 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)	
Pressure test										Yes		
Measured/design AP50										5.0100		
Infiltration rate										0.2505 (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) =	0.2317 (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												
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
F1r - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
W1 - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
W1 - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5399	58.9075	58.2752	55.1134	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	55.7458	57.0105 (38)
Average = Sum(39)m / 12 =	133.4392	132.8069	132.1745	129.0128	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	129.6451	130.9098 (39)
												129.9055 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9921	0.9874	0.9827	0.9592	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9639	0.9733 (40)
Days in month												0.9658 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.6650	11.2829		0.7600		0.7200		0.7700		19.9597 (75)
Southwest			9.3030	36.7938		0.7600		0.7200		0.7700		129.8008 (79)
Northeast			0.9200	17.4137		0.7600		0.7200		1.0000		7.8898 (82)
Southwest			1.8400	38.2331		0.7600		0.7200		1.0000		34.6454 (82)
Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	914.4695	1059.4975	1195.7491	1332.9748	1421.4792	1396.7358	1334.3188	1241.2079	1140.3003	1004.0667	897.0411	864.5137 (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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.3287	36.5017	36.6763	37.5752	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.3919	37.0307
alpha	3.4219	3.4334	3.4451	3.5050	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.4928	3.4687
util living area	0.9715	0.9526	0.9156	0.8350	0.7067	0.5473	0.4115	0.4571	0.6723	0.8744	0.9541	0.9758 (86)
MIT	19.4167	19.6643	20.0263	20.4653	20.7725	20.9309	20.9806	20.9718	20.8567	20.4524	19.8722	19.3890 (87)
Th 2	20.0899	20.0938	20.0978	20.1175	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1135	20.1056 (88)
util rest of house	0.9666	0.9448	0.9017	0.8089	0.6628	0.4836	0.3340	0.3768	0.6109	0.8483	0.9452	0.9717 (89)
MIT 2	17.9735	18.3317	18.8499	19.4724	19.8762	20.0616	20.1090	20.1026	19.9861	19.4706	18.6485	17.9436 (90)
Living area fraction	18.4596	18.7805	19.2461	19.8068	20.1781	20.3544	20.4026	20.3953	20.2794	19.8013	19.0607	18.4304 (92)
MIT	18.3096	18.6305	19.0961	19.6568	20.0281	20.2044	20.2526	20.2453	20.1294	19.6513	18.9107	-0.1500
Temperature adjustment												
adjusted MIT												18.2804 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Utilisation	0.9538	0.9286	0.8830	0.7934	0.6578	0.4899	0.3459	0.3885	0.6116	0.8319	0.9296	0.9602 (94)
Useful gains	872.2417	983.8758	1055.9036	1057.6132	935.1131	684.2861	461.4882	482.1953	697.3549	835.2481	833.9328	830.1356 (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	1869.4264	1823.5112	1664.8846	1387.7614	1069.9913	720.0493	469.2815	494.0459	774.6499	1162.9020	1531.1973	1843.2653 (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	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685 (98)
Space heating												3596.8517 (98)
Space heating per m2												26.7424 (99)

(98) / (4) =

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 %)	90.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3974.4218 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	819.7850	623.4641	500.6430	262.6594	110.8833	0.0000	0.0000	0.0000	0.0000	269.3640	554.7298	832.8933	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531	(64)
Efficiency of water heater	90.0307	89.9716	89.8444	89.5139	88.8713	87.3000	87.3000	87.3000	87.3000	89.4946	89.8948	90.0478	(216)
Fuel for water heating, kWh/month	136.6084	119.6440	125.3361	114.0933	112.9042	102.6020	99.8109	110.1554	110.0987	120.3788	125.6463	132.8773	(219)
Water heating fuel used												1410.1556	(219)
Annual totals kWh/year													
Space heating fuel - main system												3974.4218	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)	
mechanical ventilation fans (SFP = 0.2378)	95.9495 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	170.9495 (231)
Electricity for lighting (calculated in Appendix L)	518.3405 (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		4346.6280 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3974.4218	3.4800	138.3099	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1410.1556	3.4800	49.0734	(247)
Mechanical ventilation fans	95.9495	13.1900	12.6557	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	518.3405	13.1900	68.3691	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			170.4778	(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] =	0.3989 (257)
SAP value		94.4355
SAP rating (Section 12)		94 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3974.4218	0.2160	858.4751	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water heating (other fuel)	1410.1556	0.2160	304.5936 (264)
Space and water heating			1163.0687 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			624.3730 (272)
EI value			4.6400 (273)
EI rating			95.3389
EI band			95 (274)
			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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7899 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								0.0000 / (5) = 0.0000 (8)				
Pressure test								Yes				
Measured/design AP50								5.0100				
Infiltration rate								0.2505 (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) =							0.2317 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.40)			13.9700	1.3258	18.5208			(27)					
Solid Door			2.1000	1.4000	2.9400			(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591			(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080	(28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210	(29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264	(29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668	(30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722	(30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704	(30)					
Total net area of external elements Aum(A, m2)			259.1920					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4441			(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259	(32)					
Ground Floor Block			32.2749			54.0300	1743.8107	(32c)					
Ground Floor Stud			26.0505			5.8200	151.6140	(32c)					
1st Floor Block			42.2450			54.0300	2282.4974	(32c)					
1st Floor Stud			93.6199			5.8200	544.8678	(32c)					
2nd Floor Block			28.7097			54.0300	1551.1827	(32c)					
2nd Floor Stud			35.4919			5.8200	206.5629	(32c)					
Internal Floor			77.8300			18.0000	1400.9400	(32d)					
Internal Ceiling			77.8300			5.8200	452.9706	(32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	17451.6367	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								129.7519	(35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								22.4552	(36)				
Total fabric heat loss							(33) + (36) =	73.8993	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	(38)
	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	(39)
Average = Sum(39)m / 12 =													(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast	4.6650				12.9236		0.7600		0.7200		0.7700		22.8619 (75)
Southwest	9.3030				40.4699		0.7600		0.7200		0.7700		142.7692 (79)
Northeast	0.9200				20.0668		0.7600		0.7200		1.0000		9.0919 (82)
Southwest	1.8400				43.0236		0.7600		0.7200		1.0000		38.9864 (82)

Solar gains	213.7095	343.9299	505.2151	710.2799	829.5156	905.8080	853.8518	759.0259	616.5315	417.8891	265.7027	178.9231	83)
Total gains	935.8832	1060.2049	1192.5312	1352.7958	1425.7326	1461.3106	1386.1966	1301.5972	1185.4897	1031.8836	929.4959	880.7994	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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311
alpha	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154
util living area	0.9641	0.9449	0.8991	0.7986	0.6384	0.4256	0.2848	0.3121	0.5765	0.8354	0.9392	0.9698 (86)
MIT	19.6370	19.8327	20.1932	20.5868	20.8594	20.9755	20.9958	20.9941	20.9263	20.5868	20.0472	19.5795 (87)
Th 2	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208 (88)
util rest of house	0.9579	0.9358	0.8824	0.7668	0.5858	0.3557	0.2052	0.2281	0.5043	0.8010	0.9272	0.9645 (89)
MIT 2	18.3121	18.5919	19.1019	19.6380	19.9814	20.1040	20.1193	20.1185	20.0606	19.6513	18.9035	18.2298 (90)
Living area fraction	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
MIT	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
Temperature adjustment	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	-0.1500
adjusted MIT	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	18.5344 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Utilisation	0.9440	0.9192	0.8643	0.7543	0.5862	0.3660	0.2183	0.2419	0.5113	0.7873	0.9103	0.9517 (94)
Useful gains	883.4774	974.5667	1030.6712	1020.3707	835.7887	534.8719	302.6435	314.8367	606.1824	812.4115	846.1622	838.2364 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1735.5431	1703.6117	1531.4115	1272.9219	915.6873	545.7171	303.7865	316.5012	642.6783	1055.6370	1431.1010	1726.0431 (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	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating												3000.3312 (98)
Space heating per m2												22.3073 (99)

(98) / (4) =

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 %)	90.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3315.2831 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	700.4827	541.3461	411.6583	200.9247	65.6846	0.0000	0.0000	0.0000	0.0000	199.9555	465.3657	729.8653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531	(64)
Efficiency of water heater	89.9642	89.9063	89.7365	89.3224	88.4637	87.3000	87.3000	87.3000	87.3000	89.2788	89.8039	89.9941	(217)
Fuel for water heating, kWh/month	136.7094	119.7309	125.4868	114.3379	113.4244	102.6020	99.8109	110.1554	110.0987	120.6698	125.7736	132.9567	(219)
Water heating fuel used												1411.7566	(219)
Annual totals kWh/year													
Space heating fuel - main system												3315.2831	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)													
mechanical ventilation fans (SFP = 0.2378)												95.9495	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												170.9495	(231)
Electricity for lighting (calculated in Appendix L)												518.3405	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												3592.1700	(238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3315.2831	3.6300	120.3448	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1411.7566	3.6300	51.2468	(247)
Mechanical ventilation fans	95.9495	19.4400	18.6526	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	518.3405	19.4400	100.7654	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	19.4400	-354.6166	(252)
Total energy cost			45.9729	(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	3315.2831	0.2160	716.1011	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1411.7566	0.2160	304.9394	(264)
Space and water heating			1021.0406	(265)
Pumps and fans	170.9495	0.5190	88.7228	(267)
Energy for lighting	518.3405	0.5190	269.0187	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			432.0432	(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	3315.2831	1.2200	4044.6454 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	1.2200	1722.3430 (264)
Space and water heating			5766.9884 (265)
Pumps and fans	170.9495	3.0700	524.8150 (267)
Energy for lighting	518.3405	3.0700	1591.3053 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2282.9386 (272)
Primary energy kWh/m2/year			16.9735 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	129.8 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	459.51 (P1)
Transmission heat loss coefficient	73.90 (37)
Summer heat loss coefficient	533.41 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.850	0.90	1.000	0.765 (P8)
North East	0.850	1.00	1.000	0.850 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
South West	0.850	1.00	1.000	0.850 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.6650	98.8453	0.7600	0.7200	0.7650	173.7231
South West	9.3030	119.9223	0.7600	0.7200	0.7650	420.3133
North East	0.9200	171.0993	0.7600	0.7200	0.8500	65.8937
South West	1.8400	196.8859	0.7600	0.7200	0.8500	151.6492

total: 811.5793

Solar gains	Jun 861	Jul 812	Aug 722	(P3)
Internal gains	553	529	540	
Total summer gains	1413	1341	1262	(P5)
Summer gain/loss ratio	2.65	2.51	2.37	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 129.8)	1.09	1.09	1.09	
Threshold temperature	19.74	21.51	21.26	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	002 - PRJ012480				Issued on Date	10/06/2022
Assessment Reference	002 S			Prop Type Ref	PRJ012480	
Property	002 - PRJ012480					
SAP Rating	87 B	DER	12.57	TER	15.94	
Environmental	89 B	% DER<TER	21.13			
CO ₂ Emissions (t/year)	1.38	DFEE	39.90	TFEE	51.59	
General Requirements Compliance	Pass	% DFEE<TFEE	22.66			
Assessor Details	Chris Nicholls , Tel: ,				Assessor ID	U903-0001
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)	15.94	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.57	kgCO ₂ /m ²	Pass
	-3.37 (-21.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.59	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	39.90	kWh/m ² /yr	
	-11.7 (-22.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

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

Continuous extract system (decentralised)

Specific fan power

0.1900 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

4.67 m², No overhang

Windows facing South West

9.30 m², No overhang

Air change rate

4.21 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

External wall U-value

0.11

W/m²K

External wall U-value

0.08

W/m²K

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.08

W/m²K

PREDICTED ENERGY ASSESSMENT

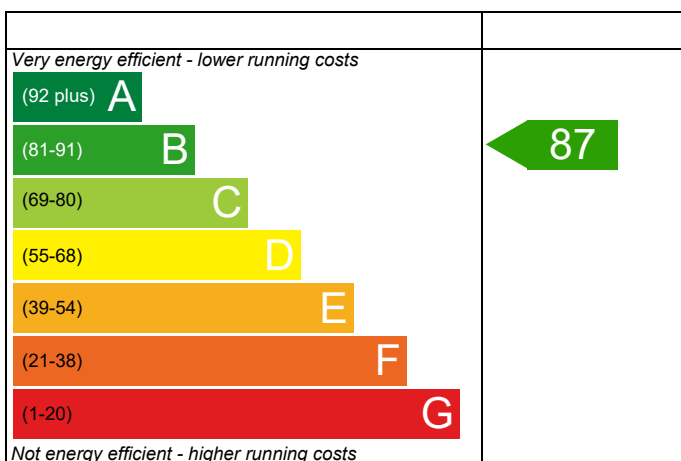
003 - PRJ012480

Dwelling type: House, Semi-Detached
Date of assessment: 10/06/2022
Produced by: Scott Binstead
Total floor area: 134.5 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

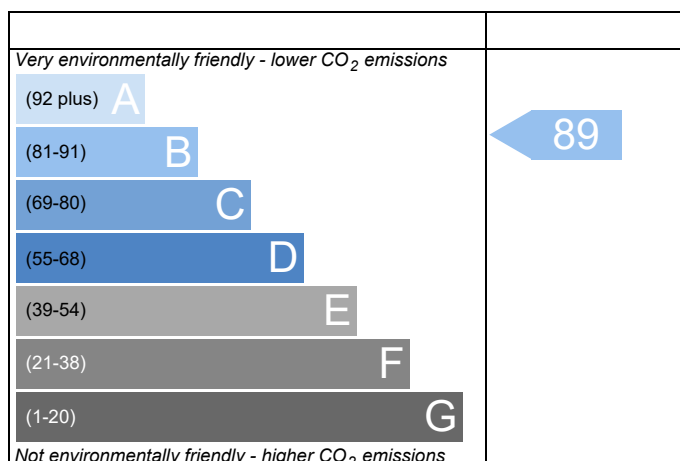


England

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	003 - PRJ012480			Issued on Date	10/06/2022
Assessment Reference	003 S	Prop Type Ref	PRJ012480		
Property	003 - PRJ012480				
SAP Rating	87 B	DER	12.57	TER	15.94
Environmental	89 B	% DER<TER	21.13		
CO ₂ Emissions (t/year)	1.38	DFEE	39.90	TFEE	51.59
General Requirements Compliance	Pass	% DFEE<TFEE	22.66		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	U903-0001
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 135 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) 15.94 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.57 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)39.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	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 ESPl 35

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: Time and temperature zone control 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

Continuous extract system (decentralised)

Specific fan power:	0.1900 0.1800	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North East: 4.67 m², No overhang

Windows facing South West: 9.30 m², No overhang

Air change rate: 4.21 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.11 W/m ² K
External wall U-value	0.08 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.08 W/m ² K

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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7899 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50													5.0100
Infiltration rate													0.2505 (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) =							0.2317 (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													
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5399	58.9075	58.2752	55.1134	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	55.7458	57.0105 (38)
Average = Sum(39)m / 12 =	133.4392	132.8069	132.1745	129.0128	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	129.6451	130.9098 (39)
												129.9055 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9921	0.9874	0.9827	0.9592	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9639	0.9733 (40)
Days in month												0.9658 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)	Total = Sum(45)m = 1623.9343 (45)											
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	-534.7156											
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.3506	26.0689	21.2007	16.0503	11.9978	10.1290	10.9448	14.2264	19.0947	24.2451	28.2976	30.1663 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	482.0069	479.4816	461.7284	432.9637	403.2332	375.1806	357.3855	364.2384	379.4196	408.4206	441.6509	467.0720 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.6650	11.2829		0.7600		0.7200		0.7700		19.9597 (75)
Southwest			9.3030	36.7938		0.7600		0.7200		0.7700		129.8008 (79)
Northeast			0.9200	17.4137		0.7600		0.7200		1.0000		7.8898 (82)
Southwest			1.8400	38.2331		0.7600		0.7200		1.0000		34.6454 (82)

Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	674.3026	822.7041	970.1615	1123.4226	1228.4954	1216.4138	1159.3595	1062.8751	950.7617	798.4928	674.8988	629.7095 (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	36.3287	36.5017	36.6763	37.5752	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.3919	37.0307
alpha	3.4219	3.4334	3.4451	3.5050	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.4928	3.4687
util living area	0.9883	0.9765	0.9503	0.8855	0.7676	0.6093	0.4668	0.5223	0.7505	0.9270	0.9795	0.9906 (86)
MIT	19.1545	19.4206	19.8215	20.3241	20.6990	20.9031	20.9712	20.9571	20.7933	20.2878	19.6401	19.1277 (87)
Th 2	20.0899	20.0938	20.0978	20.1175	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1135	20.1056 (88)
util rest of house	0.9861	0.9723	0.9412	0.8647	0.7267	0.5431	0.3813	0.4344	0.6924	0.9093	0.9751	0.9889 (89)
MIT 2	17.5945	17.9832	18.5633	19.2857	19.7897	20.0356	20.1029	20.0923	19.9191	19.2505	18.3172	17.5654 (90)
Living area fraction	18.1199	18.4673	18.9871	19.6354	20.0960	20.3278	20.3953	20.3836	20.2136	19.5999	18.7628	18.0916 (92)
MIT	18.1199	18.4673	18.9871	19.6354	20.0960	20.3278	20.3953	20.3836	20.2136	19.5999	18.7628	18.0916 (92)
Temperature adjustment	17.9699	18.3173	18.8371	19.4854	19.9460	20.1778	20.2453	20.2336	20.0636	19.4499	18.6128	-0.1500
adjusted MIT	17.9699	18.3173	18.8371	19.4854	19.9460	20.1778	20.2453	20.2336	20.0636	19.4499	18.6128	17.9416 (93)

8. Space heating requirement

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Utilisation	0.9788	0.9608	0.9248	0.8471	0.7177	0.5476	0.3939	0.4462	0.6882	0.8922	0.9648	0.9828 (94)
Useful gains	660.0183	790.4777	897.2301	951.6247	881.7320	666.1682	456.6196	474.2764	654.3351	712.4183	651.1095	618.8765 (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	1824.1010	1781.9093	1630.6441	1365.6527	1059.4375	716.6327	468.3501	492.5351	766.1973	1137.0280	1492.5749	1798.9075 (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	866.0776	666.2421	545.6600	298.1002	132.2129	0.0000	0.0000	0.0000	0.0000	315.9096	605.8551	877.9431 (98)
Space heating												4308.0005 (98)
Space heating per m2												32.0297 (99)

(98) / (4) =

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4760.2215 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	866.0776	666.2421	545.6600	298.1002	132.2129	0.0000	0.0000	0.0000	0.0000	315.9096	605.8551	877.9431 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	956.9918	736.1791	602.9392	329.3924	146.0916	0.0000	0.0000	0.0000	0.0000	349.0714	669.4531	970.1029 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater	90.0894	90.0409	89.9361	89.6613	89.0910	87.3000	87.3000	87.3000	87.3000	89.6642	89.9817	87.3000 (216)
Fuel for water heating, kWh/month	136.5194	119.5520	125.2084	113.9057	112.6258	102.6020	99.8109	110.1554	110.0987	120.1511	125.5250	132.7947 (219)
Water heating fuel used												1408.9492 (219)
Annual totals kWh/year												
Space heating fuel - main system												4760.2215 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)												
mechanical ventilation fans (SFP = 0.2378)												95.9495 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												170.9495 (231)
Electricity for lighting (calculated in Appendix L)												518.3405 (232)
Total delivered energy for all uses												6858.4607 (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	4760.2215	0.2160	1028.2078 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1408.9492	0.2160	304.3330 (264)
Space and water heating			1332.5409 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Total CO2, kg/year			1690.2824 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5700 (273)

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

DER			12.5700 ZC1
Total Floor Area			134.5000
Assumed number of occupants		TFA	2.9058
CO2 emission factor in Table 12 for electricity displaced from grid		N	0.5190
CO2 emissions from appliances, equation (L14)		EF	13.3525 ZC2
CO2 emissions from cooking, equation (L16)			1.4033 ZC3
Total CO2 emissions			27.3257 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			27.3257 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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1209 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3709	(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) =	0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3688	0.3259	0.3259	0.3174	0.3431	0.3688	0.3860	0.4031 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			13.9700	1.3258	18.5208			(27)				
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933			(27a)				
Flr - Ground			56.6800	0.1300	7.3684			(28a)				
Wl - Brick	122.1600	16.0680	106.0920	0.1800	19.0966			(29a)				
Wl - Stud Ashlar	17.7200		17.7200	0.1800	3.1896			(29a)				
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1300	3.9182			(30)				
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553			(30)				
Rf - Ashlar behind Stud	23.9200		23.9200	0.1300	3.1096			(30)				
Total net area of external elements Aum(A, m2)			259.1920					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.4518			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.3200 (36)				
Total fabric heat loss						(33) + (36) =		78.7718 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.0253	Feb 64.6197	Mar 64.2221	Apr 62.3548	May 62.0055	Jun 60.3791	Jul 60.3791	Aug 60.0779	Sep 61.0055	Oct 62.0055	Nov 62.7122	Dec 63.4511 (38)
Heat transfer coeff	143.7970	143.3915	142.9939	141.1266	140.7772	139.1508	139.1508	138.8496	139.7773	140.7772	141.4840	142.2229 (39)
Average = Sum(39)m / 12 =												141.1249 (39)
HLP	Jan 1.0691	Feb 1.0661	Mar 1.0632	Apr 1.0493	May 1.0467	Jun 1.0346	Jul 1.0346	Aug 1.0323	Sep 1.0392	Oct 1.0467	Nov 1.0519	Dec 1.0574 (40)
HLP (average)												1.0493 (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												2.9058 (42)
Average daily hot water use (litres/day)												103.2125 (43)
Daily hot water use	Jan 113.5337	Feb 109.4052	Mar 105.2767	Apr 101.1482	May 97.0197	Jun 92.8912	Jul 92.8912	Aug 97.0197	Sep 101.1482	Oct 105.2767	Nov 109.4052	Dec 113.5337 (44)
Energy conte	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9343 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4402	45.8094	47.3364	49.4402	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	219.3262	193.2825	202.9129	181.7923	176.5552	155.5000	148.9808	166.0787	167.3466	188.5133	199.4665	214.0136 (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	219.3262	193.2825	202.9129	181.7923	176.5552	155.5000	148.9808	166.0787	167.3466	188.5133	199.4665	214.0136 (64)
Heat gains from water heating, kWh/month	68.7218	60.4692	63.2644	56.3774	54.6258	47.9245	45.6309	51.1424	51.5743	58.4766	62.2541	66.9554 (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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5342	26.2320	21.3333	16.1507	12.0728	10.1924	11.0132	14.3154	19.2141	24.3967	28.4746	30.3550 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	92.3681	89.9839	85.0329	78.3020	73.4218	66.5618	61.3318	68.7397	71.6309	78.5975	86.4640	89.9938 (72)
Total internal gains	494.5555	492.0140	474.2393	445.4544	415.1993	386.4426	368.6614	376.2266	391.9415	420.9621	454.2035	479.6300 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Northeast				4.6650	11.2829		0.6300		0.7000	0.7700	16.0859 (75)	
Southwest				9.3030	36.7938		0.6300		0.7000	0.7700	104.6092 (79)	
Northeast				0.9200	17.4137		0.6300		0.7000	1.0000	6.3586 (82)	
Southwest				1.8400	38.2331		0.6300		0.7000	1.0000	27.9214 (82)	
Solar gains	154.9751	276.6102	409.7569	556.4554	665.0962	677.9676	646.3277	563.0460	460.4567	314.3674	187.9794	131.0730 (83)
Total gains	649.5306	768.6242	883.9962	1001.9098	1080.2954	1064.4101	1014.9890	939.2726	852.3981	735.3295	642.1829	610.7030 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9993	0.9981	0.9940	0.9762	0.9130	0.7615	0.5876	0.6514	0.8922	0.9880	0.9984	0.9995 (86)
tau	64.9546	65.1383	65.3194	66.1837	66.3479	67.1234	67.1234	67.2690	66.8226	66.3479	66.0165	65.6735
alpha	5.3303	5.3426	5.3546	5.4122	5.4232	5.4749	5.4749	5.4846	5.4548	5.4232	5.4011	5.3782
util living area	0.9993	0.9981	0.9940	0.9762	0.9130	0.7615	0.5876	0.6514	0.8922	0.9880	0.9984	0.9995 (86)
MIT	19.7581	19.9070	20.1524	20.4810	20.7702	20.9429	20.9887	20.9808	20.8547	20.4751	20.0576	19.7365 (87)
Th 2	20.0261	20.0286	20.0310	20.0425	20.0446	20.0546	20.0546	20.0565	20.0508	20.0446	20.0403	20.0358 (88)
util rest of house	0.9991	0.9975	0.9918	0.9665	0.8774	0.6769	0.4694	0.5319	0.8345	0.9816	0.9977	0.9993 (89)
MIT 2	18.3524	18.5719	18.9315	19.4131	19.8082	20.0144	20.0502	20.0480	19.9251	19.4111	18.8010	18.3278 (90)
Living area fraction	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022 (92)
MIT	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022 (93)
Temperature adjustment	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022 (93)
adjusted MIT	18.8259	19.0215	19.3427	19.7728	20.1322	20.3271	20.3663	20.3622	20.2382	19.7695	19.2242	18.8022 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	648.6453	765.9218	874.7644	964.8845	951.9571	748.4204	517.1864	537.6312	722.6801	719.9562	640.1871	610.1060 (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	2088.7770	2024.9082	1836.4238	1534.4341	1187.0587	796.9343	524.0784	550.1444	857.9756	1290.8505	1715.3870	2076.7739 (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	1071.4580	846.0389	715.4746	410.0757	174.9156	0.0000	0.0000	0.0000	0.0000	424.7453	774.1439	1091.2009 (98)
Space heating	1071.4580	846.0389	715.4746	410.0757	174.9156	0.0000	0.0000	0.0000	0.0000	424.7453	774.1439	1091.2009 (98)
Space heating per m2	1071.4580	846.0389	715.4746	410.0757	174.9156	0.0000	0.0000	0.0000	0.0000	424.7453	774.1439	1091.2009 (98)
												5508.0529 (98)
												(98) / (4) = 40.9521 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5897.2730 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1071.4580	846.0389	715.4746	410.0757	174.9156	0.0000	0.0000	0.0000	0.0000	424.7453	774.1439	1091.2009	(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)	1147.1713	905.8233	766.0327	439.0533	187.2758	0.0000	0.0000	0.0000	0.0000	454.7595	828.8478	1168.3093	(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	219.3262	193.2825	202.9129	181.7923	176.5552	155.5000	148.9808	166.0787	167.3466	188.5133	199.4665	214.0136	(64)
Efficiency of water heater (217)m	88.5084	88.3338	87.9557	87.0375	85.0277	80.3000	80.3000	80.3000	80.3000	87.0349	88.1290	80.3000	(216)
Fuel for water heating, kWh/month	247.8026	218.8092	230.6990	208.8666	207.6443	193.6488	185.5303	206.8228	208.4018	216.5951	226.3345	241.6232	(219)
Water heating fuel used												2592.7783	(219)
Annual totals kWh/year													
Space heating fuel - main system												5897.2730	(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)												521.5826	(232)
Total delivered energy for all uses												9086.6338	(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	5897.2730	0.2160	1273.8110	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2592.7783	0.2160	560.0401	(264)
Space and water heating			1833.8511	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	521.5826	0.5190	270.7014	(268)
Total CO2, kg/m2/year			2143.4774	(272)
Emissions per m2 for space and water heating			13.6346	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0126	(272b)
Emissions per m2 for pumps and fans			0.2894	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6346 * 1.00) + 2.0126 + 0.2894, rounded to 2 d.p.			15.9400	(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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3714 (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) =				0.3436 (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	0.4380	0.4295	0.4209	0.3779	0.3693	0.3264	0.3264	0.3178	0.3436	0.3693	0.3865	0.4037 (22b)
Effective ac	0.5959	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Floor - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
W1 - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)
W1 - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)
Total net area of external elements Aum(A, m ²)			259.1920				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.4441			(33)
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8300			18.0000	1400.9400 (32d)
Internal Ceiling			77.8300			5.8200	452.9706 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				17451.6367 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7519 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)
Total fabric heat loss			(33) + (36) =				73.8993 (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	65.0535	64.6468	64.2482	62.3758	62.0255	60.3947	60.3947	60.0927	61.0229	62.0255	62.7342	63.4751 (38)
Heat transfer coeff	138.9528	138.5461	138.1475	136.2751	135.9248	134.2941	134.2941	133.9921	134.9222	135.9248	136.6335	137.3744 (39)
Average = Sum(39)m / 12 =												136.2735 (39)
HLP	1.0331	1.0301	1.0271	1.0132	1.0106	0.9985	0.9985	0.9962	1.0031	1.0106	1.0159	1.0214 (40)
HLP (average)												1.0132 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy													2.9058 (42)
Average daily hot water use (litres/day)													103.2125 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337	(44)
Energy conte	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547	(45)
Energy content (annual)													Total = Sum(45)m = 1623.9343 (45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.7780	31.2917	32.2902	28.1514	27.0119	23.3093	21.5995	24.7857	25.0817	29.2303	31.9072	34.6491	(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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.3506	26.0689	21.2007	16.0503	11.9978	10.1290	10.9448	14.2264	19.0947	24.2451	28.2976	30.1663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	(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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	(71)
Water heating gains (Table 5)	48.0888	46.5650	43.4009	39.0992	36.3064	32.3740	29.0315	33.3141	34.8357	39.2881	44.3155	46.5714	(72)
Total internal gains	447.0926	445.4321	429.4747	403.1512	375.0088	349.1914	333.2926	337.7119	352.0268	378.5009	408.8780	433.0189	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				4.6650	11.2829	0.7600	0.7200		0.7700	19.9597 (75)		
Southwest				9.3030	36.7938	0.7600	0.7200		0.7700	129.8008 (79)		
Northeast				0.9200	17.4137	0.7600	0.7200		1.0000	7.8898 (82)		
Southwest				1.8400	38.2331	0.7600	0.7200		1.0000	34.6454 (82)		
Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	639.3883	788.6546	937.9077	1093.6102	1200.2710	1190.4247	1135.2665	1036.3486	923.3690	768.5731	642.1259	595.6564 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.8872	34.9896	35.0906	35.5727	35.6644	36.0975	36.0975	36.1788	35.9294	35.6644	35.4794	35.2881	
alpha	3.3258	3.3326	3.3394	3.3715	3.3776	3.4065	3.4065	3.4119	3.3953	3.3776	3.3653	3.3525	
util living area	0.9900	0.9796	0.9562	0.8989	0.7911	0.6352	0.4919	0.5492	0.7756	0.9374	0.9826	0.9921	(86)
MIT	19.0311	19.2972	19.7068	20.2183	20.6305	20.8781	20.9617	20.9443	20.7471	20.1857	19.5125	18.9896	(87)
Th 2	20.0558	20.0583	20.0608	20.0723	20.0745	20.0846	20.0846	20.0865	20.0807	20.0745	20.0701	20.0656	(88)
util rest of house	0.9881	0.9758	0.9479	0.8793	0.7507	0.5665	0.4001	0.4559	0.7179	0.9213	0.9788	0.9906	(89)
MIT 2	18.2386	18.5045	18.9102	19.4139	19.7958	20.0112	20.0684	20.0612	19.9111	19.3934	18.7288	18.2044	(90)
Living area fraction	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	fLA = Living area / (4) =	20.1927	19.6602	18.9927	0.3368 (91)
MIT	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	20.1927	19.6602	18.9927	18.4688	(92)
Temperature adjustment													0.0000
adjusted MIT	18.5055	18.7715	19.1785	19.6848	20.0769	20.3032	20.3693	20.3586	20.1927	19.6602	18.9927	18.4688	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9840	0.9690	0.9382	0.8698	0.7508	0.5838	0.4296	0.4850	0.7257	0.9124	0.9729	0.9871	(94)
Ext temp.	629.1341	764.2450	879.9321	951.1758	901.1856	694.9357	487.7642	502.6292	670.0773	701.2513	624.7512	587.9676	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1973.8964	1921.8384	1751.5013	1469.6994	1138.6309	765.9050	506.1943	530.4238	822.0386	1231.5114	1624.9441	1960.1728	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1000.5031	777.9027	648.4475	373.3370	176.6593	0.0000	0.0000	0.0000	0.0000	394.5135	720.1389	1020.9207	(98)
													5112.4226 (98)
													(98) / (4) = 38.0106 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1262.3642	993.7761	1018.3397	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8280	0.8851	0.8569	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1045.2754	879.5725	872.5832	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1470.2022	1405.2790	1298.5476	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	305.9473	391.1257	316.9175	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			1013.9904	(104)
Intermittency factor (Table 10b)												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	76.4868	97.7814	79.2294	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												253.4976	(107)
Energy for space heating												1.8847	(108)
Energy for space cooling												38.0106	(99)
Total												1.8847	(108)
Dwelling Fabric Energy Efficiency (DFEE)												39.8953	(109)
												39.9	(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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (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) =		0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3688	0.3259	0.3259	0.3174	0.3431	0.3688	0.3860	0.4031 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933		(27a)
Flr - Ground			56.6800	0.1300	7.3684		(28a)
Wl - Brick	122.1600	16.0680	106.0920	0.1800	19.0966		(29a)
Wl - Stud Ashlar	17.7200		17.7200	0.1800	3.1896		(29a)
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1300	3.9182		(30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553		(30)
Rf - Ashlar behind Stud	23.9200		23.9200	0.1300	3.1096		(30)
Total net area of external elements Aum(A, m ²)			259.1920				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.4518		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.3200 (36)
Total fabric heat loss						(33) + (36) =	78.7718 (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	65.0253	64.6197	64.2221	62.3548	62.0055	60.3791	60.3791	60.0779	61.0055	62.0055	62.7122	63.4511 (38)
Heat transfer coeff	143.7970	143.3915	142.9939	141.1266	140.7772	139.1508	139.1508	138.8496	139.7773	140.7772	141.4840	142.2229 (39)
Average = Sum(39)m / 12 =												141.1249 (39)
HLP	1.0691	1.0661	1.0632	1.0493	1.0467	1.0346	1.0346	1.0323	1.0392	1.0467	1.0519	1.0574 (40)
HLP (average)												1.0493 (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												2.9058 (42)
Average daily hot water use (litres/day)												103.2125 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy conte	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9343 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7780	31.2917	32.2902	28.1514	27.0119	23.3093	21.5995	24.7857	25.0817	29.2303	31.9072	34.6491 (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	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	145.2894	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5342	26.2320	21.3333	16.1507	12.0728	10.1924	11.0132	14.3154	19.2141	24.3967	28.4746	30.3550	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0664	306.2113	298.2863	281.4149	260.1178	240.1016	226.7295	223.5846	231.5096	248.3810	269.6781	289.6943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	37.5289	(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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	(71)
Water heating gains (Table 5)	48.0888	46.5650	43.4009	39.0992	36.3064	32.3740	29.0315	33.3141	34.8357	39.2881	44.3155	46.5714	(72)
Total internal gains	447.2762	445.5952	429.6073	403.2516	375.0839	349.2547	333.3611	337.8009	352.1462	378.6526	409.0550	433.2076	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.6650	11.2829	0.6300	0.7000	0.7700	16.0859 (75)			
Southwest				9.3030	36.7938	0.6300	0.7000	0.7700	104.6092 (79)			
Northeast				0.9200	17.4137	0.6300	0.7000	1.0000	6.3586 (82)			
Southwest				1.8400	38.2331	0.6300	0.7000	1.0000	27.9214 (82)			
Solar gains	154.9751	276.6102	409.7569	556.4554	665.0962	677.9676	646.3277	563.0460	460.4567	314.3674	187.9794	131.0730 (83)
Total gains	602.2513	722.2054	839.3642	959.7070	1040.1800	1027.2223	979.6887	900.8469	812.6029	693.0200	597.0344	564.2805 (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	64.9546	65.1383	65.3194	66.1837	66.3479	67.1234	67.1234	67.2690	66.8226	66.3479	66.0165	65.6735	
alpha	5.3303	5.3426	5.3546	5.4122	5.4232	5.4749	5.4749	5.4846	5.4548	5.4232	5.4011	5.3782	
util living area	0.9995	0.9986	0.9953	0.9801	0.9235	0.7795	0.6062	0.6739	0.9076	0.9908	0.9989	0.9997	(86)
MIT	19.7247	19.8744	20.1217	20.4544	20.7519	20.9359	20.9869	20.9775	20.8383	20.4467	20.0258	19.7036	(87)
Th 2	20.0261	20.0286	20.0310	20.0425	20.0446	20.0546	20.0546	20.0565	20.0508	20.0446	20.0403	20.0358	(88)
util rest of house	0.9994	0.9981	0.9935	0.9719	0.8908	0.6961	0.4856	0.5527	0.8548	0.9858	0.9984	0.9996	(89)
MIT 2	18.8500	19.0015	19.2499	19.5874	19.8680	20.0232	20.0510	20.0495	19.9530	19.5846	19.1624	18.8368	(90)
Living area fraction	19.1446	19.2955	19.5435	19.8794	20.1657	20.3306	20.3662	20.3620	20.2512	19.8750	19.4532	19.1287	(91)
MIT	19.1446	19.2955	19.5435	19.8794	20.1657	20.3306	20.3662	20.3620	20.2512	19.8750	19.4532	19.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1446	19.2955	19.5435	19.8794	20.1657	20.3306	20.3662	20.3620	20.2512	19.8750	19.4532	19.1287	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	601.7423	720.4854	832.9041	931.0500	931.6034	742.0904	516.0018	535.1944	705.2560	682.3611	595.8448	563.9477	(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	2134.6153	2064.1913	1865.1457	1549.4887	1191.7810	797.4193	524.0747	550.1273	859.7911	1305.7048	1747.7815	2123.2062	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating kWh	1140.4575	902.9704	767.9878	445.2758	193.5722	0.0000	0.0000	0.0000	0.0000	463.7677	829.3944	1160.0884	(98)
Space heating												5903.5141	(98)
Space heating per m2												43.8923	(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	1308.0178	1029.7161	1055.2573	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8389	0.9103	0.8787	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1097.2873	937.3613	927.2744	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1287.7927	1231.3561	1146.9027	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	137.1639	218.7321	163.4034	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												519.2995 (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	34.2910	54.6830	40.8509	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.8249 (107)
Space cooling per m2												0.9652 (108)
Energy for space heating												43.8923 (99)
Energy for space cooling												0.9652 (108)
Total												44.8575 (109)
Target Fabric Energy Efficiency (TFEE)												51.6 (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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													5.0100
Number of sides sheltered													0.2505 (18)
													1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2317 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)	
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)	
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5803	Feb 54.5803	Mar 54.5803	Apr 54.5803	May 54.5803	Jun 54.5803	Jul 54.5803	Aug 54.5803	Sep 54.5803	Oct 54.5803	Nov 54.5803	Dec 54.5803 (38)
Heat transfer coeff	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797 (39)
Average = Sum(39)m / 12 =												128.4797 (39)
HLP	Jan 0.9552	Feb 0.9552	Mar 0.9552	Apr 0.9552	May 0.9552	Jun 0.9552	Jul 0.9552	Aug 0.9552	Sep 0.9552	Oct 0.9552	Nov 0.9552	Dec 0.9552 (40)
HLP (average)												0.9552 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Energy content (annual)	Total = Sum(45)m = 1623.9343 (45)											
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (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	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1789.7507 (64)											
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast					4.6650	12.9236	0.7600		0.7200		0.7700		22.8619 (75)
Southwest					9.3030	40.4699	0.7600		0.7200		0.7700		142.7692 (79)
Northeast					0.9200	20.0668	0.7600		0.7200		1.0000		9.0919 (82)
Southwest					1.8400	43.0236	0.7600		0.7200		1.0000		38.9864 (82)
Solar gains	213.7095	343.9299	505.2151	710.2799	829.5156	905.8080	853.8518	759.0259	616.5315	417.8891	265.7027	178.9231	(83)
Total gains	935.8832	1060.2049	1192.5312	1352.7958	1425.7326	1461.3106	1386.1966	1301.5972	1185.4897	1031.8836	929.4959	880.7994	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311
alpha	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154
util living area	0.9641	0.9449	0.8991	0.7986	0.6384	0.4256	0.2848	0.3121	0.5765	0.8354	0.9392	0.9698 (86)
MIT	19.6370	19.8327	20.1932	20.5868	20.8594	20.9755	20.9958	20.9941	20.9263	20.5868	20.0472	19.5795 (87)
Th 2	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208 (88)
util rest of house	0.9579	0.9358	0.8824	0.7668	0.5858	0.3557	0.2052	0.2281	0.5043	0.8010	0.9272	0.9645 (89)
MIT 2	18.3121	18.5919	19.1019	19.6380	19.9814	20.1040	20.1193	20.1185	20.0606	19.6513	18.9035	18.2298 (90)
Living area fraction	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
Temperature adjustment	fLA = Living area / (4) = -0.1500											
adjusted MIT	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	18.5344 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9440	0.9192	0.8643	0.7543	0.5862	0.3660	0.2183	0.2419	0.5113	0.7873	0.9103	0.9517 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Useful gains	883.4774	974.5667	1030.6712	1020.3707	835.7887	534.8719	302.6435	314.8367	606.1824	812.4115	846.1622	838.2364	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
Month fracti	1735.5431	1703.6117	1531.4115	1272.9219	915.6873	545.7171	303.7865	316.5012	642.6783	1055.6370	1431.1010	1726.0431	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281	(98)
RHI space heating demand												3000.3312	(98)
												3000	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (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) =		0.2317 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Mechanical extract ventilation - decentralised	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)
Total net area of external elements Aum(A, m ²)			259.1920				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4441		(33)
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8300			18.0000	1400.9400 (32d)
Internal Ceiling			77.8300			5.8200	452.9706 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17451.6367 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		129.7519 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		22.4552 (36)
Total fabric heat loss	(33) + (36) =	73.8993 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5399	58.9075	58.2752	55.1134	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	55.7458	57.0105 (38)
Average = Sum(39)m / 12 =	133.4392	132.8069	132.1745	129.0128	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	129.6451	130.9098 (39)
												129.9055 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9921	0.9874	0.9827	0.9592	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9639	0.9733 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.6650	11.2829		0.7600		0.7200		0.7700		19.9597 (75)
Southwest			9.3030	36.7938		0.7600		0.7200		0.7700		129.8008 (79)
Northeast			0.9200	17.4137		0.7600		0.7200		1.0000		7.8898 (82)
Southwest			1.8400	38.2331		0.7600		0.7200		1.0000		34.6454 (82)
Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	914.4695	1059.4975	1195.7491	1332.9748	1421.4792	1396.7358	1334.3188	1241.2079	1140.3003	1004.0667	897.0411	864.5137 (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	36.3287	36.5017	36.6763	37.5752	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.3919	37.0307
alpha	3.4219	3.4334	3.4451	3.5050	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.4928	3.4687
util living area	0.9715	0.9526	0.9156	0.8350	0.7067	0.5473	0.4115	0.4571	0.6723	0.8744	0.9541	0.9758 (86)
MIT	19.4167	19.6643	20.0263	20.4653	20.7725	20.9309	20.9806	20.9718	20.8567	20.4524	19.8722	19.3890 (87)
Th 2	20.0899	20.0938	20.0978	20.1175	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1135	20.1056 (88)
util rest of house	0.9666	0.9448	0.9017	0.8089	0.6628	0.4836	0.3340	0.3768	0.6109	0.8483	0.9452	0.9717 (89)
MIT 2	17.9735	18.3317	18.8499	19.4724	19.8762	20.0616	20.1090	20.1026	19.9861	19.4706	18.6485	17.9436 (90)
Living area fraction	18.4596	18.7805	19.2461	19.8068	20.1781	20.3544	20.4026	20.3953	20.2794	19.8013	19.0607	18.4304 (92)
MIT	18.4596	18.7805	19.2461	19.8068	20.1781	20.3544	20.4026	20.3953	20.2794	19.8013	19.0607	18.4304 (92)
Temperature adjustment	18.3096	18.6305	19.0961	19.6568	20.0281	20.2044	20.2526	20.2453	20.1294	19.6513	18.9107	-0.1500
adjusted MIT	18.3096	18.6305	19.0961	19.6568	20.0281	20.2044	20.2526	20.2453	20.1294	19.6513	18.9107	18.2804 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Utilisation	0.9538	0.9286	0.8830	0.7934	0.6578	0.4899	0.3459	0.3885	0.6116	0.8319	0.9296	0.9602 (94)
Useful gains	872.2417	983.8758	1055.9036	1057.6132	935.1131	684.2861	461.4882	482.1953	697.3549	835.2481	833.9328	830.1356 (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	1869.4264	1823.5112	1664.8846	1387.7614	1069.9913	720.0493	469.2815	494.0459	774.6499	1162.9020	1531.1973	1843.2653 (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	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685 (98)
Space heating												3596.8517 (98)
Space heating per m2												26.7424 (99)

(98) / (4) =

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3974.4218 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	819.7850	623.4641	500.6430	262.6594	110.8833	0.0000	0.0000	0.0000	0.0000	269.3640	554.7298	832.8933 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater												87.3000 (216)
(217)m	90.0307	89.9716	89.8444	89.5139	88.8713	87.3000	87.3000	87.3000	87.3000	89.4946	89.8948	90.0478 (217)
Fuel for water heating, kWh/month	136.6084	119.6440	125.3361	114.0933	112.9042	102.6020	99.8109	110.1554	110.0987	120.3788	125.6463	132.8773 (219)
Water heating fuel used												1410.1556 (219)
Annual totals kWh/year												
Space heating fuel - main system												3974.4218 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)	
mechanical ventilation fans (SFP = 0.2378)	95.9495 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	170.9495 (231)
Electricity for lighting (calculated in Appendix L)	518.3405 (232)
Total delivered energy for all uses	6073.8674 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3974.4218	3.4800	138.3099 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1410.1556	3.4800	49.0734 (247)
Mechanical ventilation fans	95.9495	13.1900	12.6557 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	518.3405	13.1900	68.3691 (250)
Additional standing charges			120.0000 (251)
Total energy cost			398.3006 (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] =	0.9320 (257)
SAP value		86.9992
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3974.4218	0.2160	858.4751 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1410.1556	0.2160	304.5936 (264)
Space and water heating			1163.0687 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Total kg/year			1520.8102 (272)
CO2 emissions per m2			11.3100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value 88.6469
EI rating 89 (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	$3.48 / 0.8891 = 3.914$, stars = 5
Water heating environmental impact	$0.216 / 0.8891 = 0.2430$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													5.0100
Number of sides sheltered													0.2505 (18)
													1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2317 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)	
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)	
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss							(33) + (36) = 73.8993 (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	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803	54.5803 (38)
Heat transfer coeff	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797 (39)
Average = Sum(39)m / 12 =												128.4797 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552	0.9552 (40)
HLP (average)												0.9552 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast	4.6650				12.9236		0.7600		0.7200		0.7700		22.8619 (75)
Southwest	9.3030				40.4699		0.7600		0.7200		0.7700		142.7692 (79)
Northeast	0.9200				20.0668		0.7600		0.7200		1.0000		9.0919 (82)
Southwest	1.8400				43.0236		0.7600		0.7200		1.0000		38.9864 (82)

Solar gains	213.7095	343.9299	505.2151	710.2799	829.5156	905.8080	853.8518	759.0259	616.5315	417.8891	265.7027	178.9231	83)
Total gains	935.8832	1060.2049	1192.5312	1352.7958	1425.7326	1461.3106	1386.1966	1301.5972	1185.4897	1031.8836	929.4959	880.7994	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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311
alpha	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154
util living area	0.9641	0.9449	0.8991	0.7986	0.6384	0.4256	0.2848	0.3121	0.5765	0.8354	0.9392	0.9698 (86)
MIT	19.6370	19.8327	20.1932	20.5868	20.8594	20.9755	20.9958	20.9941	20.9263	20.5868	20.0472	19.5795 (87)
Th 2	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208 (88)
util rest of house	0.9579	0.9358	0.8824	0.7668	0.5858	0.3557	0.2052	0.2281	0.5043	0.8010	0.9272	0.9645 (89)
MIT 2	18.3121	18.5919	19.1019	19.6380	19.9814	20.1040	20.1193	20.1185	20.0606	19.6513	18.9035	18.2298 (90)
Living area fraction	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
MIT	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	-0.1500
Temperature adjustment												18.5344 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Utilisation	0.9440	0.9192	0.8643	0.7543	0.5862	0.3660	0.2183	0.2419	0.5113	0.7873	0.9103	0.9517 (94)
Useful gains	883.4774	974.5667	1030.6712	1020.3707	835.7887	534.8719	302.6435	314.8367	606.1824	812.4115	846.1622	838.2364 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1735.5431	1703.6117	1531.4115	1272.9219	915.6873	545.7171	303.7865	316.5012	642.6783	1055.6370	1431.1010	1726.0431 (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	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating												3000.3312 (98)
Space heating per m2												22.3073 (99)

(98) / (4) =

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3315.2831 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	700.4827	541.3461	411.6583	200.9247	65.6846	0.0000	0.0000	0.0000	0.0000	199.9555	465.3657	729.8653 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater	89.9642	89.9063	89.7365	89.3224	88.4637	87.3000	87.3000	87.3000	87.3000	89.2788	89.8039	89.9941 (216)
Fuel for water heating, kWh/month	136.7094	119.7309	125.4868	114.3379	113.4244	102.6020	99.8109	110.1554	110.0987	120.6698	125.7736	132.9567 (219)
Water heating fuel used												1411.7566 (219)
Annual totals kWh/year												
Space heating fuel - main system												3315.2831 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)	
mechanical ventilation fans (SFP = 0.2378)	95.9495 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	170.9495 (231)
Electricity for lighting (calculated in Appendix L)	518.3405 (232)
Total delivered energy for all uses	5416.3297 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3315.2831	3.6300	120.3448 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.7566	3.6300	51.2468 (247)
Mechanical ventilation fans	95.9495	19.4400	18.6526 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	518.3405	19.4400	100.7654 (250)
Additional standing charges			95.0000 (251)
Total energy cost			400.5895 (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	3315.2831	0.2160	716.1011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	0.2160	304.9394 (264)
Space and water heating			1021.0406 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Total kg/year			1378.7821 (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	3315.2831	1.2200	4044.6454 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	1.2200	1722.3430 (264)
Space and water heating			5766.9884 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Pumps and fans	170.9495	3.0700	524.8150 (267)
Energy for lighting	518.3405	3.0700	1591.3053 (268)
Primary energy kWh/year			7883.1087 (272)
Primary energy kWh/m ² /year			58.6105 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 7.4	-£ 355	-947 kg (68.7%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.6	-£ 18	-140 kg (10.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£355	7.04 kg/m ²	A 94 A 95
Total Savings	£355	7.04 kg/m ²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£134	£134	£0
Mains gas	£267	£267	£0
Space heating	£249	£249	£0
Water heating	£51	£51	£0
Lighting	£101	£101	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£401	£46	£355
Total cost of uses	£401	£46	£355
Delivered energy	40 kWh/m ²	27 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	0.4 tonnes	0.9 tonnes
CO2 emissions per m ²	10 kg/m ²	3 kg/m ²	7 kg/m ²
Primary energy	59 kWh/m ²	17 kWh/m ²	42 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans					= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes	
Measured/design AP50											5.0100	
Infiltration rate											0.2505 (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) =	0.2317 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.5399	Feb 58.9075	Mar 58.2752	Apr 55.1134	May 54.5803	Jun 54.5803	Jul 54.5803	Aug 54.5803	Sep 54.5803	Oct 54.5803	Nov 55.7458	Dec 57.0105 (38)
Heat transfer coeff	133.4392	132.8069	132.1745	129.0128	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	129.6451	130.9098 (39)
Average = Sum(39)m / 12 =												129.9055 (39)
HLP	Jan 0.9921	Feb 0.9874	Mar 0.9827	Apr 0.9592	May 0.9552	Jun 0.9552	Jul 0.9552	Aug 0.9552	Sep 0.9552	Oct 0.9552	Nov 0.9639	Dec 0.9733 (40)
HLP (average)												0.9658 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.6650	11.2829		0.7600		0.7200		0.7700		19.9597 (75)
Southwest			9.3030	36.7938		0.7600		0.7200		0.7700		129.8008 (79)
Northeast			0.9200	17.4137		0.7600		0.7200		1.0000		7.8898 (82)
Southwest			1.8400	38.2331		0.7600		0.7200		1.0000		34.6454 (82)
Solar gains	192.2957	343.2225	508.4330	690.4589	825.2622	841.2333	801.9739	698.6367	571.3421	390.0722	233.2479	162.6375 (83)
Total gains	914.4695	1059.4975	1195.7491	1332.9748	1421.4792	1396.7358	1334.3188	1241.2079	1140.3003	1004.0667	897.0411	864.5137 (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	36.3287	36.5017	36.6763	37.5752	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.3919	37.0307
alpha	3.4219	3.4334	3.4451	3.5050	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.4928	3.4687
util living area	0.9715	0.9526	0.9156	0.8350	0.7067	0.5473	0.4115	0.4571	0.6723	0.8744	0.9541	0.9758 (86)
MIT	19.4167	19.6643	20.0263	20.4653	20.7725	20.9309	20.9806	20.9718	20.8567	20.4524	19.8722	19.3890 (87)
Th 2	20.0899	20.0938	20.0978	20.1175	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1135	20.1056 (88)
util rest of house	0.9666	0.9448	0.9017	0.8089	0.6628	0.4836	0.3340	0.3768	0.6109	0.8483	0.9452	0.9717 (89)
MIT 2	17.9735	18.3317	18.8499	19.4724	19.8762	20.0616	20.1090	20.1026	19.9861	19.4706	18.6485	17.9436 (90)
Living area fraction	18.4596	18.7805	19.2461	19.8068	20.1781	20.3544	20.4026	20.3953	20.2794	19.8013	19.0607	18.4304 (92)
MIT	18.3096	18.6305	19.0961	19.6568	20.0281	20.2044	20.2526	20.2453	20.1294	19.6513	18.9107	-0.1500
Temperature adjustment												
adjusted MIT												18.2804 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Utilisation	0.9538	0.9286	0.8830	0.7934	0.6578	0.4899	0.3459	0.3885	0.6116	0.8319	0.9296	0.9602 (94)
Useful gains	872.2417	983.8758	1055.9036	1057.6132	935.1131	684.2861	461.4882	482.1953	697.3549	835.2481	833.9328	830.1356 (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	1869.4264	1823.5112	1664.8846	1387.7614	1069.9913	720.0493	469.2815	494.0459	774.6499	1162.9020	1531.1973	1843.2653 (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	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685 (98)
Space heating												3596.8517 (98)
Space heating per m2												26.7424 (99)

(98) / (4) =

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 %)	90.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3974.4218 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	741.9054	564.2350	453.0819	237.7067	100.3494	0.0000	0.0000	0.0000	0.0000	243.7745	502.0305	753.7685	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	819.7850	623.4641	500.6430	262.6594	110.8833	0.0000	0.0000	0.0000	0.0000	269.3640	554.7298	832.8933	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531	(64)
Efficiency of water heater	90.0307	89.9716	89.8444	89.5139	88.8713	87.3000	87.3000	87.3000	87.3000	89.4946	89.8948	90.0478	(216)
Fuel for water heating, kWh/month	136.6084	119.6440	125.3361	114.0933	112.9042	102.6020	99.8109	110.1554	110.0987	120.3788	125.6463	132.8773	(219)
Water heating fuel used												1410.1556	(219)
Annual totals kWh/year													
Space heating fuel - main system												3974.4218	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)	
mechanical ventilation fans (SFP = 0.2378)	95.9495 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	170.9495 (231)
Electricity for lighting (calculated in Appendix L)	518.3405 (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		4346.6280 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3974.4218	3.4800	138.3099 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1410.1556	3.4800	49.0734 (247)	
Mechanical ventilation fans	95.9495	13.1900	12.6557 (249)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Energy for lighting	518.3405	13.1900	68.3691 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			170.4778 (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] =	0.3989 (257)
SAP value		94.4355
SAP rating (Section 12)		94 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3974.4218	0.2160	858.4751 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water heating (other fuel)	1410.1556	0.2160	304.5936 (264)
Space and water heating			1163.0687 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			624.3730 (272)
EI value			4.6400 (273)
EI rating			95.3389
EI band			95 (274)
			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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9500 (1d)	x 2.8000 (2d)	= 75.4600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7899 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											5.0100		
Number of sides sheltered											0.2505 (18)		
											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2317 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)	
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)	
Adj infilt rate													
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.1600	16.0680	106.0920	0.1100	11.6701	7.6200	808.4210 (29a)					
Wl - Stud Ashlar	17.7200		17.7200	0.0800	1.4176	7.6200	135.0264 (29a)					
Rf - Ins Rafter	32.9000	2.7600	30.1400	0.1100	3.3154	7.6200	229.6668 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9200		23.9200	0.0800	1.9136	7.6200	182.2704 (30)					
Total net area of external elements Aum(A, m2)			259.1920				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.4441		(33)					
Party Wall			63.5300	0.0000	0.0000	54.0300	3432.5259 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8300			18.0000	1400.9400 (32d)					
Internal Ceiling			77.8300			5.8200	452.9706 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		17451.6367 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.7519 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4552 (36)					
Total fabric heat loss						(33) + (36) =	73.8993 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5803	Feb 54.5803	Mar 54.5803	Apr 54.5803	May 54.5803	Jun 54.5803	Jul 54.5803	Aug 54.5803	Sep 54.5803	Oct 54.5803	Nov 54.5803	Dec 54.5803 (38)
Heat transfer coeff	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797	128.4797 (39)
Average = Sum(39)m / 12 =												128.4797 (39)
HLP	Jan 0.9552	Feb 0.9552	Mar 0.9552	Apr 0.9552	May 0.9552	Jun 0.9552	Jul 0.9552	Aug 0.9552	Sep 0.9552	Oct 0.9552	Nov 0.9552	Dec 0.9552 (40)
HLP (average)												0.9552 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9058 (42)											
Average daily hot water use (litres/day)	103.2125 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5337	109.4052	105.2767	101.1482	97.0197	92.8912	92.8912	97.0197	101.1482	105.2767	109.4052	113.5337 (44)
Energy content (annual)	168.3672	147.2551	151.9540	132.4772	127.1150	109.6906	101.6445	116.6385	118.0316	137.5544	150.1514	163.0547 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2551	22.0883	22.7931	19.8716	19.0673	16.4536	15.2467	17.4958	17.7047	20.6332	22.5227	24.4582 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5279	160.0338	166.0753	146.1080	141.1676	123.2480	115.6276	130.6667	131.6276	151.6411	163.8246	177.2026 (62)
WWHRS	-59.5384	-52.3881	-53.4678	-43.9785	-40.8281	-33.6764	-28.4927	-34.5010	-35.5114	-43.9085	-50.8750	-57.5495 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7156
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	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Heat gains from water heating, kWh/month	59.5223	52.1570	54.0550	47.4564	45.7789	39.8615	37.2926	42.2893	42.6445	49.2585	53.3436	57.7527 (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	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473	174.3473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.3765	65.1723	53.0017	40.1257	29.9944	25.3226	27.3619	35.5661	47.7367	60.6127	70.7440	75.4158 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3380	457.0318	445.2034	420.0223	388.2356	358.3606	338.4022	333.7083	345.5367	370.7179	402.5046	432.3796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405	55.3405 (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)	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316	-116.2316 (71)
Water heating gains (Table 5)	80.0031	77.6146	72.6546	65.9116	61.5308	55.3631	50.1244	56.8405	59.2285	66.2077	74.0884	77.6245 (72)
Total internal gains	722.1738	716.2750	687.3161	642.5159	596.2171	555.5026	532.3449	542.5712	568.9582	613.9945	663.7932	701.8763 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					4.6650	12.9236	0.7600	0.7200	0.7700	22.8619 (75)		
Southwest					9.3030	40.4699	0.7600	0.7200	0.7700	142.7692 (79)		
Northeast					0.9200	20.0668	0.7600	0.7200	1.0000	9.0919 (82)		
Southwest					1.8400	43.0236	0.7600	0.7200	1.0000	38.9864 (82)		

Solar gains	213.7095	343.9299	505.2151	710.2799	829.5156	905.8080	853.8518	759.0259	616.5315	417.8891	265.7027	178.9231 (83)
Total gains	935.8832	1060.2049	1192.5312	1352.7958	1425.7326	1461.3106	1386.1966	1301.5972	1185.4897	1031.8836	929.4959	880.7994 (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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311	37.7311
alpha	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154	3.5154
util living area	0.9641	0.9449	0.8991	0.7986	0.6384	0.4256	0.2848	0.3121	0.5765	0.8354	0.9392	0.9698 (86)
MIT	19.6370	19.8327	20.1932	20.5868	20.8594	20.9755	20.9958	20.9941	20.9263	20.5868	20.0472	19.5795 (87)
Th 2	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208	20.1208 (88)
util rest of house	0.9579	0.9358	0.8824	0.7668	0.5858	0.3557	0.2052	0.2281	0.5043	0.8010	0.9272	0.9645 (89)
MIT 2	18.3121	18.5919	19.1019	19.6380	19.9814	20.1040	20.1193	20.1185	20.0606	19.6513	18.9035	18.2298 (90)
Living area fraction	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
MIT	18.7583	19.0098	19.4695	19.9576	20.2771	20.3975	20.4145	20.4134	20.3522	19.9664	19.2887	18.6844 (92)
Temperature adjustment	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	-0.1500
adjusted MIT	18.6083	18.8598	19.3195	19.8076	20.1271	20.2475	20.2645	20.2634	20.2022	19.8164	19.1387	18.5344 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Utilisation	0.9440	0.9192	0.8643	0.7543	0.5862	0.3660	0.2183	0.2419	0.5113	0.7873	0.9103	0.9517 (94)
Useful gains	883.4774	974.5667	1030.6712	1020.3707	835.7887	534.8719	302.6435	314.8367	606.1824	812.4115	846.1622	838.2364 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1735.5431	1703.6117	1531.4115	1272.9219	915.6873	545.7171	303.7865	316.5012	642.6783	1055.6370	1431.1010	1726.0431 (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	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating												3000.3312 (98)
Space heating per m2											(98) / (4) =	22.3073 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3315.2831 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	633.9369	489.9183	372.5508	181.8369	59.4446	0.0000	0.0000	0.0000	0.0000	180.9598	421.1559	660.5281 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	700.4827	541.3461	411.6583	200.9247	65.6846	0.0000	0.0000	0.0000	0.0000	199.9555	465.3657	729.8653 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	122.9895	107.6457	112.6075	102.1294	100.3394	89.5716	87.1349	96.1657	96.1162	107.7325	112.9495	119.6531 (64)
Efficiency of water heater	89.9642	89.9063	89.7365	89.3224	88.4637	87.3000	87.3000	87.3000	87.3000	89.2788	89.8039	89.9941 (217)
Fuel for water heating, kWh/month	136.7094	119.7309	125.4868	114.3379	113.4244	102.6020	99.8109	110.1554	110.0987	120.6698	125.7736	132.9567 (219)
Water heating fuel used												1411.7566 (219)
Annual totals kWh/year												
Space heating fuel - main system												3315.2831 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)												
mechanical ventilation fans (SFP = 0.2378)												95.9495 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												170.9495 (231)
Electricity for lighting (calculated in Appendix L)												518.3405 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =												-1824.1596 (233)
Total delivered energy for all uses												3592.1700 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3315.2831	3.6300	120.3448 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.7566	3.6300	51.2468 (247)
Mechanical ventilation fans	95.9495	19.4400	18.6526 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	518.3405	19.4400	100.7654 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	19.4400	-354.6166 (252)
Total energy cost			45.9729 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3315.2831	0.2160	716.1011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	0.2160	304.9394 (264)
Space and water heating			1021.0406 (265)
Pumps and fans	170.9495	0.5190	88.7228 (267)
Energy for lighting	518.3405	0.5190	269.0187 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			432.0432 (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	3315.2831	1.2200	4044.6454 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.7566	1.2200	1722.3430 (264)
Space and water heating			5766.9884 (265)
Pumps and fans	170.9495	3.0700	524.8150 (267)
Energy for lighting	518.3405	3.0700	1591.3053 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2282.9386 (272)
Primary energy kWh/m2/year			16.9735 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	129.8 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	459.51 (P1)
Transmission heat loss coefficient	73.90 (37)
Summer heat loss coefficient	533.41 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.850	0.90	1.000	0.765 (P8)
North East	0.850	1.00	1.000	0.850 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
South West	0.850	1.00	1.000	0.850 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.6650	98.8453	0.7600	0.7200	0.7650	173.7231
South West	9.3030	119.9223	0.7600	0.7200	0.7650	420.3133
North East	0.9200	171.0993	0.7600	0.7200	0.8500	65.8937
South West	1.8400	196.8859	0.7600	0.7200	0.8500	151.6492

total: 811.5793

Solar gains	Jun 861	Jul 812	Aug 722	(P3)
Internal gains	553	529	540	
Total summer gains	1413	1341	1262	(P5)
Summer gain/loss ratio	2.65	2.51	2.37	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 129.8)	1.09	1.09	1.09	
Threshold temperature	19.74	21.51	21.26	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	003 - PRJ012480				Issued on Date	10/06/2022
Assessment Reference	003 S			Prop Type Ref	PRJ012480	
Property	003 - PRJ012480					
SAP Rating	87 B	DER	12.57	TER	15.94	
Environmental	89 B	% DER<TER	21.13			
CO ₂ Emissions (t/year)	1.38	DFEE	39.90	TFEE	51.59	
General Requirements Compliance	Pass	% DFEE<TFEE	22.66			
Assessor Details	Chris Nicholls , Tel: ,				Assessor ID	U903-0001
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)	15.94	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.57	kgCO ₂ /m ²	Pass
	-3.37 (-21.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.59	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	39.90	kWh/m ² /yr	
	-11.7 (-22.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

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

Continuous extract system (decentralised)

Specific fan power

0.1900 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

4.67 m², No overhang

Windows facing South West

9.30 m², No overhang

Air change rate

4.21 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

External wall U-value

0.11

W/m²K

External wall U-value

0.08

W/m²K

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.08

W/m²K

PREDICTED ENERGY ASSESSMENT

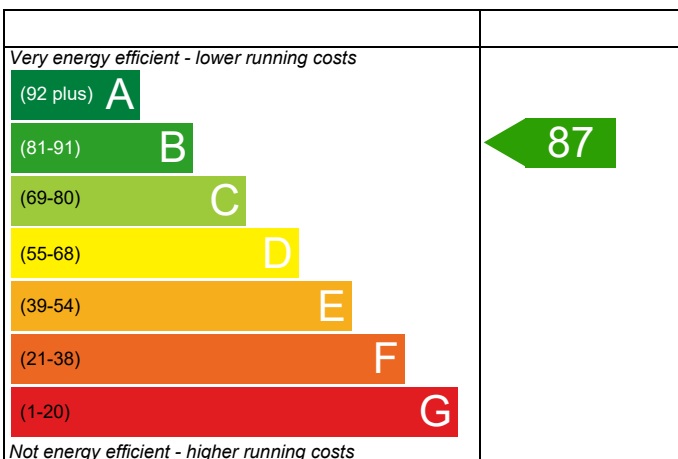
004 - PRJ012480

Dwelling type: House, Semi-Detached
Date of assessment: 10/06/2022
Produced by: Scott Binstead
Total floor area: 134.48 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

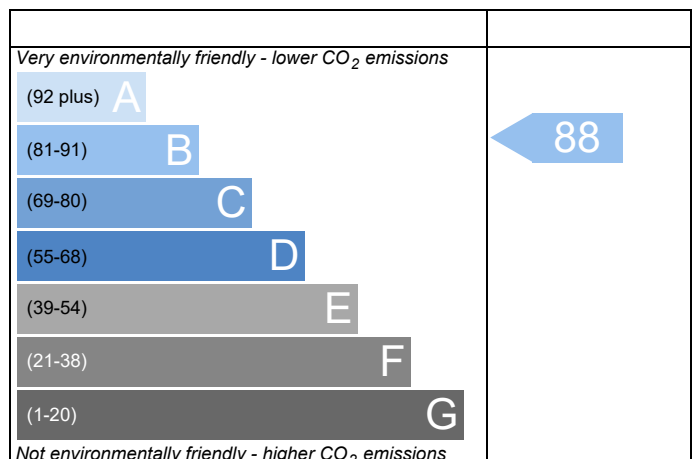


England

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	004 - PRJ012480				Issued on Date	10/06/2022
Assessment Reference	004 S	Prop Type Ref	PRJ012480			
Property	004 - PRJ012480					
SAP Rating		87 B	DER	12.79	TER	16.07
Environmental		88 B	% DER<TER	20.43		
CO ₂ Emissions (t/year)		1.41	DFEE	41.59	TFEE	52.96
General Requirements Compliance		Pass	% DFEE<TFEE	21.47		
Assessor Details	Chris Nicholls, , Tel: ,				Assessor ID	U903-0001
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 134 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) 16.07 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)41.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	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 35

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: Time and temperature zone control 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

Continuous extract system (decentralised)

Specific fan power:	0.1900 0.1800	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North East: 4.67 m², No overhang

Windows facing South West: 9.30 m², No overhang

Windows facing North West: 3.44 m², No overhang

Air change rate: 4.21 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.11 W/m ² K
External wall U-value	0.08 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.08 W/m ² K

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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (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) =		0.2317 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Mechanical extract ventilation - decentralised	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
Wl - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud	23.9500		23.9500	0.0800	1.9160	7.6200	182.4990 (30)
Total net area of external elements Aum(A, m ²)			259.0530				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6099		(33)
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8000			18.0000	1400.4000 (32d)
Internal Ceiling			77.8000			5.8200	452.7960 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17431.4305 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		129.6210 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		24.2295 (36)
Total fabric heat loss	(33) + (36) =	79.8394 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5298	58.8976	58.2653	55.1041	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	55.7364	57.0008 (38)
Average = Sum(39)m / 12 =	139.3692	138.7369	138.1047	134.9435	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	135.5757	136.8402 (39)
												135.8361 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0364	1.0317	1.0270	1.0034	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	1.0081	1.0176 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	20.7046											
Total = Sum (45)m =	1623.9177 (45)											
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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	-534.7084											
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2360	25.0789	20.3956	15.4407	11.5421	9.7444	10.5291	13.6862	18.3695	23.3243	27.2229	29.0207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	480.8674	478.4665	460.8989	432.3311	402.7562	374.7762	356.9512	363.6796	378.6753	407.4793	440.5540	465.9026 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast												4.6650	11.2829	0.7600	0.7200	0.7700	19.9597 (75)
Southwest												9.3030	36.7938	0.7600	0.7200	0.7700	129.8008 (79)
Northwest												3.4390	11.2829	0.7600	0.7200	0.7700	14.7141 (81)
Northeast												0.9200	17.4137	0.7600	0.7200	1.0000	7.8898 (82)
Southwest												1.8400	38.2331	0.7600	0.7200	1.0000	34.6454 (82)
Solar gains	207.0098	373.1735	562.3952	779.0803	944.3867	968.2326	920.7792	793.3496	637.0959	426.6747	251.7621	174.6537 (83)					
Total gains	687.8772	851.6400	1023.2941	1211.4114	1347.1429	1343.0087	1277.7304	1157.0292	1015.7712	834.1540	692.3161	640.5564 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7427	34.9010	35.0608	35.8822	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	35.7148	35.3848
alpha	3.3162	3.3267	3.3374	3.3921	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.3810	3.3590
util living area	0.9876	0.9746	0.9450	0.8717	0.7431	0.5816	0.4441	0.5029	0.7365	0.9224	0.9783	0.9901 (86)
MIT	19.0773	19.3602	19.7885	20.3202	20.7062	20.9067	20.9718	20.9570	20.7884	20.2585	19.5795	19.0468 (87)
Th 2	20.0531	20.0570	20.0609	20.0805	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0765	20.0687 (88)
util rest of house	0.9853	0.9700	0.9349	0.8487	0.6996	0.5142	0.3587	0.4140	0.6758	0.9034	0.9737	0.9883 (89)
MIT 2	17.4599	17.8724	18.4911	19.2510	19.7651	20.0034	20.0667	20.0558	19.8801	19.1832	18.2062	17.4250 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.0047	18.3736	18.9282	19.6112	20.0821	20.3077	20.3716	20.3594	20.1861	19.5454	18.6688	17.9713 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.8547	18.2236	18.7782	19.4612	19.9321	20.1577	20.2216	20.2094	20.0361	19.3954	18.5188	17.8213 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9774	0.9576	0.9173	0.8306	0.6917	0.5199	0.3720	0.4267	0.6722	0.8854	0.9625	0.9817	(94)
Useful gains	672.3354	815.5079	938.6185	1006.1917	931.8313	698.2479	475.3057	493.6839	682.8501	738.5602	666.3626	628.8159	(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	1889.1087	1848.4694	1695.6716	1425.1594	1106.4811	747.0084	486.7778	512.0201	797.8677	1182.1955	1548.1170	1863.9429	(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	905.2793	694.1502	563.2475	301.6568	129.9395	0.0000	0.0000	0.0000	0.0000	330.0647	634.8631	918.9345	(98)
Space heating												4478.1356	(98)
Space heating per m2											(98) / (4) =	33.2996	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4948.2161 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	905.2793	694.1502	563.2475	301.6568	129.9395	0.0000	0.0000	0.0000	0.0000	330.0647	634.8631	918.9345	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1000.3086	767.0168	622.3729	333.3224	143.5796	0.0000	0.0000	0.0000	0.0000	364.7123	701.5062	1015.3972	(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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)
Efficiency of water heater	90.1050	90.0568	89.9506	89.6687	89.0773	87.3000	87.3000	87.3000	87.3000	89.6910	90.0017	87.3000	(216)
(217)m	136.4948	119.5299	125.1872	113.8956	112.6423	102.6012	99.8102	110.1545	110.0979	120.1143	125.4961	132.7707	(219)
Fuel for water heating, kWh/month												1408.7947	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												4948.2161	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)													
mechanical ventilation fans (SFP = 0.2378)													95.9333 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													170.9333 (231)
Electricity for lighting (calculated in Appendix L)													498.6559 (232)
Total delivered energy for all uses													7026.6000 (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	4948.2161	0.2160	1068.8147 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1408.7947	0.2160	304.2997 (264)
Space and water heating			1373.1143 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6559	0.5190	258.8024 (268)
Total CO2, kg/year			1720.6311 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7900 (273)

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

DER			12.7900 ZC1
Total Floor Area		TFA	134.4800
Assumed number of occupants		N	2.9057
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.3534 ZC2
CO2 emissions from cooking, equation (L16)			1.4035 ZC3
Total CO2 emissions			27.5469 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			27.5469 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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (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) =		0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3689	0.3260	0.3260	0.3174	0.3431	0.3689	0.3860	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933		(27a)
Flr - Ground			56.6800	0.1300	7.3684		(28a)
Wl - Brick	122.0100	19.5070	102.5030	0.1800	18.4505		(29a)
Wl - Stud Ashlar	17.7300		17.7300	0.1800	3.1914		(29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1300	3.9143		(30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553		(30)
Rf - Ashlar behind Stud	23.9500		23.9500	0.1300	3.1135		(30)
Total net area of external elements Aum(A, m ²)			259.0530				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3681		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1046 (36)
Total fabric heat loss						(33) + (36) =	83.4727 (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	65.0154	64.6099	64.2123	62.3451	61.9958	60.3695	60.3695	60.0683	60.9959	61.9958	62.7025	63.4414 (38)
Heat transfer coeff	148.4882	148.0826	147.6851	145.8179	145.4685	143.8422	143.8422	143.5411	144.4686	145.4685	146.1752	146.9141 (39)
Average = Sum(39)m / 12 =												145.8162 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1011	1.0982	1.0843	1.0817	1.0696	1.0696	1.0674	1.0743	1.0817	1.0870	1.0925 (40)
HLP (average)												1.0843 (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												2.9057 (42)
Average daily hot water use (litres/day)												103.2114 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy conte	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Energy content (annual)										Total = Sum(45)m =		1623.9177 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	50.9589	46.0274	50.9589	49.3151	49.4397	45.8089	47.3359	49.4397	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	219.3244	193.2810	202.9114	181.7909	176.5534	155.4984	148.9793	166.0770	167.3454	188.5119	199.4649	214.0119 (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	219.3244	193.2810	202.9114	181.7909	176.5534	155.4984	148.9793	166.0770	167.3454	188.5119	199.4649	214.0119 (64)
Heat gains from water heating, kWh/month	68.7213	60.4687	63.2639	56.3770	54.6252	47.9240	45.6304	51.1418	51.5739	58.4761	62.2536	66.9549 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	28.3973	25.2222	20.5121	15.5290	11.6081	9.8000	10.5893	13.7643	18.4745	23.4576	27.3785	29.1865 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719 (68)
Pumps, fans	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Total internal gains	92.3673	89.9831	85.0322	78.3014	73.4210	66.5611	61.3312	68.7390	71.6304	78.5969	86.4633	89.9931 (72)
	493.3937	490.9791	473.3937	444.8097	414.7130	386.0303	368.2186	375.6568	391.1827	420.0024	453.0852	478.4377 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.6650	11.2829	0.6300	0.7000	0.7700	16.0859 (75)
Southwest	9.3030	36.7938	0.6300	0.7000	0.7700	104.6092 (79)
Northwest	3.4390	11.2829	0.6300	0.7000	0.7700	11.8584 (81)
Northeast	0.9200	17.4137	0.6300	0.7000	1.0000	6.3586 (82)
Southwest	1.8400	38.2331	0.6300	0.7000	1.0000	27.9214 (82)

Solar gains	166.8336	300.7484	453.2461	627.8772	761.1011	780.3190	742.0753	639.3772	513.4490	343.8661	202.9004	140.7571 (83)
Total gains	660.2273	791.7275	926.6398	1072.6869	1175.8141	1166.3493	1110.2939	1015.0340	904.6317	763.8685	655.9855	619.1948 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	62.8931	63.0654	63.2352	64.0449	64.1987	64.9245	64.9245	65.0607	64.6430	64.1987	63.8883	63.5670
util living area	5.1929	5.2044	5.2157	5.2697	5.2799	5.3283	5.3283	5.3374	5.3095	5.2799	5.2592	5.2378
	0.9992	0.9978	0.9928	0.9702	0.8934	0.7286	0.5574	0.6260	0.8794	0.9864	0.9982	0.9995 (86)
MIT	19.7183	19.8767	20.1388	20.4885	20.7862	20.9498	20.9901	20.9824	20.8574	20.4630	20.0272	19.6948 (87)
Th 2	19.9974	19.9999	20.0023	20.0137	20.0158	20.0257	20.0257	20.0276	20.0219	20.0158	20.0115	20.0070 (88)
util rest of house	0.9990	0.9971	0.9901	0.9584	0.8525	0.6409	0.4405	0.5058	0.8171	0.9792	0.9975	0.9993 (89)
MIT 2	18.2735	18.5069	18.8906	19.4003	19.8010	19.9915	20.0219	20.0200	19.9012	19.3719	18.7357	18.2461 (90)
Living area fraction	18.7602	18.9684	19.3111	19.7669	20.1329	20.3143	20.3481	20.3442	20.2233	19.7394	19.1707	18.7341 (92)
MIT	18.7602	18.9684	19.3111	19.7669	20.1329	20.3143	20.3481	20.3442	20.2233	19.7394	19.1707	18.7341 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7602	18.9684	19.3111	19.7669	20.1329	20.3143	20.3481	20.3442	20.2233	19.7394	19.1707	18.7341 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9985	0.9960	0.9875	0.9547	0.8580	0.6685	0.4802	0.5466	0.8320	0.9765	0.9965	0.9989 (94)
Ext temp.	659.2255	788.5265	915.0804	1024.1370	1008.8803	779.7412	533.1618	554.7686	752.6112	745.8905	653.7160	618.5229 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2147.1652	2083.2791	1892.0010	1584.5847	1226.7189	821.9604	539.1295	566.1493	884.6296	1329.4962	1764.4384	2135.2642 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1107.0271	870.0738	726.8290	403.5224	162.0719	0.0000	0.0000	0.0000	0.0000	434.2027	799.7201	1128.4555 (98)
												5631.9025 (98)
												41.8791 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)

93.4000 (206)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

Space heating requirement

6029.8742 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1107.0271	870.0738	726.8290	403.5224	162.0719	0.0000	0.0000	0.0000	0.0000	434.2027	799.7201	1128.4555	(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)	1185.2538	931.5565	778.1895	432.0368	173.5246	0.0000	0.0000	0.0000	0.0000	464.8851	856.2314	1208.1965	(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	219.3244	193.2810	202.9114	181.7909	176.5534	155.4984	148.9793	166.0770	167.3454	188.5119	199.4649	214.0119	(64)
Efficiency of water heater (217)m	88.5581	88.3795	87.9848	87.0013	84.8365	80.3000	80.3000	80.3000	80.3000	87.0842	88.1858	88.6230	(216)
Fuel for water heating, kWh/month	247.6616	218.6944	230.6210	208.9520	208.1101	193.6468	185.5284	206.8207	208.4003	216.4710	226.1872	241.4857	(219)
Water heating fuel used												2592.5794	(219)
Annual totals kWh/year													
Space heating fuel - main system												6029.8742	(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)												501.5048	(232)
Total delivered energy for all uses												9198.9584	(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	6029.8742	0.2160	1302.4528 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2592.5794	0.2160	559.9971 (264)
Space and water heating			1862.4500 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	501.5048	0.5190	260.2810 (268)
Total CO2, kg/m2/year			2161.6560 (272)
Emissions per m2 for space and water heating			13.8493 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9355 (272b)
Emissions per m2 for pumps and fans			0.2894 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8493 * 1.00) + 1.9355 + 0.2894, rounded to 2 d.p.			16.0700 (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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3714 (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) =		0.3436 (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	0.4381	0.4295	0.4209	0.3779	0.3694	0.3264	0.3264	0.3178	0.3436	0.3694	0.3865	0.4037 (22b)
Effective ac	0.5960	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
Solid Door			2.1000	1.4000	2.9400		(26)
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)
Floor - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)
W1 - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)
W1 - Stud Ashlar			17.7300	0.0800	1.4184	7.6200	135.1026 (29a)
Rf - Ins Rafter		2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)
Rf - Staggered Roof at Front		5.8100	5.8100	0.1100	0.6391	7.6200	44.2722 (30)
Rf - Ashlar behind Stud		23.9500	23.9500	0.0800	1.9160	7.6200	182.4990 (30)
Total net area of external elements Aum(A, m ²)			259.0530				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6099		(33)
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)
1st Floor Block			42.2450			54.0300	2282.4974 (32c)
1st Floor Stud			93.6199			5.8200	544.8678 (32c)
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)
Internal Floor			77.8000			18.0000	1400.4000 (32d)
Internal Ceiling			77.8000			5.8200	452.7960 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17431.4305 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.6210 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.2295 (36)
Total fabric heat loss						(33) + (36) =	79.8394 (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	65.0436	64.6370	64.2383	62.3661	62.0158	60.3851	60.3851	60.0832	61.0132	62.0158	62.7244	63.4653 (38)
Heat transfer coeff	144.8830	144.4763	144.0777	142.2055	141.8552	140.2245	140.2245	139.9225	140.8526	141.8552	142.5638	143.3046 (39)
Average = Sum(39)m / 12 =												142.2038 (39)
HLP	1.0774	1.0743	1.0714	1.0574	1.0548	1.0427	1.0427	1.0405	1.0474	1.0548	1.0601	1.0656 (40)
HLP (average)												1.0574 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy												2.9057 (42)
Average daily hot water use (litres/day)												103.2114 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy conte	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Energy content (annual)												Total = Sum(45)m = 1623.9177 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7777	31.2914	32.2899	28.1511	27.0117	23.3090	21.5992	24.7854	25.0815	29.2300	31.9068	34.6488 (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	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2360	25.0789	20.3956	15.4407	11.5421	9.7444	10.5291	13.6862	18.3695	23.3243	27.2229	29.0207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	48.0883	46.5646	43.4004	39.0988	36.3060	32.3736	29.0312	33.3138	34.8353	39.2877	44.3151	46.5709 (72)
Total internal gains	445.9534	444.4173	428.6454	402.5189	374.5320	348.7872	332.8585	337.1534	351.2827	377.5599	407.7814	431.8497 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					4.6650	11.2829		0.7600	0.7200	0.7700		19.9597 (75)
Southwest					9.3030	36.7938		0.7600	0.7200	0.7700		129.8008 (79)
Northwest					3.4390	11.2829		0.7600	0.7200	0.7700		14.7141 (81)
Northeast					0.9200	17.4137		0.7600	0.7200	1.0000		7.8898 (82)
Southwest					1.8400	38.2331		0.7600	0.7200	1.0000		34.6454 (82)
Solar gains	207.0098	373.1735	562.3952	779.0803	944.3867	968.2326	920.7792	793.3496	637.0959	426.6747	251.7621	174.6537 (83)
Total gains	652.9632	817.5908	991.0405	1181.5992	1318.9187	1317.0197	1253.6377	1130.5030	988.3786	804.2346	659.5435	606.5035 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.4205	33.5146	33.6073	34.0498	34.1339	34.5308	34.5308	34.6053	34.3768	34.1339	33.9642	33.7886
alpha	3.2280	3.2343	3.2405	3.2700	3.2756	3.3021	3.3021	3.3070	3.2918	3.2756	3.2643	3.2526
util living area	0.9893	0.9777	0.9510	0.8853	0.7662	0.6057	0.4669	0.5276	0.7605	0.9326	0.9814	0.9915 (86)
MIT	18.9565	19.2393	19.6765	20.2180	20.6419	20.8839	20.9631	20.9450	20.7440	20.1587	19.4546	18.9116 (87)
Th 2	20.0194	20.0218	20.0243	20.0357	20.0379	20.0479	20.0479	20.0497	20.0440	20.0379	20.0335	20.0290 (88)
util rest of house	0.9873	0.9735	0.9417	0.8635	0.7228	0.5354	0.3753	0.4332	0.6998	0.9152	0.9773	0.9899 (89)
MIT 2	18.1380	18.4202	18.8524	19.3828	19.7717	19.9795	20.0328	20.0254	19.8748	19.3386	18.6445	18.1004 (90)
Living area fraction	18.4137	18.6961	19.1300	19.6641	20.0648	20.2841	20.3462	20.3352	20.1676	19.6149	18.9174	18.3736 (92)
MIT	18.4137	18.6961	19.1300	19.6641	20.0648	20.2841	20.3462	20.3352	20.1676	19.6149	18.9174	18.3736 (93)
Temperature adjustment												0.0000
adjusted MIT	18.4137	18.6961	19.1300	19.6641	20.0648	20.2841	20.3462	20.3352	20.1676	19.6149	18.9174	18.3736 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9828	0.9662	0.9312	0.8538	0.7241	0.5538	0.4049	0.4628	0.7085	0.9058	0.9710	0.9862 (94)
Ext temp.	641.7182	789.9462	922.8678	1008.7957	955.0596	729.3120	507.6193	523.2155	700.2616	728.4771	640.3986	598.1079 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2044.8411	1993.2146	1819.7007	1530.7186	1186.5947	797.0554	525.3041	550.6179	854.6374	1278.8046	1684.7329	2031.1458 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1043.9235	808.5963	667.2437	375.7845	172.2621	0.0000	0.0000	0.0000	0.0000	409.4436	751.9207	1066.1801 (98)
Space heating per m ²												5295.3545 (98)
												(98) / (4) = 39.3765 (99)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1318.1102	1037.6613	1063.4111	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8392	0.8921	0.8621	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1106.1526	925.6679	916.7443	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1617.6520	1543.0755	1407.8730	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	368.2796	459.3513	365.3997	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1193.0306 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	92.0699	114.8378	91.3499	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													298.2576 (107)
Space cooling per m2													2.2179 (108)
Energy for space heating													39.3765 (99)
Energy for space cooling													2.2179 (108)
Total													41.5944 (109)
Dwelling Fabric Energy Efficiency (DFEE)													41.6 (109)

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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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (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) =		0.3431 (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	0.4375	0.4289	0.4203	0.3774	0.3689	0.3260	0.3260	0.3174	0.3431	0.3689	0.3860	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5883	0.5712	0.5680	0.5531	0.5531	0.5504	0.5589	0.5680	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			17.4100	1.3258	23.0814		(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933		(27a)
Flr - Ground			56.6800	0.1300	7.3684		(28a)
Wl - Brick	122.0100	19.5070	102.5030	0.1800	18.4505		(29a)
Wl - Stud Ashlar	17.7300		17.7300	0.1800	3.1914		(29a)
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1300	3.9143		(30)
Rf - Staggered Roof at Front	5.8100		5.8100	0.1300	0.7553		(30)
Rf - Ashlar behind Stud	23.9500		23.9500	0.1300	3.1135		(30)
Total net area of external elements Aum(A, m ²)			259.0530				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3681		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1046 (36)
Total fabric heat loss						(33) + (36) =	83.4727 (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	65.0154	64.6099	64.2123	62.3451	61.9958	60.3695	60.3695	60.0683	60.9959	61.9958	62.7025	63.4414 (38)
Heat transfer coeff	148.4882	148.0826	147.6851	145.8179	145.4685	143.8422	143.8422	143.5411	144.4686	145.4685	146.1752	146.9141 (39)
Average = Sum(39)m / 12 =												145.8162 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1011	1.0982	1.0843	1.0817	1.0696	1.0696	1.0674	1.0743	1.0817	1.0870	1.0925 (40)
HLP (average)												1.0843 (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												2.9057 (42)
Average daily hot water use (litres/day)												103.2114 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy conte	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Energy content (annual)										Total = Sum(45)m =		1623.9177 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7777	31.2914	32.2899	28.1511	27.0117	23.3090	21.5992	24.7854	25.0815	29.2300	31.9068	34.6488 (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	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	145.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3973	25.2222	20.5121	15.5290	11.6081	9.8000	10.5893	13.7643	18.4745	23.4576	27.3785	29.1865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.0430	306.1876	298.2632	281.3932	260.0977	240.0830	226.7119	223.5673	231.4917	248.3618	269.6572	289.6719	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	37.5287	(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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	(71)
Water heating gains (Table 5)	48.0883	46.5646	43.4004	39.0988	36.3060	32.3736	29.0312	33.3138	34.8353	39.2877	44.3151	46.5709	(72)
Total internal gains	446.1147	444.5606	428.7619	402.6071	374.5980	348.8428	332.9186	337.2316	351.3877	377.6932	407.9369	432.0156	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.6650	11.2829		0.6300	0.7000	0.7700		16.0859 (75)	
Southwest					9.3030	36.7938		0.6300	0.7000	0.7700		104.6092 (79)	
Northwest					3.4390	11.2829		0.6300	0.7000	0.7700		11.8584 (81)	
Northeast					0.9200	17.4137		0.6300	0.7000	1.0000		6.3586 (82)	
Southwest					1.8400	38.2331		0.6300	0.7000	1.0000		27.9214 (82)	
Solar gains		166.8336	300.7484	453.2461	627.8772	761.1011	780.3190	742.0753	639.3772	513.4490	343.8661	202.9004	140.7571 (83)
Total gains		612.9483	745.3089	882.0080	1030.4843	1135.6991	1129.1619	1074.9940	976.6087	864.8367	721.5593	610.8373	572.7727 (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	62.8931	63.0654	63.2352	64.0449	64.1987	64.9245	64.9245	65.0607	64.6430	64.1987	63.8883	63.5670	
alpha	5.1929	5.2044	5.2157	5.2697	5.2799	5.3283	5.3283	5.3374	5.3095	5.2799	5.2592	5.2378	
util living area	0.9995	0.9984	0.9942	0.9747	0.9044	0.7454	0.5738	0.6465	0.8948	0.9894	0.9987	0.9996	(86)
MIT	19.6851	19.8444	20.1085	20.4628	20.7697	20.9440	20.9886	20.9795	20.8421	20.4350	19.9956	19.6622	(87)
Th 2	19.9974	19.9999	20.0023	20.0137	20.0158	20.0257	20.0257	20.0276	20.0219	20.0158	20.0115	20.0070	(88)
util rest of house	0.9993	0.9978	0.9920	0.9644	0.8661	0.6582	0.4545	0.5243	0.8369	0.9837	0.9982	0.9995	(89)
MIT 2	18.7873	18.9483	19.2133	19.5707	19.8559	19.9993	20.0227	20.0214	19.9286	19.5491	19.1089	18.7721	(90)
Living area fraction									fLA = Living area / (4) =			0.3369	(91)
MIT	19.0897	19.2502	19.5149	19.8712	20.1637	20.3175	20.3481	20.3442	20.2363	19.8475	19.4076	19.0719	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0897	19.2502	19.5149	19.8712	20.1637	20.3175	20.3481	20.3442	20.2363	19.8475	19.4076	19.0719	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	612.3629	743.2326	873.7338	991.9219	991.0849	774.7407	532.2498	552.7667	736.6111	708.8281	609.4598	572.3920	(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	2196.0968	2125.0101	1922.1004	1599.7949	1231.2033	822.4234	539.1355	566.1506	886.5058	1345.2251	1799.0624	2184.8918	(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	1178.2980	928.5545	779.9848	437.6686	178.6481	0.0000	0.0000	0.0000	0.0000	473.4793	856.5139	1199.6999	(98)
Space heating												6032.8471	(98)
Space heating per m2										(98) / (4) =		44.8606	(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	1352.1170	1064.4325	1090.9121	0.0000	0.0000	0.0000	0.0000	(100)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8581	0.9218	0.8894	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1160.2155	981.2061	970.2543	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1406.4141	1342.1814	1234.7160	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	177.2630	268.5656	196.7594	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												642.5880 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	44.3157	67.1414	49.1899	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												160.6470 (107)
Space cooling per m2												1.1946 (108)
Energy for space heating												44.8606 (99)
Energy for space cooling												1.1946 (108)
Total												46.0551 (109)
Target Fabric Energy Efficiency (TFEE)												53.0 (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	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

												main	secondary	other	total	m3 per hour							
												heating	heating										
Number of chimneys												0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues												0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans																		0 * 10 =	0.0000 (7a)				
Number of passive vents																		0 * 10 =	0.0000 (7b)				
Number of flueless gas fires																		0 * 40 =	0.0000 (7c)				
												Air changes per hour											
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =												0.0000 / (5) =							0.0000 (8)				
Pressure test												Yes											
Measured/design AP50																			5.0100				
Infiltration rate																			0.2505 (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) =							0.2317 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec											
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)											
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)											
Adj infilt rate																							
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)											
Mechanical extract ventilation - decentralised																							
If mechanical ventilation:												0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)											

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9500		23.9500	0.0800	1.9160	7.6200	182.4990 (30)					
Total net area of external elements Aum(A, m2)			259.0530				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6099		(33)					
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17431.4305 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.6210 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.2295 (36)					
Total fabric heat loss						(33) + (36) =	79.8394 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5711	Feb 54.5711	Mar 54.5711	Apr 54.5711	May 54.5711	Jun 54.5711	Jul 54.5711	Aug 54.5711	Sep 54.5711	Oct 54.5711	Nov 54.5711	Dec 54.5711 (38)
Heat transfer coeff	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105 (39)
Average = Sum(39)m / 12 =												134.4105 (39)
HLP	Jan 0.9995	Feb 0.9995	Mar 0.9995	Apr 0.9995	May 0.9995	Jun 0.9995	Jul 0.9995	Aug 0.9995	Sep 0.9995	Oct 0.9995	Nov 0.9995	Dec 0.9995 (40)
HLP (average)												0.9995 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (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	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (64)
RHI water heating demand	1789.7340 (64)											
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5899	62.6973	50.9889	38.6019	28.8553	24.3609	26.3228	34.2154	45.9238	58.3108	68.0574	72.5518 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3503	713.7627	685.2669	640.9578	595.0462	554.5115	531.2779	541.1930	567.1168	611.6622	661.0736	698.9769 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					4.6650	12.9236	0.7600	0.7200	0.7700	22.8619 (75)		
Southwest					9.3030	40.4699	0.7600	0.7200	0.7700	142.7692 (79)		
Northwest					3.4390	12.9236	0.7600	0.7200	0.7700	16.8536 (81)		
Northeast					0.9200	20.0668	0.7600	0.7200	1.0000	9.0919 (82)		
Southwest					1.8400	43.0236	0.7600	0.7200	1.0000	38.9864 (82)		

Solar gains	230.5631	374.9629	560.6464	803.9727	951.7618	1044.9667	982.7561	864.4858	689.7494	458.4594	287.4650	192.5291 (83)
Total gains	949.9134	1088.7256	1245.9133	1444.9305	1546.8080	1599.4782	1514.0340	1405.6788	1256.8663	1070.1216	948.5386	891.5060 (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	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245
alpha	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016
util living area	0.9638	0.9434	0.8939	0.7850	0.6181	0.4071	0.2727	0.3022	0.5674	0.8323	0.9386	0.9696 (86)
MIT	19.5587	19.7696	20.1574	20.5780	20.8594	20.9754	20.9956	20.9937	20.9216	20.5601	19.9889	19.4984 (87)
Th 2	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838 (88)
util rest of house	0.9574	0.9338	0.8762	0.7515	0.5640	0.3372	0.1933	0.2174	0.4932	0.7967	0.9263	0.9642 (89)
MIT 2	18.1752	18.4766	19.0243	19.5947	19.9461	20.0672	20.0822	20.0814	20.0207	19.5866	18.7955	18.0889 (90)
Living area fraction	18.6412	18.9121	19.4060	19.9260	20.2537	20.3731	20.3899	20.3887	20.3242	19.9145	19.1975	18.5637 (92)
MIT	18.6412	18.9121	19.4060	19.9260	20.2537	20.3731	20.3899	20.3887	20.3242	19.9145	19.1975	18.5637 (92)
Temperature adjustment	18.4912	18.7621	19.2560	19.7760	20.1037	20.2231	20.2399	20.2387	20.1742	19.7645	19.0475	-0.1500
adjusted MIT	18.4912	18.7621	19.2560	19.7760	20.1037	20.2231	20.2399	20.2387	20.1742	19.7645	19.0475	18.4137 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.9429	0.9164	0.8572	0.7390	0.5653	0.3481	0.2069	0.2319	0.5009	0.7824	0.9087	0.9508 (94)
Useful gains	895.6456	997.6791	1068.0235	1067.7994	874.3839	556.7241	313.3154	326.0106	629.6031	837.3025	861.8919	847.6515 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1799.9226	1769.1293	1593.5678	1327.4341	954.8156	567.6347	314.5047	327.7897	668.5798	1097.3961	1484.8978	1789.5008 (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	672.7820	518.4145	391.0049	186.9370	59.8412	0.0000	0.0000	0.0000	0.0000	193.5096	448.5642	700.7359 (98)
Space heating												3171.7894 (98)
RHI space heating demand												3172 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50													5.0100
Infiltration rate													0.2505 (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) =							0.2317 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
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													
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9500		23.9500	0.0800	1.9160	7.6200	182.4990 (30)					
Total net area of external elements Aum(A, m2)			259.0530				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	55.6099		(33)					
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		17431.4305 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.6210 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.2295 (36)					
Total fabric heat loss						(33) + (36) =	79.8394 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.5298	Feb 58.8976	Mar 58.2653	Apr 55.1041	May 54.5711	Jun 54.5711	Jul 54.5711	Aug 54.5711	Sep 54.5711	Oct 54.5711	Nov 55.7364	Dec 57.0008 (38)
Heat transfer coeff	139.3692	138.7369	138.1047	134.9435	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	135.5757	136.8402 (39)
Average = Sum(39)m / 12 =												135.8361 (39)
HLP	Jan 1.0364	Feb 1.0317	Mar 1.0270	Apr 1.0034	May 0.9995	Jun 0.9995	Jul 0.9995	Aug 0.9995	Sep 0.9995	Oct 0.9995	Nov 1.0081	Dec 1.0176 (40)
HLP (average)												1.0101 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1623.9177 (45)											
Water storage loss:	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7084
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5899	62.6973	50.9889	38.6019	28.8553	24.3609	26.3228	34.2154	45.9238	58.3108	68.0574	72.5518 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3503	713.7627	685.2669	640.9578	595.0462	554.5115	531.2779	541.1930	567.1168	611.6622	661.0736	698.9769 (73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast	4.6650				11.2829		0.7600		0.7200		0.7700		19.9597 (75)
Southwest	9.3030				36.7938		0.7600		0.7200		0.7700		129.8008 (79)
Northwest	3.4390				11.2829		0.7600		0.7200		0.7700		14.7141 (81)
Northeast	0.9200				17.4137		0.7600		0.7200		1.0000		7.8898 (82)
Southwest	1.8400				38.2331		0.7600		0.7200		1.0000		34.6454 (82)
Solar gains	207.0098	373.1735	562.3952	779.0803	944.3867	968.2326	920.7792	793.3496	637.0959	426.6747	251.7621	174.6537	(83)
Total gains	926.3601	1086.9362	1247.6621	1420.0380	1539.4328	1522.7440	1452.0571	1334.5426	1204.2127	1038.3369	912.8357	873.6306	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7427	34.9010	35.0608	35.8822	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	35.7148	35.3848
alpha	3.3162	3.3267	3.3374	3.3921	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.3810	3.3590
util living area	0.9711	0.9511	0.9108	0.8230	0.6867	0.5266	0.3957	0.4445	0.6636	0.8718	0.9536	0.9756 (86)
MIT	19.3343	19.5982	19.9867	20.4530	20.7725	20.9311	20.9801	20.9704	20.8486	20.4188	19.8068	19.3027 (87)
Th 2	20.0531	20.0570	20.0609	20.0805	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0765	20.0687 (88)
util rest of house	0.9661	0.9429	0.8961	0.7951	0.6411	0.4620	0.3178	0.3629	0.6002	0.8448	0.9445	0.9714 (89)
MIT 2	17.8310	18.2126	18.7676	19.4253	19.8419	20.0257	20.0720	20.0651	19.9430	19.3968	18.5305	17.7955 (90)
Living area fraction	18.3374	18.6794	19.1782	19.7715	20.1554	20.3307	20.3779	20.3700	20.2481	19.7410	18.9604	18.3032 (92)
Temperature adjustment	18.1874	18.5294	19.0282	19.6215	20.0054	20.1807	20.2279	20.2200	20.0981	19.5910	18.8104	18.1532 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9528	0.9259	0.8764	0.7795	0.6369	0.4691	0.3303	0.3754	0.6013	0.8275	0.9282	0.9594 (94)
Unst fuel gains	882.5909	1006.3425	1093.4777	1106.8836	980.4862	714.2830	479.6513	501.0083	724.1081	859.2738	847.3104	838.1714 (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	1935.4769	1890.8969	1730.2086	1446.7939	1116.3320	750.1036	487.6303	513.4531	806.2019	1208.4896	1587.6468	1909.3586 (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	783.3471	594.4206	473.7278	244.7354	101.0693	0.0000	0.0000	0.0000	0.0000	259.8165	533.0423	796.9633 (98)
Space heating												3787.1222 (98)
Space heating per m2											(98) / (4) =	28.1612 (99)

Not applicable

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 %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4184.6655	(211)

[illegible]

(MEVDecentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)		
mechanical ventilation fans (SFP = 0.2378)		95.9333 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		170.9333 (231)
Electricity for lighting (calculated in Appendix L)		498.6559 (232)
Total delivered energy for all uses		6264.1426 (238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4184.6655	3.4800	145.6264 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1409.8880	3.4800	49.0641 (247)
Mechanical ventilation fans	95.9333	13.1900	12.6536 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	498.6559	13.1900	65.7727 (250)
Additional standing charges			120.0000 (251)
Total energy cost			403.0093 (255)

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9431 (257)
SAP value		86.8440
SAP rating (Section 12)		87 (258)
SAP band		B

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4184.6655	0.2160	903.8877 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1409.8880	0.2160	304.5358 (264)
Space and water heating			1208.4235 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6559	0.5190	258.8024 (268)
Total kg/year			1555.9403 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

CO2 emissions per m2	11.5700 (273)
EI value	88.3833
EI rating	88 (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	$3.48 / 0.8892 = 3.914$, stars = 5
Water heating environmental impact	$0.216 / 0.8892 = 0.2429$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 330.7339 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour			
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans												0 * 10 =	0.0000 (7a)	
Number of passive vents												0 * 10 =	0.0000 (7b)	
Number of flueless gas fires												0 * 40 =	0.0000 (7c)	
												Air changes per hour		
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =		0.0000 (8)
Pressure test												Yes		
Measured/design AP50														5.0100
Infiltration rate														0.2505 (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) =								0.2317 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)	
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)	
Adj infilt rate														
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201	(22b)	
Mechanical extract ventilation - decentralised														
If mechanical ventilation:												0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9500		23.9500	0.0800	1.9160	7.6200	182.4990 (30)					
Total net area of external elements Aum(A, m2)			259.0530				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	55.6099		(33)					
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		17431.4305 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.6210 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.2295 (36)					
Total fabric heat loss						(33) + (36) =	79.8394 (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	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711 (38)
Heat transfer coeff	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105 (39)
Average = Sum(39)m / 12 =												134.4105 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995 (40)
HLP (average)												0.9995 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1623.9177 (45)											
Water storage loss:	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-534.7084
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5899	62.6973	50.9889	38.6019	28.8553	24.3609	26.3228	34.2154	45.9238	58.3108	68.0574	72.5518 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3503	713.7627	685.2669	640.9578	595.0462	554.5115	531.2779	541.1930	567.1168	611.6622	661.0736	698.9769 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.6650	12.9236	0.7600	0.7200	0.7700		22.8619 (75)	
Southwest					9.3030	40.4699	0.7600	0.7200	0.7700		142.7692 (79)	
Northwest					3.4390	12.9236	0.7600	0.7200	0.7700		16.8536 (81)	
Northeast					0.9200	20.0668	0.7600	0.7200	1.0000		9.0919 (82)	
Southwest					1.8400	43.0236	0.7600	0.7200	1.0000		38.9864 (82)	

Solar gains	230.5631	374.9629	560.6464	803.9727	951.7618	1044.9667	982.7561	864.4858	689.7494	458.4594	287.4650	192.5291 (83)
Total gains	949.9134	1088.7256	1245.9133	1444.9305	1546.8080	1599.4782	1514.0340	1405.6788	1256.8663	1070.1216	948.5386	891.5060 (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	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245
alpha	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016
util living area	0.9638	0.9434	0.8939	0.7850	0.6181	0.4071	0.2727	0.3022	0.5674	0.8323	0.9386	0.9696 (86)
MIT	19.5587	19.7696	20.1574	20.5780	20.8594	20.9754	20.9956	20.9937	20.9216	20.5601	19.9889	19.4984 (87)
Th 2	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838 (88)
util rest of house	0.9574	0.9338	0.8762	0.7515	0.5640	0.3372	0.1933	0.2174	0.4932	0.7967	0.9263	0.9642 (89)
MIT 2	18.1752	18.4766	19.0243	19.5947	19.9461	20.0672	20.0822	20.0814	20.0207	19.5866	18.7955	18.0889 (90)
Living area fraction	18.6412	18.9121	19.4060	19.9260	20.2537	20.3731	20.3899	20.3887	20.3242	19.9145	19.1975	18.5637 (92)
Temperature adjustment	18.4912	18.7621	19.2560	19.7760	20.1037	20.2231	20.2399	20.2387	20.1742	19.7645	19.0475	-0.1500
adjusted MIT	18.4912	18.7621	19.2560	19.7760	20.1037	20.2231	20.2399	20.2387	20.1742	19.7645	19.0475	18.4137 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9429	0.9164	0.8572	0.7390	0.5653	0.3481	0.2069	0.2319	0.5009	0.7824	0.9087	0.9508	(94)
Useful gains	895.6456	997.6791	1068.0235	1067.7994	874.3839	556.7241	313.3154	326.0106	629.6031	837.3025	861.8919	847.6515	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1799.9226	1769.1293	1593.5678	1327.4341	954.8156	567.6347	314.5047	327.7897	668.5798	1097.3961	1484.8978	1789.5008	(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													
	672.7820	518.4145	391.0049	186.9370	59.8412	0.0000	0.0000	0.0000	0.0000	193.5096	448.5642	700.7359	(98)
Space heating													
Space heating per m2													
											(98) / (4) =	23.5856	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3504.7396	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	672.7820	518.4145	391.0049	186.9370	59.8412	0.0000	0.0000	0.0000	0.0000	193.5096	448.5642	700.7359	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	743.4056	572.8337	432.0496	206.5602	66.1229	0.0000	0.0000	0.0000	0.0000	213.8228	495.6510	774.2938	(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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)	
Efficiency of water heater	89.9902	89.9332	89.7643	89.3430	88.4686	87.3000	87.3000	87.3000	87.3000	89.3290	89.8376	87.3000	(216)	
(217)m												90.0188	(217)	
Fuel for water heating, kWh/month	136.6689	119.6942	125.4471	114.3108	113.4172	102.6012	99.8102	110.1545	110.0979	120.6011	125.7254	132.9192	(219)	
Water heating fuel used												1411.4476	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3504.7396	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)														
mechanical ventilation fans (SFP = 0.2378)													95.9333	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													170.9333	(231)
Electricity for lighting (calculated in Appendix L)													498.6559	(232)
Total delivered energy for all uses													5585.7764	(238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3504.7396	3.6300	127.2220 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1411.4476	3.6300	51.2355 (247)
Mechanical ventilation fans	95.9333	19.4400	18.6494 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	498.6559	19.4400	96.9387 (250)
Additional standing charges			95.0000 (251)
Total energy cost			403.6257 (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	3504.7396	0.2160	757.0238 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.4476	0.2160	304.8727 (264)
Space and water heating			1061.8965 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6559	0.5190	258.8024 (268)
Total kg/year			1409.4132 (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	3504.7396	1.2200	4275.7824 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.4476	1.2200	1721.9661 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			5997.7485 (265)
Pumps and fans	170.9333	3.0700	524.7651 (267)
Energy for lighting	498.6559	3.0700	1530.8736 (268)
Primary energy kWh/year			8053.3872 (272)
Primary energy kWh/m ² /year			59.8854 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 7.4	-£ 355	-947 kg (67.2%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.6	-£ 18	-140 kg (9.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£355 7.04 kg/m ²	A 94	A 95
Total Savings	£355 7.04 kg/m ²		

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£130	£130	£0
Mains gas	£273	£273	£0
Space heating	£255	£255	£0
Water heating	£51	£51	£0
Lighting	£97	£97	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£403	£48	£355
Total cost of uses	£403	£48	£355
Delivered energy	42 kWh/m ²	28 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	0.5 tonnes	0.9 tonnes
CO2 emissions per m ²	10 kg/m ²	3 kg/m ²	7 kg/m ²
Primary energy	60 kWh/m ²	18 kWh/m ²	42 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	330.7339 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans					= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes	
Measured/design AP50											5.0100	
Infiltration rate											0.2505 (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) =	0.2317 (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												
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:											0.5000 (23a)	
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9500		23.9500	0.0800	1.9160	7.6200	182.4990 (30)					
Total net area of external elements Aum(A, m2)			259.0530				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6099		(33)					
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			17431.4305 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.6210 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.2295 (36)					
Total fabric heat loss						(33) + (36) =	79.8394 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.5298	58.8976	58.2653	55.1041	54.5711	54.5711	54.5711	54.5711	54.5711	54.5711	55.7364	57.0008 (38)
Average = Sum(39)m / 12 =	139.3692	138.7369	138.1047	134.9435	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	135.5757	136.8402 (39)
												135.8361 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0364	1.0317	1.0270	1.0034	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	1.0081	1.0176 (40)
Days in month												1.0101 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1623.9177 (45)											
Solar input	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	-534.7084											
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5899	62.6973	50.9889	38.6019	28.8553	24.3609	26.3228	34.2154	45.9238	58.3108	68.0574	72.5518 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3503	713.7627	685.2669	640.9578	595.0462	554.5115	531.2779	541.1930	567.1168	611.6622	661.0736	698.9769 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.6650	11.2829	0.7600	0.7200	0.7700		19.9597 (75)	
Southwest					9.3030	36.7938	0.7600	0.7200	0.7700		129.8008 (79)	
Northwest					3.4390	11.2829	0.7600	0.7200	0.7700		14.7141 (81)	
Northeast					0.9200	17.4137	0.7600	0.7200	1.0000		7.8898 (82)	
Southwest					1.8400	38.2331	0.7600	0.7200	1.0000		34.6454 (82)	
Solar gains	207.0098	373.1735	562.3952	779.0803	944.3867	968.2326	920.7792	793.3496	637.0959	426.6747	251.7621	174.6537 (83)
Total gains	926.3601	1086.9362	1247.6621	1420.0380	1539.4328	1522.7440	1452.0571	1334.5426	1204.2127	1038.3369	912.8357	873.6306 (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	34.7427	34.9010	35.0608	35.8822	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	35.7148	35.3848
alpha	3.3162	3.3267	3.3374	3.3921	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.3810	3.3590
util living area	0.9711	0.9511	0.9108	0.8230	0.6867	0.5266	0.3957	0.4445	0.6636	0.8718	0.9536	0.9756 (86)
MIT	19.3343	19.5982	19.9867	20.4530	20.7725	20.9311	20.9801	20.9704	20.8486	20.4188	19.8068	19.3027 (87)
Th 2	20.0531	20.0570	20.0609	20.0805	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0765	20.0687 (88)
util rest of house	0.9661	0.9429	0.8961	0.7951	0.6411	0.4620	0.3178	0.3629	0.6002	0.8448	0.9445	0.9714 (89)
MIT 2	17.8310	18.2126	18.7676	19.4253	19.8419	20.0257	20.0720	20.0651	19.9430	19.3968	18.5305	17.7955 (90)
Living area fraction	fLA = Living area / (4) = 0.3369 (91)											
MIT	18.3374	18.6794	19.1782	19.7715	20.1554	20.3307	20.3779	20.3700	20.2481	19.7410	18.9604	18.3032 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.1874	18.5294	19.0282	19.6215	20.0054	20.1807	20.2279	20.2200	20.0981	19.5910	18.8104	18.1532 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9528	0.9259	0.8764	0.7795	0.6369	0.4691	0.3303	0.3754	0.6013	0.8275	0.9282	0.9594	(94)
Useful gains	882.5909	1006.3425	1093.4777	1106.8836	980.4862	714.2830	479.6513	501.0083	724.1081	859.2738	847.3104	838.1714	(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	1935.4769	1890.8969	1730.2086	1446.7939	1116.3320	750.1036	487.6303	513.4531	806.2019	1208.4896	1587.6468	1909.3586	(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	783.3471	594.4206	473.7278	244.7354	101.0693	0.0000	0.0000	0.0000	0.0000	259.8165	533.0423	796.9633	(98)
Space heating												3787.1222	(98)
Space heating per m2											(98) / (4) =	28.1612	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4184.6655	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	783.3471	594.4206	473.7278	244.7354	101.0693	0.0000	0.0000	0.0000	0.0000	259.8165	533.0423	796.9633	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	865.5770	656.8183	523.4561	270.4258	111.6788	0.0000	0.0000	0.0000	0.0000	287.0901	588.9970	880.6224	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)	
Efficiency of water heater	90.0521	89.9942	89.8674	89.5337	88.8770	87.3000	87.3000	87.3000	87.3000	89.5380	89.9237	87.3000	(216)	
(217)m	90.0521	89.9942	89.8674	89.5337	88.8770	87.3000	87.3000	87.3000	87.3000	89.5380	89.9237	87.3000	(217)	
Fuel for water heating, kWh/month	136.5749	119.6131	125.3032	114.0673	112.8961	102.6012	99.8102	110.1545	110.0979	120.3195	125.6050	132.8450	(219)	
Water heating fuel used												1409.8880	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4184.6655	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)														
mechanical ventilation fans (SFP = 0.2378)													95.9333	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													170.9333	(231)
Electricity for lighting (calculated in Appendix L)													498.6559	(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												4536.9032	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4184.6655	3.4800	145.6264	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1409.8880	3.4800	49.0641	(247)
Mechanical ventilation fans	95.9333	13.1900	12.6536	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	498.6559	13.1900	65.7727	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			175.1864	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.4100	(257)
SAP value			94.2812	
SAP rating (Section 12)			94	(258)
SAP band			A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4184.6655	0.2160	903.8877	(261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1409.8880	0.2160	304.5358 (264)
Space and water heating			1208.4235 (265)
Pumps and fans	170.9333	0.5190	88.7144 (267)
Energy for lighting	498.6559	0.5190	258.8024 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			659.5031 (272)
CO2 emissions per m2			4.9000 (273)
EI value			95.0761
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6800 (1b)	x 2.2700 (2b)	= 128.6636 (1b) - (3b)
First floor	50.8700 (1c)	x 2.4900 (2c)	= 126.6663 (1c) - (3c)
Second floor	26.9300 (1d)	x 2.8000 (2d)	= 75.4040 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	330.7339 (5)

2. Ventilation rate

	main heating		+	secondary heating		+	other		=	total	m3 per hour		
Number of chimneys		0	+		0	+		0	=	0 * 40 =	0.0000 (6a)		
Number of open flues		0	+		0	+		0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans										0 * 10 =	0.0000 (7a)		
Number of passive vents										0 * 10 =	0.0000 (7b)		
Number of flueless gas fires										0 * 40 =	0.0000 (7c)		
											Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =									0.0000 / (5) =	0.0000 (8)		
Pressure test											Yes		
Measured/design AP50											5.0100		
Infiltration rate											0.2505	(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) =	0.2317 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)	
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)	
Adj infilt rate													
	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:	0.5000 (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.40)			17.4100	1.3258	23.0814		(27)					
Solid Door			2.1000	1.4000	2.9400		(26)					
Roof Window (Uw = 1.40)			2.7600	1.3258	3.6591		(27a)					
Flr - Ground			56.6800	0.1300	7.3684	75.6000	4285.0080 (28a)					
Wl - Brick	122.0100	19.5070	102.5030	0.1100	11.2753	7.6200	781.0729 (29a)					
Wl - Stud Ashlar	17.7300		17.7300	0.0800	1.4184	7.6200	135.1026 (29a)					
Rf - Ins Rafter	32.8700	2.7600	30.1100	0.1100	3.3121	7.6200	229.4382 (30)					
Rf - Staggered Roof at Front	5.8100		5.8100	0.1100	0.6391	7.6200	44.2722 (30)					
Rf - Ashlar behind Stud	23.9500		23.9500	0.0800	1.9160	7.6200	182.4990 (30)					
Total net area of external elements Aum(A, m2)			259.0530				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6099		(33)					
Party Wall			63.6740	0.0000	0.0000	54.0300	3440.3062 (32)					
Ground Floor Block			32.2749			54.0300	1743.8107 (32c)					
Ground Floor Stud			26.0505			5.8200	151.6140 (32c)					
1st Floor Block			42.2450			54.0300	2282.4974 (32c)					
1st Floor Stud			93.6199			5.8200	544.8678 (32c)					
2nd Floor Block			28.7097			54.0300	1551.1827 (32c)					
2nd Floor Stud			35.4919			5.8200	206.5629 (32c)					
Internal Floor			77.8000			18.0000	1400.4000 (32d)					
Internal Ceiling			77.8000			5.8200	452.7960 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			17431.4305 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.6210 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.2295 (36)					
Total fabric heat loss						(33) + (36) =	79.8394 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.5711	Feb 54.5711	Mar 54.5711	Apr 54.5711	May 54.5711	Jun 54.5711	Jul 54.5711	Aug 54.5711	Sep 54.5711	Oct 54.5711	Nov 54.5711	Dec 54.5711 (38)
Heat transfer coeff	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105	134.4105 (39)
Average = Sum(39)m / 12 =												134.4105 (39)
HLP	Jan 0.9995	Feb 0.9995	Mar 0.9995	Apr 0.9995	May 0.9995	Jun 0.9995	Jul 0.9995	Aug 0.9995	Sep 0.9995	Oct 0.9995	Nov 0.9995	Dec 0.9995 (40)
HLP (average)												0.9995 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9057 (42)											
Average daily hot water use (litres/day)	103.2114 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5326	109.4041	105.2757	101.1472	97.0187	92.8903	92.8903	97.0187	101.1472	105.2757	109.4041	113.5326 (44)
Energy content (annual)	168.3655	147.2536	151.9525	132.4759	127.1137	109.6895	101.6434	116.6373	118.0304	137.5530	150.1499	163.0530 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1623.9177 (45)											
Solar input	25.2548	22.0880	22.7929	19.8714	19.0671	16.4534	15.2465	17.4956	17.7046	20.6329	22.5225	24.4580 (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	14.1606	12.7787	14.1212	13.6307	14.0525	13.5573	13.9832	14.0281	13.5961	14.0867	13.6732	14.1479 (61)
Total heat required for water heating calculated for each month	182.5262	160.0323	166.0737	146.1066	141.1663	123.2468	115.6266	130.6655	131.6264	151.6397	163.8230	177.2009 (62)
WWHRS	-59.5376	-52.3874	-53.4671	-43.9780	-40.8276	-33.6759	-28.4923	-34.5006	-35.5110	-43.9080	-50.8744	-57.5487 eq. (G10)
Total of WWHRS savings	-534.7084											
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	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522 (64)
Heat gains from water heating, kWh/month	59.5217	52.1565	54.0545	47.4559	45.7785	39.8611	37.2922	42.2889	42.6441	49.2580	53.3431	57.7521 (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	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447	174.3447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5899	62.6973	50.9889	38.6019	28.8553	24.3609	26.3228	34.2154	45.9238	58.3108	68.0574	72.5518 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	452.3030	456.9965	445.1690	419.9898	388.2056	358.3328	338.3760	333.6825	345.5100	370.6892	402.4735	432.3462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402	55.3402 (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)	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298	-116.2298 (71)
Water heating gains (Table 5)	80.0023	77.6138	72.6539	65.9110	61.5302	55.3626	50.1240	56.8400	59.2279	66.2070	74.0877	77.6238 (72)
Total internal gains	719.3503	713.7627	685.2669	640.9578	595.0462	554.5115	531.2779	541.1930	567.1168	611.6622	661.0736	698.9769 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					4.6650	12.9236	0.7600	0.7200			0.7700			22.8619 (75)		
Southwest					9.3030	40.4699	0.7600	0.7200			0.7700			142.7692 (79)		
Northwest					3.4390	12.9236	0.7600	0.7200			0.7700			16.8536 (81)		
Northeast					0.9200	20.0668	0.7600	0.7200			1.0000			9.0919 (82)		
Southwest					1.8400	43.0236	0.7600	0.7200			1.0000			38.9864 (82)		
Solar gains					230.5631	374.9629	560.6464	803.9727	951.7618	1044.9667	982.7561	864.4858	689.7494	458.4594	287.4650	192.5291 (83)
Total gains					949.9134	1088.7256	1245.9133	1444.9305	1546.8080	1599.4782	1514.0340	1405.6788	1256.8663	1070.1216	948.5386	891.5060 (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	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245	36.0245
alpha	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016	3.4016
util living area	0.9638	0.9434	0.8939	0.7850	0.6181	0.4071	0.2727	0.3022	0.5674	0.8323	0.9386	0.9696 (86)
MIT	19.5587	19.7696	20.1574	20.5780	20.8594	20.9754	20.9956	20.9937	20.9216	20.5601	19.9889	19.4984 (87)
Th 2	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838	20.0838 (88)
util rest of house	0.9574	0.9338	0.8762	0.7515	0.5640	0.3372	0.1933	0.2174	0.4932	0.7967	0.9263	0.9642 (89)
MIT 2	18.1752	18.4766	19.0243	19.5947	19.9461	20.0672	20.0822	20.0814	20.0207	19.5866	18.7955	18.0889 (90)
Living area fraction	18.6412	18.9121	19.4060	19.9260	20.2537	20.3731	20.3899	20.3887	20.3242	19.9145	19.1975	18.5637 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.4912	18.7621	19.2560	19.7760	20.1037	20.2231	20.2399	20.2387	20.1742	19.7645	19.0475	18.4137 (93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9429	0.9164	0.8572	0.7390	0.5653	0.3481	0.2069	0.2319	0.5009	0.7824	0.9087	0.9508	(94)
Useful gains	895.6456	997.6791	1068.0235	1067.7994	874.3839	556.7241	313.3154	326.0106	629.6031	837.3025	861.8919	847.6515	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1799.9226	1769.1293	1593.5678	1327.4341	954.8156	567.6347	314.5047	327.7897	668.5798	1097.3961	1484.8978	1789.5008	(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	672.7820	518.4145	391.0049	186.9370	59.8412	0.0000	0.0000	0.0000	0.0000	193.5096	448.5642	700.7359	(98)
Space heating												3171.7894	(98)
Space heating per m2											(98) / (4) =	23.5856	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3504.7396	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	672.7820	518.4145	391.0049	186.9370	59.8412	0.0000	0.0000	0.0000	0.0000	193.5096	448.5642	700.7359	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	743.4056	572.8337	432.0496	206.5602	66.1229	0.0000	0.0000	0.0000	0.0000	213.8228	495.6510	774.2938	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	122.9886	107.6449	112.6067	102.1286	100.3387	89.5709	87.1343	96.1649	96.1155	107.7317	112.9487	119.6522	(64)	
Efficiency of water heater	89.9902	89.9332	89.7643	89.3430	88.4686	87.3000	87.3000	87.3000	87.3000	89.3290	89.8376	87.3000	(216)	
(217)m	89.9902	89.9332	89.7643	89.3430	88.4686	87.3000	87.3000	87.3000	87.3000	89.3290	89.8376	87.3000	(217)	
Fuel for water heating, kWh/month	136.6689	119.6942	125.4471	114.3108	113.4172	102.6012	99.8102	110.1545	110.0979	120.6011	125.7254	132.9192	(219)	
Water heating fuel used												1411.4476	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3504.7396	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.6990, total flow = 45.0000, SFP = 0.2378)														
mechanical ventilation fans (SFP = 0.2378)													95.9333	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													170.9333	(231)
Electricity for lighting (calculated in Appendix L)													498.6559	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)	
Total delivered energy for all uses												3761.6168	(238)	

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3504.7396	3.6300	127.2220	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1411.4476	3.6300	51.2355	(247)
Mechanical ventilation fans	95.9333	19.4400	18.6494	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	498.6559	19.4400	96.9387	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	19.4400	-354.6166	(252)
Total energy cost			49.0091	(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	3504.7396	0.2160	757.0238	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1411.4476	0.2160	304.8727	(264)
Space and water heating			1061.8965	(265)
Pumps and fans	170.9333	0.5190	88.7144	(267)
Energy for lighting	498.6559	0.5190	258.8024	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			462.6744	(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	3504.7396	1.2200	4275.7824 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1411.4476	1.2200	1721.9661 (264)
Space and water heating			5997.7485 (265)
Pumps and fans	170.9333	3.0700	524.7651 (267)
Energy for lighting	498.6559	3.0700	1530.8736 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2453.2171 (272)
Primary energy kWh/m2/year			18.2422 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	129.6 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	459.43 (P1)
Transmission heat loss coefficient	79.84 (37)
Summer heat loss coefficient	539.27 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	0.850	0.90	1.000	0.765 (P8)
North East	0.850	1.00	1.000	0.850 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
South West	0.850	1.00	1.000	0.850 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.6650	98.8453	0.7600	0.7200	0.7650	173.7231
South West	9.3030	119.9223	0.7600	0.7200	0.7650	420.3133
North West	3.4390	98.8453	0.7600	0.7200	0.7650	128.0673
North East	0.9200	171.0993	0.7600	0.7200	0.8500	65.8937
South West	1.8400	196.8859	0.7600	0.7200	0.8500	151.6492
total:						939.6465

	Jun	Jul	Aug	
Solar gains	999	940	827	(P3)
Internal gains	552	528	538	
Total summer gains	1551	1468	1365	(P5)
Summer gain/loss ratio	2.88	2.72	2.53	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 129.6)	1.09	1.09	1.09	
Threshold temperature	19.97	21.71	21.42	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	004 - PRJ012480	Issued on Date	10/06/2022
Assessment Reference	004 S	Prop Type Ref	PRJ012480
Property	004 - PRJ012480		
SAP Rating	87 B	DER	12.79
Environmental	88 B	TER	16.07
CO ₂ Emissions (t/year)	1.41	% DER<TER	20.43
General Requirements Compliance	Pass	DFEE	41.59
		TFEE	52.96
		% DFEE<TFEE	21.47
Assessor Details	Chris Nicholls, , Tel: ,		Assessor ID
Client			U903-0001

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)	16.07	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.79	kgCO ₂ /m ²	Pass
	-3.28 (-20.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	41.59	kWh/m ² /yr	
	-11.4 (-21.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

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

Continuous extract system (decentralised)

Specific fan power

0.1900 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

4.67 m², No overhang

Windows facing South West

9.30 m², No overhang

Windows facing North West

3.44 m², No overhang

Air change rate

4.21 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

External wall U-value

0.11

W/m²K

External wall U-value

0.08

W/m²K

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.08

W/m²K