

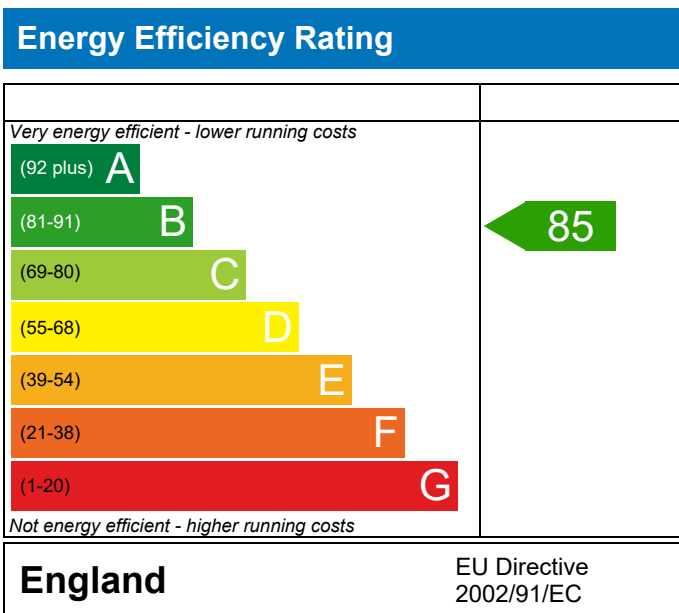
PREDICTED ENERGY ASSESSMENT

Land North of Grange Road,
SO31

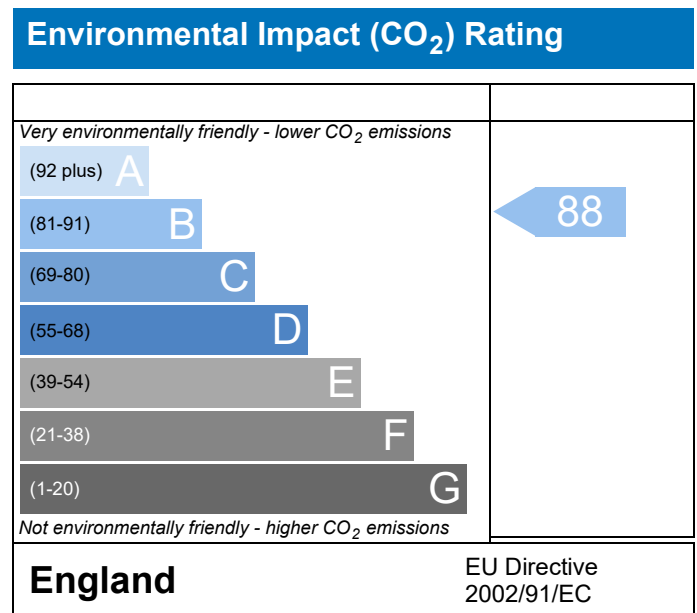
Dwelling type: House, End-Terrace
Date of assessment: 27/01/2023
Produced by: Scott Binstead
Total floor area: 81.82 m²

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.



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.



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	058 - PRJ013014			Issued on Date	27/01/2023
Assessment Reference	058	Prop Type Ref	2B		
Property	Land North of Grange Road, SO31				
SAP Rating	85 B	DER	15.13	TER	18.35
Environmental	88 B	% DER<TER	17.54		
CO ₂ Emissions (t/year)	1.04	DFEE	44.85	TFEE	50.80
General Requirements Compliance	Pass	% DFEE<TFEE	11.71		
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

End-Terrace House, total floor area 82 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.35 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	OK
Openings	1.36 (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: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 30

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing East:

6.36 m², No overhang

Windows facing West:

2.72 m², No overhang

Air change rate:

4.67 ach

Blinds/curtains:

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

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.08 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)					
Total fabric heat loss							(33) + (36) = 53.4232 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.4890	94.2023	93.9214	92.6015	92.3546	91.2051	91.2051	90.9922	91.6478	92.3546	92.8541	93.3764 (39)
Average = Sum(39)m / 12 =												92.6003 (39)
HLP	Jan 1.1548	Feb 1.1513	Mar 1.1479	Apr 1.1318	May 1.1288	Jun 1.1147	Jul 1.1147	Aug 1.1121	Sep 1.1201	Oct 1.1288	Nov 1.1349	Dec 1.1412 (40)
HLP (average)												1.1318 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3314.2672 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.7538	438.4601	402.9424	278.4490	176.2144	0.0000	0.0000	0.0000	0.0000	252.9254	392.1316	531.5349	(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)	582.0484	484.4863	445.2403	307.6784	194.7121	0.0000	0.0000	0.0000	0.0000	279.4756	433.2946	587.3314	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.9212	89.8968	89.8303	89.6740	89.3768	87.3000	87.3000	87.3000	87.3000	89.5791	89.8143	87.3000	(216)
Fuel for water heating, kWh/month	124.7764	109.2882	114.5239	104.2135	102.8530	94.1970	91.8250	101.0747	100.9497	110.0544	114.8687	121.4343	(219)
Water heating fuel used													1290.0586 (219)
Annual totals kWh/year													
Space heating fuel - main system													3314.2672 (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)													394.3960 (232)
Total delivered energy for all uses													5073.7218 (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	3314.2672	0.2160	715.8817 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.0586	0.2160	278.6527 (264)
Space and water heating			994.5344 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Total CO2, kg/year			1238.1509 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1300 (273)

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

	TFA	N	EF	
DER				15.1300 ZC1
Total Floor Area				81.8200
Assumed number of occupants				2.4965
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				16.1654 ZC2
CO2 emissions from cooking, equation (L16)				2.1867 ZC3
Total CO2 emissions				33.4821 ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year				0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000 ZC7
Net CO2 emissions				33.4821 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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (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			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1300	5.3186		(28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.1800	14.2564		(29a)					
RF - Ins Joist	40.9120		40.9120	0.1300	5.3186		(30)					
Total net area of external elements Aum(A, m ²)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0214		(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)							8.8094 (36)					
Total fabric heat loss							(33) + (36) = 47.8308 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	88.8965	88.6099	88.3289	87.0090	86.7621	85.6126	85.6126	85.3997	86.0554	86.7621	87.2617	87.7839 (39)
Average = Sum(39)m / 12 =												87.0079 (39)
HLP	Jan 1.0865	Feb 1.0830	Mar 1.0796	Apr 1.0634	May 1.0604	Jun 1.0464	Jul 1.0464	Aug 1.0438	Sep 1.0518	Oct 1.0604	Nov 1.0665	Dec 1.0729 (40)
HLP (average)												1.0634 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	50.9589	45.6136	48.5951	45.1833	44.7837	41.4949	42.8781	44.7837	45.1833	48.5951	48.8718	50.9589	61			
Solar input	203.4687	178.9997	186.2376	165.1834	159.9266	140.8545	134.9493	150.4368	152.0983	173.1942	184.8814	198.6565	(62)			
Output from w/h	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)			
Heat gains from water heating, kWh/month	203.4687	178.9997	186.2376	165.1834	159.9266	140.8545	134.9493	150.4368	152.0983	173.1942	184.8814	198.6565	(64)			
	63.4492	55.7543	57.9149	51.1958	49.4810	43.4108	41.3332	46.3256	46.8450	53.5780	57.4411	61.8492	(65)			

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4705	19.9581	16.2310	12.2879	9.1854	7.7547	8.3792	10.8916	14.6187	18.5617	21.6643	23.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2022	225.5183	219.6817	207.2563	191.5714	176.8299	166.9816	164.6655	170.5021	182.9275	198.6124	213.3539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	(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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	(71)
Water heating gains (Table 5)	85.2812	82.9677	77.8426	71.1053	66.5067	60.2927	55.5554	62.2656	65.0626	72.0134	79.7794	83.1306	(72)
Total internal gains	394.4012	391.8914	377.2027	354.0969	330.7108	308.3246	294.3635	301.2699	313.6306	336.9499	363.5033	383.0269	(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								
East	6.3550	19.6403	0.6300	0.7000	0.7700	38.1447 (76)							
West	2.7240	19.6403	0.6300	0.7000	0.7700	16.3503 (80)							
Solar gains	54.4951	106.6039	175.5614	256.0459	313.7939	321.2239	305.8182	262.6933	204.1852	126.4945	67.9489	44.8141	(83)
Total gains	448.8963	498.4953	552.7641	610.1428	644.5046	629.5484	600.1817	563.9633	517.8158	463.4444	431.4523	427.8409	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.9164	64.1232	64.3271	65.3029	65.4888	66.3681	66.3681	66.5335	66.0266	65.4888	65.1139	64.7265	
alpha	5.2611	5.2749	5.2885	5.3535	5.3659	5.4245	5.4245	5.4356	5.4018	5.3659	5.3409	5.3151	
util living area	0.9987	0.9975	0.9933	0.9766	0.9208	0.7803	0.6080	0.6638	0.8954	0.9862	0.9974	0.9990	(86)
MIT	19.7966	19.9200	20.1492	20.4671	20.7509	20.9337	20.9862	20.9783	20.8479	20.4804	20.0878	19.7807	(87)
Th 2	20.0119	20.0148	20.0176	20.0308	20.0333	20.0449	20.0449	20.0470	20.0404	20.0333	20.0283	20.0230	(88)
util rest of house	0.9983	0.9966	0.9908	0.9671	0.8871	0.6964	0.4860	0.5422	0.8383	0.9789	0.9964	0.9987	(89)
MIT 2	18.3984	18.5808	18.9169	19.3844	19.7747	19.9974	20.0394	20.0373	19.9084	19.4099	18.8362	18.3832	(90)
Living area fraction	f _{LA} = Living area / (4) = 0.1678 (91)												
MIT	18.6331	18.8055	19.1237	19.5661	19.9385	20.1545	20.1983	20.1952	20.0661	19.5895	19.0463	18.6177	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.6331	18.8055	19.1237	19.5661	19.9385	20.1545	20.1983	20.1952	20.0661	19.5895	19.0463	18.6177	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	447.6927	495.9782	545.8642	586.3515	569.1486	445.1257	303.9761	317.1256	435.0523	451.4953	429.1703	426.9517
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	1274.1595	1232.1683	1115.0333	928.0466	714.7939	475.5349	308.0566	324.1128	513.4127	779.9498	1042.4513	1265.6399
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
Space heating kWh	614.8913	494.7198	423.4618	246.0205	108.3601	0.0000	0.0000	0.0000	0.0000	244.3702	441.5623	623.9840
Space heating	3197.3700 (98)											
Space heating per m2	39.0781 (99)											

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													3423.3084 (211)
Space heating requirement	614.8913	494.7198	423.4618	246.0205	108.3601	0.0000	0.0000	0.0000	0.0000	244.3702	441.5623	623.9840	(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)	658.3419	529.6786	453.3852	263.4052	116.0172	0.0000	0.0000	0.0000	0.0000	261.6383	472.7648	668.0771	(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	203.4687	178.9997	186.2376	165.1834	159.9266	140.8545	134.9493	150.4368	152.0983	173.1942	184.8814	198.6565	(64)
Efficiency of water heater (217)m	87.6587	87.4767	87.0553	86.0521	84.0948	80.3000	80.3000	80.3000	80.3000	85.9177	87.1644	87.7352	(217)
Fuel for water heating, kWh/month	232.1147	204.6256	213.9301	191.9573	190.1742	175.4103	168.0564	187.3435	189.4125	201.5814	212.1065	226.4275	(219)
Water heating fuel used													2393.1401 (219)
Annual totals kWh/year													
Space heating fuel - main system													3423.3084 (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)													396.8354 (232)
Total delivered energy for all uses													6288.2838 (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	3423.3084	0.2160	739.4346 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2393.1401	0.2160	516.9183 (264)
Space and water heating			1256.3529 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	396.8354	0.5190	205.9576 (268)
Total CO2, kg/m2/year			1501.2354 (272)
Emissions per m2 for space and water heating			15.3551 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5172 (272b)
Emissions per m2 for pumps and fans			0.4757 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3551 * 1.00) + 2.5172 + 0.4757, rounded to 2 d.p.			18.3500 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)					
Total fabric heat loss							(33) + (36) = 53.4232 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.4890	94.2023	93.9214	92.6015	92.3546	91.2051	91.2051	90.9922	91.6478	92.3546	92.8541	93.3764 (39)
Average = Sum(39)m / 12 =												92.6003 (39)
HLP	Jan 1.1548	Feb 1.1513	Mar 1.1479	Apr 1.1318	May 1.1288	Jun 1.1147	Jul 1.1147	Aug 1.1121	Sep 1.1201	Oct 1.1288	Nov 1.1349	Dec 1.1412 (40)
HLP (average)												1.1318 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF 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	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	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	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	0.0000	(59)
Heat gains from water heating, kWh/month	32.4083	28.3445	29.2490	25.5000	24.4679	21.1139	19.5651	22.4513	22.7194	26.4773	28.9020	31.3857	31.3857	(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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3323	19.8354	16.1312	12.2124	9.1289	7.7070	8.3277	10.8246	14.5288	18.4476	21.5311	22.9530	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2022	225.5183	219.6817	207.2563	191.5714	176.8299	166.9816	164.6655	170.5021	182.9275	198.6124	213.3539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	(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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	(71)
Water heating gains (Table 5)	43.5596	42.1794	39.3132	35.4167	32.8869	29.3249	26.2972	30.1765	31.5548	35.5878	40.1417	42.1851	(72)
Total internal gains	349.5414	347.9804	335.5735	315.3327	294.0346	274.3090	262.0538	266.1139	277.0329	297.4102	320.7325	338.9394	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (76)							
West	2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (80)							
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829	(83)
Total gains	394.0272	435.0040	478.8889	524.3497	550.1928	536.5326	511.7013	480.5574	443.7147	400.6710	376.2010	375.5223	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													
Utilisation factor for gains for living area, n _{ll,m} (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
alpha	2.0686	2.0718	2.0751	2.0904	2.0933	2.1071	2.1071	2.1097	2.1017	2.0933	2.0874	2.0813	
util living area	0.9569	0.9452	0.9228	0.8797	0.8108	0.7063	0.5930	0.6305	0.7875	0.8998	0.9447	0.9607	(86)
MIT	17.7262	17.9818	18.4846	19.1849	19.8619	20.4319	20.7284	20.6791	20.2169	19.3458	18.4282	17.6876	(87)
Th 2	19.9563	19.9591	19.9619	19.9750	19.9774	19.9888	19.9888	19.9910	19.9844	19.9774	19.9725	19.9673	(88)
util rest of house	0.9516	0.9385	0.9127	0.8625	0.7795	0.6480	0.4995	0.5419	0.7409	0.8821	0.9369	0.9560	(89)
MIT 2	16.9457	17.2007	17.7000	18.3963	19.0521	19.5898	19.8405	19.8067	19.4017	18.5641	17.6549	16.9144	(90)
Living area fraction	fLA = Living area / (4) = 0.1678 (91)												
MIT	17.0767	17.3317	17.8316	18.5286	19.1880	19.7311	19.9895	19.9531	19.5385	18.6953	17.7847	17.0442	(92)
Temperature adjustment	0.0000												
adjusted MIT	17.0767	17.3317	17.8316	18.5286	19.1880	19.7311	19.9895	19.9531	19.5385	18.6953	17.7847	17.0442	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9313	0.9152	0.8853	0.8316	0.7502	0.6308	0.4996	0.5381	0.7161	0.8529	0.9137	0.9370	(94)
Useful gains	366.9720	398.1086	423.9459	436.0298	412.7627	338.4412	255.6443	298.5880	317.7277	341.7251	343.7221	351.8523	(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	1207.2574	1171.1000	1064.2831	891.6259	691.5520	467.9860	309.1402	323.3052	498.4301	747.6335	992.1153	1199.3436	(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	625.1724	519.4502	476.4109	328.0292	207.4192	0.0000	0.0000	0.0000	0.0000	301.9959	466.8431	630.5335	(98)
Space heating	3555.8543 (98)												
Space heating per m ²	43.4595 (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	857.3275	674.9174	691.5406	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6181	0.6859	0.6604	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	529.8995	462.9129	456.6868	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	721.4178	690.5436	656.0608	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	137.8932	169.3573	148.3343	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												455.5848 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												
Space cooling per m2												113.8962 (107)
Energy for space heating												1.3920 (108)
Energy for space cooling												43.4595 (99)
Total												1.3920 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.8515 (109)
												44.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (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			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1300	5.3186		(28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.1800	14.2564		(29a)					
RF - Ins Joist	40.9120		40.9120	0.1300	5.3186		(30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0214		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8094 (36)					
Total fabric heat loss							(33) + (36) = 47.8308 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	88.8965	88.6099	88.3289	87.0090	86.7621	85.6126	85.6126	85.3997	86.0554	86.7621	87.2617	87.7839 (39)
Average = Sum(39)m / 12 =												87.0079 (39)
HLP	Jan 1.0865	Feb 1.0830	Mar 1.0796	Apr 1.0634	May 1.0604	Jun 1.0464	Jul 1.0464	Aug 1.0438	Sep 1.0518	Oct 1.0604	Nov 1.0665	Dec 1.0729 (40)
HLP (average)												1.0634 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	21.0882	33.6075	26.1658	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												80.8615 (107)
Space cooling per m2												0.9883 (108)
Energy for space heating												43.1871 (99)
Energy for space cooling												0.9883 (108)
Total												44.1754 (109)
Target Fabric Energy Efficiency (TFEE)												50.8 (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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =		0.3672 (21)							
Wind speed	Jan 4.9000	Feb 4.6000	Mar 4.5000	Apr 4.2000	May 4.2000	Jun 4.1000	Jul 4.1000	Aug 4.0000	Sep 4.0000	Oct 4.3000	Nov 4.3000	Dec 4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4498	0.4223	0.4131	0.3855	0.3855	0.3764	0.3764	0.3672	0.3672	0.3947	0.3947	0.4039 (22b)
Effective ac	0.6012	0.5892	0.5853	0.5743	0.5743	0.5708	0.5708	0.5674	0.5674	0.5779	0.5779	0.5816 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m ²)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)					
Total fabric heat loss							(33) + (36) = 53.4232 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4981	Feb 39.6892	Mar 39.4309	Apr 38.6901	May 38.6901	Jun 38.4545	Jul 38.4545	Aug 38.2246	Sep 38.2246	Oct 38.9313	Nov 38.9313	Dec 39.1783 (38)
Heat transfer coeff	93.9214	93.1124	92.8541	92.1133	92.1133	91.8777	91.8777	91.6478	91.6478	92.3546	92.3546	92.6015 (39)
Average = Sum(39)m / 12 =												92.3730 (39)
HLP	Jan 1.1479	Feb 1.1380	Mar 1.1349	Apr 1.1258	May 1.1258	Jun 1.1229	Jul 1.1229	Aug 1.1201	Sep 1.1201	Oct 1.1288	Nov 1.1288	Dec 1.1318 (40)
HLP (average)												1.1290 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (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	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (64)
RHI water heating demand	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (65)
Heat gains from water heating, kWh/month												1642.5199 (64)
												1643 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (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						
East	6.3550	25.1733	0.5000	0.7200	0.7700	39.9108 (76)						
West	2.7240	25.1733	0.5000	0.7200	0.7700	17.1073 (80)						
Solar gains	57.0182	94.8824	158.5751	232.3325	267.9250	302.6183	278.5361	249.5843	194.1034	122.9158	70.8622	46.0892 (83)
Total gains	624.4806	657.3936	698.6146	737.9148	738.4174	741.9652	699.9895	679.9084	644.5644	608.0475	594.2591	598.2490 (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	16.1258	16.2659	16.3111	16.4423	16.4423	16.4844	16.4844	16.5258	16.5258	16.3993	16.3993	16.3556
alpha	2.0751	2.0844	2.0874	2.0962	2.0962	2.0990	2.0990	2.1017	2.1017	2.0933	2.0933	2.0904
util living area	0.8913	0.8768	0.8403	0.7739	0.6721	0.5147	0.3873	0.3861	0.5915	0.7651	0.8563	0.8965 (86)
MIT	18.5928	18.7730	19.2183	19.8046	20.3611	20.7605	20.9113	20.9149	20.6601	20.0673	19.2965	18.6011 (87)
Th 2	19.9619	19.9699	19.9725	19.9798	19.9798	19.9822	19.9822	19.9844	19.9844	19.9774	19.9774	19.9750 (88)
util rest of house	0.8788	0.8627	0.8212	0.7448	0.6240	0.4376	0.2824	0.2782	0.5183	0.7271	0.8369	0.8845 (89)
MIT 2	16.8160	17.0743	17.7068	18.5302	19.2844	19.7793	19.9339	19.9398	19.6744	18.9054	17.8292	16.8334 (90)
Living area fraction	17.1141	17.3593	17.9605	18.7440	19.4651	19.9439	20.0979	20.1034	19.8398	19.1004	18.0754	17.1301 (92)
Temperature adjustment	16.9641	17.2093	17.8105	18.5940	19.3151	19.7939	19.9479	19.9534	19.6898	18.9504	17.9254	-0.1500
adjusted MIT												16.9801 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8290	0.8118	0.7693	0.6966	0.5879	0.4219	0.2786	0.2746	0.4943	0.6801	0.7852	0.8357 (94)
Ext temp.	517.6742	533.6924	537.4313	514.0432	434.1057	313.0257	195.0394	186.7227	318.6106	413.5424	466.6106	499.9457 (95)
Heat loss rate W	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Month fracti	1057.9438	1034.4179	938.7993	782.4129	572.4922	357.7650	206.5338	197.3589	383.9882	614.1919	842.7734	1035.2898 (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)
RHI space heating demand	401.9606	336.4876	298.6178	193.2262	102.9595	0.0000	0.0000	0.0000	0.0000	149.2833	270.8372	398.2960 (98)
												2151.6683 (98)
												2152 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)					
Total fabric heat loss							(33) + (36) = 53.4232 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.4890	94.2023	93.9214	92.6015	92.3546	91.2051	91.2051	90.9922	91.6478	92.3546	92.8541	93.3764 (39)
Average = Sum(39)m / 12 =												92.6003 (39)
HLP	Jan 1.1548	Feb 1.1513	Mar 1.1479	Apr 1.1318	May 1.1288	Jun 1.1147	Jul 1.1147	Aug 1.1121	Sep 1.1201	Oct 1.1288	Nov 1.1349	Dec 1.1412 (40)
HLP (average)												1.1318 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (76)						
West	2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (80)						
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829 (83)
Total gains	611.9483	649.5348	683.3550	714.5993	726.6507	701.5705	671.1009	644.7677	617.1428	588.3925	578.8654	588.7427 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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)	0.9087	0.8935	0.8646	0.8116	0.7313	0.6141	0.4960	0.5253	0.6858	0.8220	0.8871	0.9146 (86)
MIT	18.2144	18.4437	18.8919	19.5117	20.0971	20.5758	20.8101	20.7782	20.4212	19.6854	18.8629	18.1748 (87)
Th 2	19.9563	19.9591	19.9619	19.9750	19.9774	19.9888	19.9888	19.9910	19.9844	19.9774	19.9725	19.9673 (88)
util rest of house	0.8988	0.8818	0.8491	0.7881	0.6937	0.5524	0.4073	0.4390	0.6309	0.7954	0.8729	0.9053 (89)
MIT 2	16.2711	16.5993	17.2398	18.1210	18.9319	19.5687	19.8442	19.8141	19.3799	18.3789	17.2100	16.2180 (90)
Living area fraction	16.5972	16.9088	17.5171	18.3544	19.1274	19.7377	20.0063	19.9759	19.5546	18.5981	17.4874	16.5464 (92)
Temperature adjustment	16.4472	16.7588	17.3671	18.2044	18.9774	19.5877	19.8563	19.8259	19.4046	18.4481	17.3374	16.3964 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	520.9617	540.5279	544.7639	526.7807	472.2995	368.1207	264.7152	272.9244	366.6321	437.8190	476.3085	505.8591 (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	1147.7736	1117.1276	1020.6504	861.6013	672.1005	454.9014	296.9934	311.7272	486.1588	724.8118	950.5807	1138.8556 (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	466.3481	387.4750	354.0596	241.0708	148.6519	0.0000	0.0000	0.0000	0.0000	213.5227	341.4760	470.9494 (98)
Space heating												2623.5535 (98)
Space heating per m ²												(98) / (4) = 32.0649 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2898.9542 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.3481	387.4750	354.0596	241.0708	148.6519	0.0000	0.0000	0.0000	0.0000	213.5227	341.4760	470.9494	(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)	515.3018	428.1492	391.2260	266.3766	164.2563	0.0000	0.0000	0.0000	0.0000	235.9366	377.3216	520.3861	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.8612	89.8340	89.7592	89.5827	89.2499	87.3000	87.3000	87.3000	87.3000	89.4642	89.7368	87.3000	(216)
Fuel for water heating, kWh/month	124.8597	109.3646	114.6145	104.3198	102.9992	94.1970	91.8250	101.0747	100.9497	110.1957	114.9679	121.5130	(219)
Water heating fuel used													1290.8808 (219)
Annual totals kWh/year													
Space heating fuel - main system													2898.9542 (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)													394.3960 (232)
Total delivered energy for all uses													4659.2310 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2898.9542	3.4800	100.8836 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1290.8808	3.4800	44.9227 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.3960	13.1900	52.0208 (250)
Additional standing charges			120.0000 (251)
Total energy cost			327.7196 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0853 (257)
SAP value		84.8596
SAP rating (Section 12)		85 (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	2898.9542	0.2160	626.1741 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.8808	0.2160	278.8303 (264)
Space and water heating			905.0044 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Total kg/year			1148.6209 (272)
CO2 emissions per m2			14.0400 (273)
EI value			87.8635
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	$3.48 / 0.8888 = 3.915$, stars = 5
Water heating environmental impact	$0.216 / 0.8888 = 0.2430$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3970 (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) =	0.3672 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate												
Effective ac	0.4498	0.4223	0.4131	0.3855	0.3855	0.3764	0.3764	0.3672	0.3672	0.3947	0.3947	0.4039 (22b)
	0.6012	0.5892	0.5853	0.5743	0.5743	0.5708	0.5708	0.5674	0.5674	0.5779	0.5779	0.5816 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)
Total net area of external elements Aum(A, m ²)			172.1960				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			70.7018			7.4000	523.1936 (32c)
Internal Floor			40.9120			7.4000	302.7488 (32d)
Internal Ceiling			40.9120			7.4000	302.7488 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.6389 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)
Total fabric heat loss							(33) + (36) = 53.4232 (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	40.4981	39.6892	39.4309	38.6901	38.6901	38.4545	38.4545	38.2246	38.2246	38.9313	38.9313	39.1783 (38)
Average = Sum(39)m / 12 =	93.9214	93.1124	92.8541	92.1133	92.1133	91.8777	91.8777	91.6478	91.6478	92.3546	92.3546	92.6015 (39)
												92.3730 (39)
HLP	1.1479	1.1380	1.1349	1.1258	1.1258	1.1229	1.1229	1.1201	1.1201	1.1288	1.1288	1.1318 (40)
HLP (average)												1.1290 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													2377.5340 (211)
Space heating requirement	401.9606	336.4876	298.6178	193.2262	102.9595	0.0000	0.0000	0.0000	0.0000	149.2833	270.8372	398.2960	(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)	444.1553	371.8095	329.9645	213.5096	113.7675	0.0000	0.0000	0.0000	0.0000	164.9539	299.2677	440.1061	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.7818	89.7565	89.6579	89.4314	88.9618	87.3000	87.3000	87.3000	87.3000	89.1996	89.5941	87.3000	(216)
Fuel for water heating, kWh/month	124.9701	109.4590	114.7441	104.4962	103.3328	94.1970	91.8250	101.0747	100.9497	110.5226	115.1510	121.6322	(219)
Water heating fuel used													1292.3544 (219)
Annual totals kWh/year													
Space heating fuel - main system													2377.5340 (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)													394.3960 (232)
Total delivered energy for all uses													4139.2844 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2377.5340	3.6300	86.3045 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.3544	3.6300	46.9125 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	394.3960	19.4400	76.6706 (250)
Additional standing charges			95.0000 (251)
Total energy cost			319.4675 (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	2377.5340	0.2160	513.5473 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3544	0.2160	279.1485 (264)
Space and water heating			792.6959 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Total kg/year			1036.3124 (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	2377.5340	1.2200	2900.5915 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3544	1.2200	1576.6723 (264)
Space and water heating			4477.2638 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	394.3960	3.0700	1210.7958 (268)
Primary energy kWh/year			5918.3096 (272)
Primary energy kWh/m2/year			72.3333 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
 Current environmental impact rating: B 88

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	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	+ 10.5	-£ 378	-1010 kg (97.5%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 17	-131 kg (12.6%)
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Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£378	12.35 kg/m ²	A 95	A 97
Total Savings	£378	12.35 kg/m²		
Potential energy efficiency rating:			A 95	
Potential environmental impact rating:				A 97

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, Southern England):

	Current	Potential	Saving
Electricity	£91	£91	£0
Mains gas	£228	£228	£0
Space heating	£196	£196	£0
Water heating	£47	£47	£0
Lighting	£77	£77	£0
Generated (PV)	-£0	-£378	£378
Total cost of fuels	£319	-£59	£378
Total cost of uses	£320	-£58	£378
Delivered energy	51 kWh/m ²	27 kWh/m ²	24 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	0.0 tonnes	1.0 tonnes
CO2 emissions per m ²	13 kg/m ²	0 kg/m ²	12 kg/m ²
Primary energy	72 kWh/m ²	-1 kWh/m ²	73 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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m ²)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)					
Total fabric heat loss							(33) + (36) = 53.4232 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.4890	94.2023	93.9214	92.6015	92.3546	91.2051	91.2051	90.9922	91.6478	92.3546	92.8541	93.3764 (39)
Average = Sum(39)m / 12 =												92.6003 (39)
HLP	Jan 1.1548	Feb 1.1513	Mar 1.1479	Apr 1.1318	May 1.1288	Jun 1.1147	Jul 1.1147	Aug 1.1121	Sep 1.1201	Oct 1.1288	Nov 1.1349	Dec 1.1412 (40)
HLP (average)												1.1318 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
East		6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (76)					
West		2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (80)					
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829 (83)
Total gains	611.9483	649.5348	683.3550	714.5993	726.6507	701.5705	671.1009	644.7677	617.1428	588.3925	578.8654	588.7427 (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	16.0289	16.0777	16.1258	16.3556	16.3993	16.6060	16.6060	16.6449	16.5258	16.3993	16.3111	16.2199	
alpha	2.0686	2.0718	2.0751	2.0904	2.0933	2.1071	2.1071	2.1097	2.1017	2.0933	2.0874	2.0813	
util living area	0.9087	0.8935	0.8646	0.8116	0.7313	0.6141	0.4960	0.5253	0.6858	0.8220	0.8871	0.9146 (86)	
MIT	18.2144	18.4437	18.8919	19.5117	20.0971	20.5758	20.8101	20.7782	20.4212	19.6854	18.8629	18.1748 (87)	
Th 2	19.9563	19.9591	19.9619	19.9750	19.9774	19.9888	19.9888	19.9910	19.9844	19.9774	19.9725	19.9673 (88)	
util rest of house	0.8988	0.8818	0.8491	0.7881	0.6937	0.5524	0.4073	0.4390	0.6309	0.7954	0.8729	0.9053 (89)	
MIT 2	16.2711	16.5993	17.2398	18.1210	18.9319	19.5687	19.8442	19.8141	19.3799	18.3789	17.2100	16.2180 (90)	
Living area fraction									fLA = Living area / (4) =			0.1678 (91)	
MIT	16.5972	16.9088	17.5171	18.3544	19.1274	19.7377	20.0063	19.9759	19.5546	18.5981	17.4874	16.5464 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	16.4472	16.7588	17.3671	18.2044	18.9774	19.5877	19.8563	19.8259	19.4046	18.4481	17.3374	16.3964 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8513	0.8322	0.7972	0.7372	0.6500	0.5247	0.3944	0.4233	0.5941	0.7441	0.8228	0.8592 (94)
Useful gains	520.9617	540.5279	544.7639	526.7807	472.2995	368.1207	264.7152	272.9244	366.6321	437.8190	476.3085	505.8591 (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	1147.7736	1117.1276	1020.6504	861.6013	672.1005	454.9014	296.9934	311.7272	486.1588	724.8118	950.5807	1138.8556 (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	466.3481	387.4750	354.0596	241.0708	148.6519	0.0000	0.0000	0.0000	0.0000	213.5227	341.4760	470.9494 (98)
Space heating												2623.5535 (98)
Space heating per m ²										(98) / (4) =		32.0649 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2898.9542 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.3481	387.4750	354.0596	241.0708	148.6519	0.0000	0.0000	0.0000	0.0000	213.5227	341.4760	470.9494	(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)	515.3018	428.1492	391.2260	266.3766	164.2563	0.0000	0.0000	0.0000	0.0000	235.9366	377.3216	520.3861	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.8612	89.8340	89.7592	89.5827	89.2499	87.3000	87.3000	87.3000	87.3000	89.4642	89.7368	87.3000	(216)
Fuel for water heating, kWh/month	124.8597	109.3646	114.6145	104.3198	102.9992	94.1970	91.8250	101.0747	100.9497	110.1957	114.9679	121.5130	(219)
Water heating fuel used												1290.8808	(219)
Annual totals kWh/year													
Space heating fuel - main system													2898.9542 (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)													394.3960 (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													2931.9916 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2898.9542	3.4800	100.8836 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1290.8808	3.4800	44.9227 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.3960	13.1900	52.0208 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			99.8967 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3308 (257)
SAP value		95.3848
SAP rating (Section 12)		95 (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	2898.9542	0.2160	626.1741 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.8808	0.2160	278.8303 (264)
Space and water heating			905.0044 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			252.1836 (272)
CO2 emissions per m2			3.0800 (273)
EI value			97.3354
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 4.9000	Feb 4.6000	Mar 4.5000	Apr 4.2000	May 4.2000	Jun 4.1000	Jul 4.1000	Aug 4.0000	Sep 4.0000	Oct 4.3000	Nov 4.3000	Dec 4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4498	0.4223	0.4131	0.3855	0.3855	0.3764	0.3764	0.3672	0.3672	0.3947	0.3947	0.4039 (22b)
Effective ac	0.6012	0.5892	0.5853	0.5743	0.5743	0.5708	0.5708	0.5674	0.5674	0.5779	0.5779	0.5816 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m ²)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5563	(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8669 (36)					
Total fabric heat loss							(33) + (36) = 53.4232 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4981	Feb 39.6892	Mar 39.4309	Apr 38.6901	May 38.6901	Jun 38.4545	Jul 38.4545	Aug 38.2246	Sep 38.2246	Oct 38.9313	Nov 38.9313	Dec 39.1783 (38)
Heat transfer coeff	93.9214	93.1124	92.8541	92.1133	92.1133	91.8777	91.8777	91.6478	91.6478	92.3546	92.3546	92.6015 (39)
Average = Sum(39)m / 12 =												92.3730 (39)
HLP	Jan 1.1479	Feb 1.1380	Mar 1.1349	Apr 1.1258	May 1.1258	Jun 1.1229	Jul 1.1229	Aug 1.1201	Sep 1.1201	Oct 1.1288	Nov 1.1288	Dec 1.1318 (40)
HLP (average)												1.1290 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	6.3550	25.1733	0.5000	0.7200	0.7700	39.9108 (76)						
West	2.7240	25.1733	0.5000	0.7200	0.7700	17.1073 (80)						
Solar gains	57.0182	94.8824	158.5751	232.3325	267.9250	302.6183	278.5361	249.5843	194.1034	122.9158	70.8622	46.0892 (83)
Total gains	624.4806	657.3936	698.6146	737.9148	738.4174	741.9652	699.9895	679.9084	644.5644	608.0475	594.2591	598.2490 (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)	0.8913	0.8768	0.8403	0.7739	0.6721	0.5147	0.3873	0.3861	0.5915	0.7651	0.8563	0.8965 (86)
MIT	18.5928	18.7730	19.2183	19.8046	20.3611	20.7605	20.9113	20.9149	20.6601	20.0673	19.2965	18.6011 (87)
Th 2	19.9619	19.9699	19.9725	19.9798	19.9798	19.9822	19.9822	19.9844	19.9844	19.9774	19.9774	19.9750 (88)
util rest of house	0.8788	0.8627	0.8212	0.7448	0.6240	0.4376	0.2824	0.2782	0.5183	0.7271	0.8369	0.8845 (89)
MIT 2	16.8160	17.0743	17.7068	18.5302	19.2844	19.7793	19.9339	19.9398	19.6744	18.9054	17.8292	16.8334 (90)
Living area fraction	17.1141	17.3593	17.9605	18.7440	19.4651	19.9439	20.0979	20.1034	19.8398	19.1004	18.0754	17.1301 (92)
Temperature adjustment	16.9641	17.2093	17.8105	18.5940	19.3151	19.7939	19.9479	19.9534	19.6898	18.9504	17.9254	16.9801 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	517.6742	533.6924	537.4313	514.0432	434.1057	313.0257	195.0394	186.7227	318.6106	413.5424	466.6106	499.9457 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1057.9438	1034.4179	938.7993	782.4129	572.4922	357.7650	206.5338	197.3589	383.9882	614.1919	842.7734	1035.2898 (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	401.9606	336.4876	298.6178	193.2262	102.9595	0.0000	0.0000	0.0000	0.0000	149.2833	270.8372	398.2960 (98)
Space heating												2151.6683 (98)
Space heating per m ²												(98) / (4) = 26.2976 (99)

8c. Space cooling 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

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													2377.5340 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	401.9606	336.4876	298.6178	193.2262	102.9595	0.0000	0.0000	0.0000	0.0000	149.2833	270.8372	398.2960	(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)	444.1553	371.8095	329.9645	213.5096	113.7675	0.0000	0.0000	0.0000	0.0000	164.9539	299.2677	440.1061	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.7818	89.7565	89.6579	89.4314	88.9618	87.3000	87.3000	87.3000	87.3000	89.1996	89.5941	87.3000	(216)
Fuel for water heating, kWh/month	124.9701	109.4590	114.7441	104.4962	103.3328	94.1970	91.8250	101.0747	100.9497	110.5226	115.1510	121.6322	(219)
Water heating fuel used													1292.3544 (219)
Annual totals kWh/year													
Space heating fuel - main system													2377.5340 (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)													394.3960 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1217 * 0.80) =													-1946.4459 (233)
Total delivered energy for all uses													2192.8384 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2377.5340	3.6300	86.3045 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.3544	3.6300	46.9125 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	394.3960	19.4400	76.6706 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	19.4400	-378.3891 (252)
Total energy cost			-58.9216 (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	2377.5340	0.2160	513.5473 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3544	0.2160	279.1485 (264)
Space and water heating			792.6959 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	0.5190	-1010.2054 (269)
Total kg/year			26.1070 (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	2377.5340	1.2200	2900.5915 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3544	1.2200	1576.6723 (264)
Space and water heating			4477.2638 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	394.3960	3.0700	1210.7958 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	3.0700	-5975.5890 (269)
Primary energy kWh/year			-57.2795 (272)
Primary energy kWh/m2/year			-0.7001 (273)

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 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	66.6 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.67 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	314.60 (P1)
Transmission heat loss coefficient	53.42 (37)
Summer heat loss coefficient	368.02 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	6.3550	125.2818	0.5000	0.7200	0.7650	197.3376
West	2.7240	125.2818	0.5000	0.7200	0.7650	84.5866
total:						281.9242

	Jun	Jul	Aug	
Solar gains	303	282	248	(P3)
Internal gains	436	418	427	
Total summer gains	740	700	675	(P5)
Summer gain/loss ratio	2.01	1.90	1.83	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 66.6)	1.53	1.53	1.53	
Threshold temperature	18.94	20.74	20.67	(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	058 - PRJ013014		Issued on Date	27/01/2023	
Assessment Reference	058	Prop Type Ref	2B		
Property	Land North of Grange Road, SO31				
SAP Rating	85 B	DER	15.13	TER	18.35
Environmental	88 B	% DER<TER	17.54		
CO₂ Emissions (t/year)	1.04	DFEE	44.85	TFEE	50.80
General Requirements Compliance	Pass	% DFEE<TFEE	11.71		
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)	18.35	kgCO ₂ /m ²		
Dwelling Carbon Dioxide Emission Rate (DER)	15.13	kgCO ₂ /m ²		Pass
	-3.22 (-17.5%)	kgCO ₂ /m ²		

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.80	kWh/m ² /yr		
Dwelling Fabric Energy Efficiency (DFEE)	44.85	kWh/m ² /yr		
	-5.9 (-11.6%)	kWh/m ² /yr		Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.36 (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	5.00 (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 30 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

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

6.36 m², No overhang

Windows facing West

2.72 m², No overhang

Air change rate

4.67 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

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K