

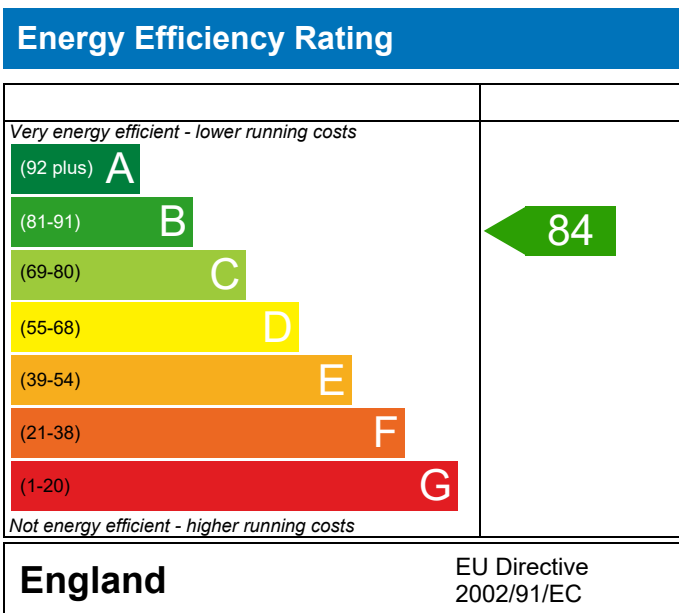
PREDICTED ENERGY ASSESSMENT

Lancing Phase 2,
BN15

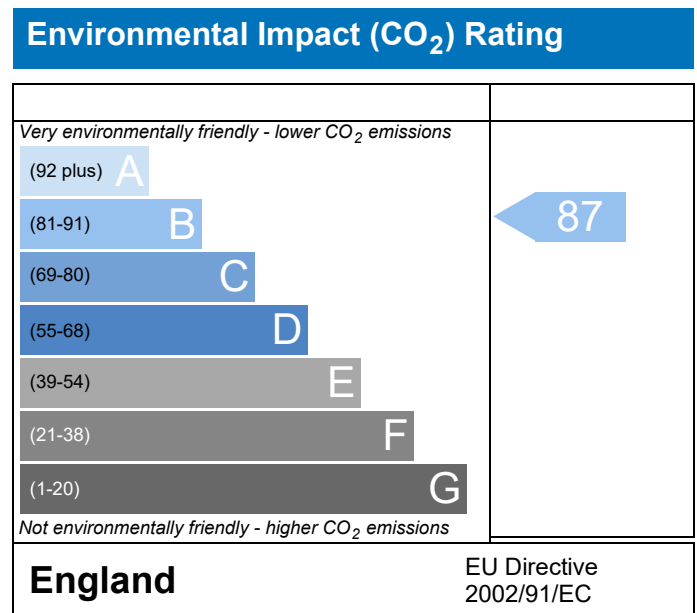
Dwelling type: House, Semi-Detached
Date of assessment: 01/02/2023
Produced by: Michael Juckes
Total floor area: 80.102 m²

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	633 - PRJ012992			Issued on Date	01/02/2023
Assessment Reference	633	Prop Type Ref	Bellflower		
Property	Lancing Phase 2, BN15				
SAP Rating	84 B	DER	17.21	TER	18.27
Environmental	87 B	% DER<TER	5.78		
CO ₂ Emissions (t/year)	1.16	DFEE	43.82	TFEE	49.93
General Requirements Compliance	Pass	% DFEE<TFEE	12.24		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	T850-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 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) 18.27 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.8 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	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.35 (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: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England): Slight OK

Based on:

Overshading:

Average

Windows facing North:

3.93 m², No overhang

Windows facing South:

6.11 m², No overhang

Air change rate:

4.62 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 0.10 W/m²K

Door U-value 1.09 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	2.3850 (2b)	95.5216 (1b) - (3b)
First floor	40.0510 (1c)	2.6830 (2c)	107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		202.9785 (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				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) =	0.0985 (8)						
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate						0.3485 (18)						
Number of sides sheltered					1	1 (19)						
Shelter factor					(20) = 1 - [0.075 x (19)] =	0.9250 (20)						
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =	0.3224 (21)						
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Adj infilt rate	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717

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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)	170.8860						(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5366		(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss					(33) + (36) =		52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.1503	38.9305	38.7151	37.7035	37.5142	36.6331	36.6331	36.4699	36.9724	37.5142	37.8971	38.2974
Heat transfer coeff	92.1086	91.8889	91.6735	90.6618	90.4725	89.5914	89.5914	89.4282	89.9308	90.4725	90.8554	91.2558
Average = Sum(39)m / 12 =	90.6609 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1499	1.1471	1.1445	1.1318	1.1295	1.1185	1.1185	1.1164	1.1227	1.1295	1.1342	1.1392
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy	2.4648 (42)											
Average daily hot water use (litres/day)	92.7388 (43)											
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085
Energy content (annual)	Total = Sum(45)m = 1459.1432 (45)											

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

	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													3461.4640 (211)
Space heating requirement	589.7851	466.6923	407.7779	261.8348	145.2965	0.0000	0.0000	0.0000	0.0000	236.8042	421.5310	602.9030	(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)	651.6963	515.6821	450.5833	289.3203	160.5486	0.0000	0.0000	0.0000	0.0000	261.6621	465.7802	666.1912	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649	(64)
Efficiency of water heater (217)m	89.7774	89.7182	89.6118	89.3956	88.9680	87.3000	87.3000	87.3000	87.3000	89.2940	89.6416	89.8057	(217)
Fuel for water heating, kWh/month	184.8491	162.2228	168.6594	148.9076	144.6941	128.9401	121.1633	136.6477	137.5734	154.7288	166.2964	179.4597	(219)
Water heating fuel used													1834.1425 (219)
Annual totals kWh/year													
Space heating fuel - main system													3461.4640 (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)													377.7688 (232)
Total delivered energy for all uses													5748.3753 (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	3461.4640	0.2160	747.6762	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1834.1425	0.2160	396.1748	(264)
Space and water heating			1143.8510	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	377.7688	0.5190	196.0620	(268)
Total CO2, kg/year			1378.8380	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2100	(273)

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

DER			17.2100	ZC1
Total Floor Area		TFA	80.1020	
Assumed number of occupants		N	2.4648	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.2495	ZC2
CO2 emissions from cooking, equation (L16)			2.2241	ZC3
Total CO2 emissions			35.6836	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			35.6836	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	40.0510 (1b)	x 2.3850 (2b)	= 95.5216 (1b) - (3b)
First floor	40.0510 (1c)	x 2.6830 (2c)	= 107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 202.9785 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					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) = 0.1478 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3978 (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) = 0.3680 (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 infiltr rate	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5782	0.5611	0.5611	0.5579	0.5677	0.5782	0.5857	0.5935 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1300	5.2066		(28a)					
Brick	90.7890	12.1650	78.6240	0.1800	14.1523		(29a)					
Rf - Ins Joist	40.0510		40.0510	0.1300	5.2066		(30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.9962		(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)							8.4433 (36)					
Total fabric heat loss							(33) + (36) = 48.4395 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.8631	Feb 40.5769	Mar 40.2963	Apr 38.9784	May 38.7318	Jun 37.5840	Jul 37.5840	Aug 37.3714	Sep 38.0261	Oct 38.7318	Nov 39.2306	Dec 39.7521 (38)
Heat transfer coeff	89.3026	89.0163	88.7357	87.4179	87.1713	86.0234	86.0234	85.8109	86.4656	87.1713	87.6701	88.1916 (39)
Average = Sum(39)m / 12 =												87.4167 (39)
HLP	Jan 1.1149	Feb 1.1113	Mar 1.1078	Apr 1.0913	May 1.0883	Jun 1.0739	Jul 1.0739	Aug 1.0713	Sep 1.0794	Oct 1.0883	Nov 1.0945	Dec 1.1010 (40)
HLP (average)												1.0913 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.6923	19.8468	20.4801	17.8551	17.1324	14.7839	13.6995	15.7204	15.9081	18.5394	20.2372	21.9763 (46)
Total storage loss:												
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 (56)

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 (57)
Total heat required for water heating calculated for each month	50.9589	45.2464	48.2039	44.8195	44.4232	41.1608	42.5328	44.4232	44.8195	48.2039	48.4783	50.9589 (61)
Solar input	202.2408	177.5585	184.7382	163.8534	158.6390	139.7204	133.8628	149.2256	150.8737	171.7997	183.3928	197.4674 (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	202.2408	177.5585	184.7382	163.8534	158.6390	139.7204	133.8628	149.2256	150.8737	171.7997	183.3928	197.4674 (64)
	63.0410	55.3054	57.4486	50.7837	49.0826	43.0613	41.0004	45.9526	46.4679	53.1466	56.9787	61.4538 (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	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5249	19.1182	15.5480	11.7708	8.7988	7.4283	8.0266	10.4333	14.0035	17.7807	20.7527	22.1231 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.6536	221.9329	216.1891	203.9612	188.5257	174.0185	164.3268	162.0475	167.7913	180.0192	195.4547	209.9619 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240 (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)	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917 (71)
Water heating gains (Table 5)	84.7325	82.2997	77.2159	70.5329	65.9712	59.8073	55.1081	61.7643	64.5387	71.4336	79.1370	82.5992 (72)
Total internal gains	388.8829	386.3227	371.9249	349.2368	326.2676	304.2261	290.4334	297.2169	309.3054	332.2054	358.3163	377.6561 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	3.9300	10.6334	0.6300	0.7000	0.7700	12.7713 (74)						
South	6.1140	46.7521	0.6300	0.7000	0.7700	87.3571 (78)						
Solar gains	100.1284	167.4750	223.7166	272.5911	304.3767	302.6277	291.5132	267.1557	240.2389	183.3656	119.3030	86.1314 (83)
Total gains	489.0113	553.7978	595.6415	621.8279	630.6443	606.8538	581.9466	564.3726	549.5444	515.5710	477.6193	463.7875 (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)												21.0000 (85)
tau	62.2898	62.4901	62.6877	63.6328	63.8127	64.6642	64.6642	64.8244	64.3336	63.8127	63.4497	63.0745
alpha	5.1527	5.1660	5.1792	5.2422	5.2542	5.3109	5.3109	5.3216	5.2889	5.2542	5.2300	5.2050
util living area	0.9978	0.9955	0.9900	0.9736	0.9251	0.7979	0.6256	0.6644	0.8734	0.9771	0.9955	0.9984 (86)
MIT	19.8160	19.9587	20.1765	20.4639	20.7305	20.9211	20.9828	20.9765	20.8615	20.5223	20.1198	19.7950 (87)
Th 2	19.9887	19.9916	19.9945	20.0079	20.0104	20.0222	20.0222	20.0244	20.0177	20.0104	20.0053	20.0000 (88)
util rest of house	0.9971	0.9939	0.9863	0.9629	0.8922	0.7143	0.4991	0.5404	0.8095	0.9657	0.9936	0.9978 (89)
MIT 2	18.4100	18.6203	18.9389	19.3618	19.7295	19.9648	20.0153	20.0139	19.9014	19.4505	18.8659	18.3875 (90)
Living area fraction	18.7372	18.9317	19.2269	19.6182	19.9624	20.1873	20.2404	20.2379	20.1248	19.6999	19.1576	18.7150 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7372	18.9317	19.2269	19.6182	19.9624	20.1873	20.2404	20.2379	20.1248	19.6999	19.1576	18.7150 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9958	0.9916	0.9825	0.9575	0.8903	0.7300	0.5287	0.5692	0.8177	0.9610	0.9913	0.9968 (94)
Useful gains	486.9510	549.1523	585.1965	595.4018	561.4709	443.0317	307.6690	321.2605	449.3531	495.4507	473.4833	462.2853 (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	1289.2758	1249.0487	1129.3289	936.9639	720.2456	480.6427	313.1623	329.3325	520.9388	793.2489	1057.0931	1280.0992 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	596.9296	470.3304	404.8345	245.9247	118.1284	0.0000	0.0000	0.0000	0.0000	221.5618	420.1991	608.4535 (98)
Space heating												3086.3620 (98)
Space heating per m2												38.5304 (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													3304.4561 (211)
Space heating requirement	596.9296	470.3304	404.8345	245.9247	118.1284	0.0000	0.0000	0.0000	0.0000	221.5618	420.1991	608.4535	(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)	639.1109	503.5657	433.4416	263.3027	126.4758	0.0000	0.0000	0.0000	0.0000	237.2182	449.8920	651.4492	(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	202.2408	177.5585	184.7382	163.8534	158.6390	139.7204	133.8628	149.2256	150.8737	171.7997	183.3928	197.4674	(64)
Efficiency of water heater (217)m	87.6113	87.3877	86.9723	86.0712	84.3209	80.3000	80.3000	80.3000	80.3000	85.6926	87.0724	87.6973	(217)
Fuel for water heating, kWh/month	230.8387	203.1848	212.4104	190.3697	188.1372	173.9980	166.7034	185.8352	187.8875	200.4837	210.6210	225.1692	(219)
Water heating fuel used													2375.6388 (219)
Annual totals kWh/year													
Space heating fuel - main system													3304.4561 (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)													380.1365 (232)
Total delivered energy for all uses													6135.2314 (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	3304.4561	0.2160	713.7625 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2375.6388	0.2160	513.1380 (264)
Space and water heating			1226.9005 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	380.1365	0.5190	197.2908 (268)
Total CO2, kg/m2/year			1463.1163 (272)
Emissions per m2 for space and water heating			15.3167 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4630 (272b)
Emissions per m2 for pumps and fans			0.4859 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3167 * 1.00) + 2.4630 + 0.4859, rounded to 2 d.p.			18.2700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	2.3850 (2b)	95.5216 (1b) - (3b)
First floor	40.0510 (1c)	2.6830 (2c)	107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 202.9785 (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) =	0.1478 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3978 (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) =	0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5782	0.5611	0.5611	0.5579	0.5677	0.5782	0.5857	0.5935 (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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5366	(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss							(33) + (36) = 52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.8631	Feb 40.5769	Mar 40.2963	Apr 38.9784	May 38.7318	Jun 37.5840	Jul 37.5840	Aug 37.3714	Sep 38.0261	Oct 38.7318	Nov 39.2306	Dec 39.7521 (38)
Heat transfer coeff	93.8215	93.5352	93.2546	91.9367	91.6902	90.5423	90.5423	90.3298	90.9845	91.6902	92.1890	92.7105 (39)
Average = Sum(39)m / 12 =												91.9356 (39)
HLP	Jan 1.1713	Feb 1.1677	Mar 1.1642	Apr 1.1477	May 1.1447	Jun 1.1303	Jul 1.1303	Aug 1.1277	Sep 1.1359	Oct 1.1447	Nov 1.1509	Dec 1.1574 (40)
HLP (average)												1.1477 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	830.3998	798.9345	771.4283	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	146.9048	192.3158	171.8742	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												511.0948 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	36.7262	48.0790	42.9685	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												127.7737 (107)
Space cooling per m2												1.5951 (108)
Energy for space heating												42.2260 (99)
Energy for space cooling												1.5951 (108)
Total												43.8211 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	x 2.3850 (2b)	= 95.5216 (1b) - (3b)
First floor	40.0510 (1c)	x 2.6830 (2c)	= 107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 202.9785 (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) =	0.1478 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3978 (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) =		0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5782	0.5611	0.5611	0.5579	0.5677	0.5782	0.5857	0.5935 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1300	5.2066		(28a)					
Brick	90.7890	12.1650	78.6240	0.1800	14.1523		(29a)					
Rf - Ins Joist	40.0510		40.0510	0.1300	5.2066		(30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		39.9962 (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)							8.4433 (36)					
Total fabric heat loss							(33) + (36) = 48.4395 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.8631	Feb 40.5769	Mar 40.2963	Apr 38.9784	May 38.7318	Jun 37.5840	Jul 37.5840	Aug 37.3714	Sep 38.0261	Oct 38.7318	Nov 39.2306	Dec 39.7521 (38)
Heat transfer coeff	89.3026	89.0163	88.7357	87.4179	87.1713	86.0234	86.0234	85.8109	86.4656	87.1713	87.6701	88.1916 (39)
Average = Sum(39)m / 12 =												87.4167 (39)
HLP	Jan 1.1149	Feb 1.1113	Mar 1.1078	Apr 1.0913	May 1.0883	Jun 1.0739	Jul 1.0739	Aug 1.0713	Sep 1.0794	Oct 1.0883	Nov 1.0945	Dec 1.1010 (40)
HLP (average)												1.0913 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy content (annual)	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1459.1432 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.1474	28.1163	29.0135	25.2947	24.2709	20.9439	19.4076	22.2705	22.5365	26.2641	28.6693	31.1331	(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	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	123.2397	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5249	19.1182	15.5480	11.7708	8.7988	7.4283	8.0266	10.4333	14.0035	17.7807	20.7527	22.1231	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.6536	221.9329	216.1891	203.9612	188.5257	174.0185	164.3268	162.0475	167.7913	180.0192	195.4547	209.9619	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	35.3240	(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)	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	(71)
Water heating gains (Table 5)	43.2089	41.8398	38.9967	35.1315	32.6221	29.0888	26.0855	29.9335	31.3007	35.3012	39.8185	41.8455	(72)
Total internal gains	344.3593	342.8628	330.7057	310.8355	289.9186	270.5075	258.4108	262.3862	273.0674	293.0730	315.9978	333.9024	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	3.9300	10.6334	0.6300	0.7000	0.7700	12.7713	(74)						
South	6.1140	46.7521	0.6300	0.7000	0.7700	87.3571	(78)						
Solar gains	100.1284	167.4750	223.7166	272.5911	304.3767	302.6277	291.5132	267.1557	240.2389	183.3656	119.3030	86.1314	(83)
Total gains	444.4877	510.3379	554.4223	583.4266	594.2952	573.1352	549.9240	529.5418	513.3064	476.4386	435.3008	420.0338	(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)	62.2898	62.4901	62.6877	63.6328	63.8127	64.6642	64.6642	64.8244	64.3336	63.8127	63.4497	63.0745	21.0000 (85)
tau	5.1527	5.1660	5.1792	5.2422	5.2542	5.3109	5.3109	5.3216	5.2889	5.2542	5.2300	5.2050	
util living area	0.9986	0.9969	0.9927	0.9797	0.9390	0.8242	0.6557	0.6983	0.8970	0.9836	0.9970	0.9990	(86)
MIT	19.7640	19.9085	20.1300	20.4238	20.7004	20.9070	20.9787	20.9703	20.8382	20.4806	20.0707	19.7436	(87)
Th 2	19.9887	19.9916	19.9945	20.0079	20.0104	20.0222	20.0222	20.0244	20.0177	20.0104	20.0053	20.0000	(88)
util rest of house	0.9982	0.9958	0.9900	0.9712	0.9106	0.7441	0.5261	0.5725	0.8396	0.9750	0.9958	0.9986	(89)
MIT 2	18.8590	19.0054	19.2281	19.5286	19.7931	19.9747	20.0162	20.0151	19.9218	19.5886	19.1787	18.8478	(90)
Living area fraction	19.0696	19.2156	19.4380	19.7369	20.0042	20.1916	20.2401	20.2373	20.1351	19.7961	19.3862	19.0562	(91)
MIT	19.0696	19.2156	19.4380	19.7369	20.0042	20.1916	20.2401	20.2373	20.1351	19.7961	19.3862	19.0562	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0696	19.2156	19.4380	19.7369	20.0042	20.1916	20.2401	20.2373	20.1351	19.7961	19.3862	19.0562	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9947	0.9879	0.9682	0.9104	0.7598	0.5567	0.6021	0.8478	0.9726	0.9948	0.9982	(94)
Useful gains	443.4014	507.6206	547.7390	564.8701	541.0518	435.4461	306.1627	318.8286	435.1958	463.3774	433.0226	419.2677	(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	1318.9607	1274.3178	1148.0628	947.3403	723.8919	481.0092	313.1371	329.2844	521.8249	801.6386	1077.1360	1310.1956	(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	651.4161	515.2205	446.6409	275.3785	136.0331	0.0000	0.0000	0.0000	0.0000	251.6663	463.7616	662.8503	(98)
Space heating												3402.9675	(98)
Space heating per m2												42.4829	(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	808.6204	636.5735	652.1627	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8159	0.8948	0.8762	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	659.7755	569.5961	571.3969	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	762.6589	733.6950	711.6879	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	74.0760	122.0896	104.3765	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												300.5422	(104)
Cooled fraction												1.0000	(105)

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	18.5190	30.5224	26.0941	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												75.1356 (107)
Space cooling per m2												0.9380 (108)
Energy for space heating												42.4829 (99)
Energy for space cooling												0.9380 (108)
Total												43.4209 (109)
Target Fabric Energy Efficiency (TFEE)												49.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	2.3850 (2b)	95.5216 (1b) - (3b)
First floor	40.0510 (1c)	2.6830 (2c)	107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 202.9785 (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				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0985 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3485 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4594	0.4191	0.3949	0.3627	0.3708	0.3385	0.3466	0.3385	0.3627	0.3949	0.3949	0.4191 (22b)
	0.6055	0.5878	0.5780	0.5658	0.5687	0.5573	0.5601	0.5573	0.5658	0.5780	0.5780	0.5878 (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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5366	(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss					(33) + (36) =		52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.5601	Feb 39.3743	Mar 38.7151	Apr 37.8971	May 38.0951	Jun 37.3293	Jul 37.5142	Aug 37.3293	Sep 37.8971	Oct 38.7151	Nov 38.7151	Dec 39.3743 (38)
Heat transfer coeff	93.5184	92.3327	91.6735	90.8554	91.0534	90.2876	90.4725	90.2876	90.8554	91.6735	91.6735	92.3327 (39)
Average = Sum(39)m / 12 =												91.4180 (39)
HLP	Jan 1.1675	Feb 1.1527	Mar 1.1445	Apr 1.1342	May 1.1367	Jun 1.1272	Jul 1.1295	Aug 1.1272	Sep 1.1342	Oct 1.1445	Nov 1.1445	Dec 1.1527 (40)
HLP (average)												1.1413 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.6923	19.8468	20.4801	17.8551	17.1324	14.7839	13.6995	15.7204	15.9081	18.5394	20.2372	21.9763 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6708	13.2313	14.6044	14.0828	14.5156	14.0051	14.4456	14.4910	14.0475	14.5677	14.1562	14.6564 (61)
Total heat required for water heating calculated for each month	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649 (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	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649 (64)
RHI water heating demand												1630.6175 (64)
Heat gains from water heating, kWh/month	53.9689	47.3016	49.0487	43.0995	41.6057	36.2723	33.9786	38.4696	38.7749	44.7375	48.3981	52.3782 (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	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4771	47.4979	38.6279	29.2438	21.8601	18.4552	19.9415	25.9207	34.7907	44.1748	51.5585	54.9634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.8412	331.2431	322.6703	304.4197	281.3817	259.7291	245.2639	241.8619	250.4348	268.6854	291.7234	313.3760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536 (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)	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917 (71)
Water heating gains (Table 5)	72.5389	70.3893	65.9257	59.8604	55.9216	50.3782	45.6702	51.7064	53.8540	60.1311	67.2196	70.4008 (72)
Total internal gains	558.4066	553.6797	531.7733	498.0733	463.7128	433.1120	415.4250	424.0385	443.6289	477.5407	515.0510	543.2895 (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					
North		3.9300	13.4530	0.7300	0.7200	0.7700	19.2576 (74)					
South		6.1140	56.4170	0.7300	0.7200	0.7700	125.6389 (78)					
Solar gains	144.8964	209.6485	283.9556	363.8481	395.8123	428.0424	402.7724	370.3568	324.2890	246.8620	172.0364	122.5730 (83)
Total gains	703.3030	763.3282	815.7289	861.9214	859.5251	861.1544	818.1974	794.3953	767.9179	724.4027	687.0873	665.8626 (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	27.9497	28.3086	28.5121	28.7689	28.7063	28.9498	28.8906	28.9498	28.7689	28.5121	28.5121	28.3086	28.3086
alpha	2.8633	2.8872	2.9008	2.9179	2.9138	2.9300	2.9260	2.9300	2.9179	2.9008	2.9008	2.8872	2.8872
util living area	0.9318	0.9156	0.8803	0.8114	0.6996	0.5363	0.4095	0.3910	0.6003	0.7898	0.8932	0.9372 (86)	
MIT	19.3871	19.5420	19.8756	20.2994	20.6686	20.8927	20.9639	20.9707	20.8478	20.4887	19.9425	19.3911 (87)	
Th 2	19.9461	19.9580	19.9647	19.9730	19.9710	19.9787	19.9768	19.9787	19.9730	19.9647	19.9647	19.9580 (88)	
util rest of house	0.9208	0.9024	0.8612	0.7803	0.6467	0.4575	0.3104	0.2874	0.5212	0.7466	0.8732	0.9268 (89)	
MIT 2	18.5154	18.6737	19.0007	19.4072	19.7372	19.9209	19.9641	19.9695	19.8868	19.5819	19.0713	18.5291 (90)	
Living area fraction									FLA = Living area / (4) =			0.2327 (91)	
MIT	18.7182	18.8758	19.2042	19.6148	19.9539	20.1470	20.1967	20.2024	20.1104	19.7929	19.2740	18.7297 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.5682	18.7258	19.0542	19.4648	19.8039	19.9970	20.0467	20.0524	19.9604	19.6429	19.1240	18.5797 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9026	0.8832	0.8413	0.7628	0.6372	0.4590	0.3175	0.2951	0.5201	0.7311	0.8535	0.9093 (94)
Useful gains	634.7730	674.1707	686.2331	657.4500	547.6734	395.2905	259.7569	234.4508	399.4232	529.6252	586.4276	605.4860 (95)
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000 (96)
Heat loss rate W	1231.4728	1211.9364	1095.8866	905.3564	655.9405	424.0828	266.5956	239.4805	441.5901	700.6511	964.7761	1198.4490 (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	443.9446	361.3785	304.7822	178.4926	80.5507	0.0000	0.0000	0.0000	0.0000	127.2433	272.4109	441.1645 (98)
Space heating												2209.9672 (98)
RHI space heating demand												2210 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	2.3850 (2b)	95.5216 (1b) - (3b)
First floor	40.0510 (1c)	2.6830 (2c)	107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		202.9785 (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				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0985 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3485 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (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	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788 (22b)
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717 (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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5366	(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss					(33) + (36) =		52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.1503	Feb 38.9305	Mar 38.7151	Apr 37.7035	May 37.5142	Jun 36.6331	Jul 36.6331	Aug 36.4699	Sep 36.9724	Oct 37.5142	Nov 37.8971	Dec 38.2974 (38)
Heat transfer coeff	92.1086	91.8889	91.6735	90.6618	90.4725	89.5914	89.5914	89.4282	89.9308	90.4725	90.8554	91.2558 (39)
Average = Sum(39)m / 12 =												90.6609 (39)
HLP	Jan 1.1499	Feb 1.1471	Mar 1.1445	Apr 1.1318	May 1.1295	Jun 1.1185	Jul 1.1185	Aug 1.1164	Sep 1.1227	Oct 1.1295	Nov 1.1342	Dec 1.1392 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)

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Distribution loss (46)m = 0.15 x (45)m	22.6923	19.8468	20.4801	17.8551	17.1324	14.7839	13.6995	15.7204	15.9081	18.5394	20.2372	21.9763 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6708	13.2313	14.6044	14.0828	14.5156	14.0051	14.4456	14.4910	14.0475	14.5677	14.1562	14.6564 (61)
Total heat required for water heating calculated for each month	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649 (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	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649 (64)
Heat gains from water heating, kWh/month	53.9689	47.3016	49.0487	43.0995	41.6057	36.2723	33.9786	38.4696	38.7749	44.7375	48.3981	52.3782 (65)
												1630.6175 (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	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4771	47.4979	38.6279	29.2438	21.8601	18.4552	19.9415	25.9207	34.7907	44.1748	51.5585	54.9634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.8412	331.2431	322.6703	304.4197	281.3817	259.7291	245.2639	241.8619	250.4348	268.6854	291.7234	313.3760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536 (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)	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917 (71)
Water heating gains (Table 5)	72.5389	70.3893	65.9257	59.8604	55.9216	50.3782	45.6702	51.7064	53.8540	60.1311	67.2196	70.4008 (72)
Total internal gains	558.4066	553.6797	531.7733	498.0733	463.7128	433.1120	415.4250	424.0385	443.6289	477.5407	515.0510	543.2895 (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						
North	3.9300	10.6334	0.7300	0.7200	0.7700	15.2213 (74)						
South	6.1140	46.7521	0.7300	0.7200	0.7700	104.1154 (78)						
Solar gains	119.3367	199.6029	266.6337	324.8841	362.7673	360.6828	347.4361	318.4059	286.3256	218.5419	142.1897	102.6545 (83)
Total gains	677.7433	753.2826	798.4070	822.9574	826.4800	793.7948	762.8611	742.4444	729.9545	696.0826	657.2407	645.9441 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.3775	28.4453	28.5121	28.8303	28.8906	29.1748	29.1748	29.2280	29.0647	28.8906	28.7689	28.6427
alpha	2.8918	2.8964	2.9008	2.9220	2.9260	2.9450	2.9450	2.9485	2.9376	2.9260	2.9179	2.9095
util living area	0.9455	0.9251	0.8945	0.8405	0.7519	0.6159	0.4782	0.5061	0.6827	0.8447	0.9227	0.9515 (86)
MIT	19.1887	19.4192	19.7565	20.1772	20.5532	20.8277	20.9400	20.9273	20.7513	20.2831	19.6685	19.1401 (87)
Th 2	19.9603	19.9625	19.9647	19.9749	19.9768	19.9858	19.9858	19.9874	19.9823	19.9768	19.9730	19.9689 (88)
util rest of house	0.9370	0.9137	0.8779	0.8138	0.7074	0.5439	0.3814	0.4107	0.6169	0.8137	0.9090	0.9440 (89)
MIT 2	18.3307	18.5569	18.8862	19.2962	19.6434	19.8822	19.9605	19.9549	19.8221	19.4041	18.8125	18.2896 (90)
Living area fraction	18.5303	18.7576	19.0887	19.5012	19.8551	20.1022	20.1884	20.1812	20.0383	19.6086	19.0117	18.4875 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3803	18.6076	18.9387	19.3512	19.7051	19.9522	20.0384	20.0312	19.8883	19.4586	18.8617	18.3375 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	623.9010	674.3197	685.0577	654.1943	573.7589	429.6620	294.9733	308.1469	445.3848	553.5330	585.2615	599.7572 (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	1296.9194	1259.5718	1140.2975	947.5256	724.2431	479.5125	308.0505	324.7319	520.5478	801.4637	1068.6105	1290.1260 (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	500.7257	393.2895	338.6985	211.1985	111.9603	0.0000	0.0000	0.0000	0.0000	184.4604	348.0112	513.6344 (98)
Space heating												2601.9784 (98)
Space heating per m ²												32.4833 (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

	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													2875.1143 (211)
Space heating requirement	500.7257	393.2895	338.6985	211.1985	111.9603	0.0000	0.0000	0.0000	0.0000	184.4604	348.0112	513.6344	(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)	553.2881	434.5740	374.2524	233.3685	123.7130	0.0000	0.0000	0.0000	0.0000	203.8237	384.5428	567.5519	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649	(64)
Efficiency of water heater (217)m	89.6817	89.6128	89.4879	89.2354	88.7599	87.3000	87.3000	87.3000	87.3000	89.1013	89.5160	89.7146	(217)
Fuel for water heating, kWh/month	185.0463	162.4137	168.8928	149.1748	145.0334	128.9401	121.1633	136.6477	137.5734	155.0634	166.5297	179.6418	(219)
Water heating fuel used													1836.1205 (219)
Annual totals kWh/year													
Space heating fuel - main system													2875.1143 (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)													377.7688 (232)
Total delivered energy for all uses													5164.0036 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2875.1143	3.4800	100.0540	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1836.1205	3.4800	63.8970	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	377.7688	13.1900	49.8277	(250)
Additional standing charges			120.0000	(251)
Total energy cost			343.6712	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1538 (257)
SAP value		83.9046
SAP rating (Section 12)		84 (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	2875.1143	0.2160	621.0247	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1836.1205	0.2160	396.6020	(264)
Space and water heating			1017.6267	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	377.7688	0.5190	196.0620	(268)
Total kg/year			1252.6137	(272)
CO2 emissions per m2			15.6400	(273)
EI value			86.5829	
EI rating			87	(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	$3.48 / 0.8869 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8869 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	2.3850 (2b)	95.5216 (1b) - (3b)
First floor	40.0510 (1c)	2.6830 (2c)	107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 202.9785 (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				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0985 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3485 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4594	0.4191	0.3949	0.3627	0.3708	0.3385	0.3466	0.3385	0.3627	0.3949	0.3949	0.4191 (22b)
	0.6055	0.5878	0.5780	0.5658	0.5687	0.5573	0.5601	0.5573	0.5658	0.5780	0.5780	0.5878 (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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5366	(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss						(33) + (36) =	52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.5601	Feb 39.3743	Mar 38.7151	Apr 37.8971	May 38.0951	Jun 37.3293	Jul 37.5142	Aug 37.3293	Sep 37.8971	Oct 38.7151	Nov 38.7151	Dec 39.3743 (38)
Heat transfer coeff	93.5184	92.3327	91.6735	90.8554	91.0534	90.2876	90.4725	90.2876	90.8554	91.6735	91.6735	92.3327 (39)
Average = Sum(39)m / 12 =												91.4180 (39)
HLP	Jan 1.1675	Feb 1.1527	Mar 1.1445	Apr 1.1342	May 1.1367	Jun 1.1272	Jul 1.1295	Aug 1.1272	Sep 1.1342	Oct 1.1445	Nov 1.1445	Dec 1.1527 (40)
HLP (average)												1.1413 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)

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													2441.9527 (211)
Space heating requirement	443.9446	361.3785	304.7822	178.4926	80.5507	0.0000	0.0000	0.0000	0.0000	127.2433	272.4109	441.1645	(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)	490.5465	399.3133	336.7759	197.2294	89.0063	0.0000	0.0000	0.0000	0.0000	140.6003	301.0065	487.4745	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649	(64)
Efficiency of water heater (217)m	89.6063	89.5575	89.4135	89.1047	88.5045	87.3000	87.3000	87.3000	87.3000	88.8054	89.3417	89.6210	(217)
Fuel for water heating, kWh/month	185.2021	162.5140	169.0333	149.3936	145.4519	128.9401	121.1633	136.6477	137.5734	155.5800	166.8545	179.8294	(219)
Water heating fuel used													1838.1833 (219)
Annual totals kWh/year													
Space heating fuel - main system													2441.9527 (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)													377.7688 (232)
Total delivered energy for all uses													4732.9048 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2441.9527	4.2600	104.0272 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1838.1833	4.2600	78.3066 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	377.7688	22.5500	85.1869 (250)
Additional standing charges			96.0000 (251)
Total energy cost			380.4332 (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	2441.9527	0.2160	527.4618 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1838.1833	0.2160	397.0476 (264)
Space and water heating			924.5094 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.7688	0.5190	196.0620 (268)
Total kg/year			1159.4964 (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	2441.9527	1.2200	2979.1823 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1838.1833	1.2200	2242.5837 (264)
Space and water heating			5221.7660 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	377.7688	3.0700	1159.7502 (268)
Primary energy kWh/year			6611.7661 (272)
Primary energy kWh/m2/year			82.5418 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
 Current environmental impact rating: B 87

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	Recommended
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
N Solar water heating	+ 1.2	-£ 31	-186 kg (16.0%)
U Solar photovoltaic panels	+ 10.7	-£ 453	-1042 kg (107.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£31	2.32 kg/m ²	B 85 B 89
Solar photovoltaic panels	£453	13.00 kg/m ²	A 96 A 98
Total Savings	£483	15.32 kg/m ²	

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

Fuel prices for cost data on this page from database revision number 510 TEST (21 Dec 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£102	£113	-£11
Mains gas	£278	£237	£42
Space heating	£217	£217	£0
Water heating	£78	£48	£31
Lighting	£85	£85	£0
Generated (PV)	-£0	-£453	£453
Total cost of fuels	£380	-£103	£484
Total cost of uses	£380	-£103	£484
Delivered energy	59 kWh/m ²	22 kWh/m ²	37 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	-0.1 tonnes	1.2 tonnes
CO2 emissions per m ²	14 kg/m ²	-1 kg/m ²	15 kg/m ²
Primary energy	83 kWh/m ²	-7 kWh/m ²	90 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	40.0510 (1b)	2.3850 (2b)	95.5216 (1b) - (3b)
First floor	40.0510 (1c)	2.6830 (2c)	107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 202.9785 (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				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0985 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3485 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (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	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788 (22b)
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717 (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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5366	(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss					(33) + (36) =		52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.1503	Feb 38.9305	Mar 38.7151	Apr 37.7035	May 37.5142	Jun 36.6331	Jul 36.6331	Aug 36.4699	Sep 36.9724	Oct 37.5142	Nov 37.8971	Dec 38.2974 (38)
Heat transfer coeff	92.1086	91.8889	91.6735	90.6618	90.4725	89.5914	89.5914	89.4282	89.9308	90.4725	90.8554	91.2558 (39)
Average = Sum(39)m / 12 =												90.6609 (39)
HLP	Jan 1.1499	Feb 1.1471	Mar 1.1445	Apr 1.1318	May 1.1295	Jun 1.1185	Jul 1.1185	Aug 1.1164	Sep 1.1227	Oct 1.1295	Nov 1.1342	Dec 1.1392 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.6923	19.8468	20.4801	17.8551	17.1324	14.7839	13.6995	15.7204	15.9081	18.5394	20.2372	21.9763 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6708	13.2313	14.6044	14.0828	14.5156	14.0051	14.4456	14.4910	14.0475	14.5677	14.1562	14.6564 (61)
Total heat required for water heating calculated for each month	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2429 (H8)
Utilisation factor												0.5527 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.7388 (H14)
Volume ratio Veff/V												0.8087 (H15)
Solar storage volume factor												0.9575 (H16)
Solar input												-843.9809 (H17)
Solar input	-24.4738	-40.8397	-69.5546	-93.2169	-115.1617	-113.2223	-111.7260	-97.6156	-76.4526	-52.2081	-29.0294	-20.4804 (63)
Solar input (sum of months) = Sum(63)m =												-843.9809 (63)
Output from w/h												
	141.4789	104.7038	81.5840	39.8998	13.5698	0.0000	0.0000	21.6779	43.6490	85.9554	120.0413	140.6846 (64)
Total per year (kWh/year) = Sum(64)m =												793.2446 (64)
Heat gains from water heating, kWh/month												
	53.9689	47.3016	49.0487	43.0995	41.6057	36.2723	33.9786	38.4696	38.7749	44.7375	48.3981	52.3782 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4771	47.4979	38.6279	29.2438	21.8601	18.4552	19.9415	25.9207	34.7907	44.1748	51.5585	54.9634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.8412	331.2431	322.6703	304.4197	281.3817	259.7291	245.2639	241.8619	250.4348	268.6854	291.7234	313.3760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536 (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)	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917 (71)
Water heating gains (Table 5)	72.5389	70.3893	65.9257	59.8604	55.9216	50.3782	45.6702	51.7064	53.8540	60.1311	67.2196	70.4008 (72)
Total internal gains	558.4066	553.6797	531.7733	498.0733	463.7128	433.1120	415.4250	424.0385	443.6289	477.5407	515.0510	543.2895 (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						
North		3.9300	10.6334	0.7300	0.7200	0.7700	15.2213 (74)					
South		6.1140	46.7521	0.7300	0.7200	0.7700	104.1154 (78)					
Solar gains	119.3367	199.6029	266.6337	324.8841	362.7673	360.6828	347.4361	318.4059	286.3256	218.5419	142.1897	102.6545 (83)
Total gains	677.7433	753.2826	798.4070	822.9574	826.4800	793.7948	762.8611	742.4444	729.9545	696.0826	657.2407	645.9441 (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)												
tau	28.3775	28.4453	28.5121	28.8303	28.8906	29.1748	29.1748	29.2280	29.0647	28.8906	28.7689	28.6427
alpha	2.8918	2.8964	2.9008	2.9220	2.9260	2.9450	2.9450	2.9485	2.9376	2.9260	2.9179	2.9095
util living area	0.9455	0.9251	0.8945	0.8405	0.7519	0.6159	0.4782	0.5061	0.6827	0.8447	0.9227	0.9515 (86)
MIT	19.1887	19.4192	19.7565	20.1772	20.5532	20.8277	20.9400	20.9273	20.7513	20.2831	19.6685	19.1401 (87)
Th 2	19.9603	19.9625	19.9647	19.9749	19.9768	19.9858	19.9858	19.9874	19.9823	19.9768	19.9730	19.9689 (88)
util rest of house	0.9370	0.9137	0.8779	0.8138	0.7074	0.5439	0.3814	0.4107	0.6169	0.8137	0.9090	0.9440 (89)
MIT 2	18.3307	18.5569	18.8862	19.2962	19.6434	19.8822	19.9605	19.9549	19.8221	19.4041	18.8125	18.2896 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.2327 (91)
MIT	18.5303	18.7576	19.0887	19.5012	19.8551	20.1022	20.1884	20.1812	20.0383	19.6086	19.0117	18.4875 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3803	18.6076	18.9387	19.3512	19.7051	19.9522	20.0384	20.0312	19.8883	19.4586	18.8617	18.3375 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9206	0.8952	0.8580	0.7949	0.6942	0.5413	0.3867	0.4150	0.6102	0.7952	0.8905	0.9285	(94)
Useful gains	623.9010	674.3197	685.0577	654.1943	573.7589	429.6620	294.9733	308.1469	445.3848	553.5330	585.2615	599.7572	(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	1296.9194	1259.5718	1140.2975	947.5256	724.2431	479.5125	308.0505	324.7319	520.5478	801.4637	1068.6105	1290.1260	(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	500.7257	393.2895	338.6985	211.1985	111.9603	0.0000	0.0000	0.0000	0.0000	184.4604	348.0112	513.6344	(98)
Space heating per m2											(98) / (4) =	32.4833	(99)

8c. Space cooling requirement

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													2875.1143	(211)	
Space heating requirement	500.7257	393.2895	338.6985	211.1985	111.9603	0.0000	0.0000	0.0000	0.0000	184.4604	348.0112	513.6344	(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)	553.2881	434.5740	374.2524	233.3685	123.7130	0.0000	0.0000	0.0000	0.0000	203.8237	384.5428	567.5519	(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	141.4789	104.7038	81.5840	39.8998	13.5698	0.0000	0.0000	21.6779	43.6490	85.9554	120.0413	140.6846	(64)		
Efficiency of water heater (217)m	89.7750	89.8079	89.8606	89.9759	90.1428	87.3000	87.3000	87.3000	87.3000	89.4577	89.6571	87.7923	(217)		
Fuel for water heating, kWh/month	157.5927	116.5864	90.7895	44.3450	15.0537	0.0000	0.0000	24.8315	49.9989	96.0850	133.8893	156.6777	(219)		
Water heating fuel used												885.8497	(219)		
Annual totals kWh/year															
Space heating fuel - main system													2875.1143	(211)	
Space heating fuel - secondary													0.0000	(215)	
Electricity for pumps and fans:															
central heating pump														30.0000	(230c)
main heating flue fan														45.0000	(230e)
pump for solar water heating														50.0000	(230g)
Total electricity for the above, kWh/year														125.0000	(231)
Electricity for lighting (calculated in Appendix L)														377.7688	(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													2536.4934	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year		
Space heating - main system 1	2875.1143	3.4800	100.0540	(240)	
Space heating - secondary	0.0000	0.0000	0.0000	(242)	
Water heating (other fuel)	885.8497	3.4800	30.8276	(247)	
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)	
Pump for solar water heating	50.0000	13.1900	6.5950	(249)	
Energy for lighting	377.7688	13.1900	49.8277	(250)	
Additional standing charges			120.0000	(251)	
Energy saving/generation technologies					
PV Unit		-1727.2394	13.1900	-227.8229	(252)
Total energy cost			89.3739	(255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.3001	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	95.8143	
SAP rating (Section 12)		96	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2875.1143	0.2160	621.0247 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	885.8497	0.2160	191.3435 (264)
Space and water heating			812.3682 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	377.7688	0.5190	196.0620 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			176.8680 (272)
EI value			2.2100 (273)
EI rating			98.1055
EI band			98 (274)
			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0510 (1b)	x 2.3850 (2b)	= 95.5216 (1b) - (3b)
First floor	40.0510 (1c)	x 2.6830 (2c)	= 107.4568 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.1020		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 202.9785 (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				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0985 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3485 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4594	0.4191	0.3949	0.3627	0.3708	0.3385	0.3466	0.3385	0.3627	0.3949	0.3949	0.4191 (22b)
	0.6055	0.5878	0.5780	0.5658	0.5687	0.5573	0.5601	0.5573	0.5658	0.5780	0.5780	0.5878 (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			2.1200	1.0900	2.3108		(26)					
Windows (Uw = 1.40)			10.0400	1.3258	13.3106		(27)					
Flr - Ground			40.0510	0.1562	6.2541	75.6000	3027.8556 (28a)					
Brick	90.7890	12.1650	78.6240	0.2500	19.6560	51.1900	4024.7626 (29a)					
Rf - Ins Joist	40.0510		40.0510	0.1000	4.0051	7.4000	296.3774 (30)					
Total net area of external elements Aum(A, m ²)			170.8860				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5366	(33)					
Party Wall			43.5950	0.0000	0.0000	7.4000	322.6030 (32)					
Stud			79.0151			7.4000	584.7114 (32c)					
Stud			75.7626			7.4000	560.6429 (32c)					
Internal Floor			40.0510			7.4000	296.3774 (32d)					
Internal Ceiling			40.0510			7.4000	296.3774 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9409.7076 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.4716 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4217 (36)					
Total fabric heat loss					(33) + (36) =		52.9584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.5601	Feb 39.3743	Mar 38.7151	Apr 37.8971	May 38.0951	Jun 37.3293	Jul 37.5142	Aug 37.3293	Sep 37.8971	Oct 38.7151	Nov 38.7151	Dec 39.3743 (38)
Heat transfer coeff	93.5184	92.3327	91.6735	90.8554	91.0534	90.2876	90.4725	90.2876	90.8554	91.6735	91.6735	92.3327 (39)
Average = Sum(39)m / 12 =												91.4180 (39)
HLP	Jan 1.1675	Feb 1.1527	Mar 1.1445	Apr 1.1342	May 1.1367	Jun 1.1272	Jul 1.1295	Aug 1.1272	Sep 1.1342	Oct 1.1445	Nov 1.1445	Dec 1.1527 (40)
HLP (average)												1.1413 (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												2.4648 (42)
Average daily hot water use (litres/day)												92.7388 (43)
Daily hot water use	102.0127	98.3032	94.5936	90.8841	87.1745	83.4650	83.4650	87.1745	90.8841	94.5936	98.3032	102.0127 (44)
Energy conte	151.2819	132.3121	136.5343	119.0339	114.2159	98.5596	91.3300	104.8025	106.0541	123.5959	134.9146	146.5085 (45)
Energy content (annual)												Total = Sum(45)m = 1459.1432 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	22.6923	19.8468	20.4801	17.8551	17.1324	14.7839	13.6995	15.7204	15.9081	18.5394	20.2372	21.9763 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6708	13.2313	14.6044	14.0828	14.5156	14.0051	14.4456	14.4910	14.0475	14.5677	14.1562	14.6564 (61)
Total heat required for water heating calculated for each month	165.9527	145.5434	151.1387	133.1167	128.7315	112.5647	105.7756	119.2935	120.1016	138.1635	149.0707	161.1649 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1254.2188 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2107.0876 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4441 (H8)
Utilisation factor												0.4997 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.7388 (H14)
Volume ratio Veff/V												0.8087 (H15)
Solar storage volume factor												0.9575 (H16)
Solar input												-886.4599 (H17)
Solar input	-27.7728	-40.1592	-69.1963	-96.6491	-115.2358	-122.7106	-118.4977	-104.6922	-80.6533	-55.2070	-32.8499	-22.8361 (63)
Solar input (sum of months) = Sum(63)m =												-886.4599 (63)
Output from w/h	138.1799	105.3842	81.9424	36.4677	13.4957	0.0000	0.0000	14.6012	39.4483	82.9566	116.2209	138.3288 (64)
Total per year (kWh/year) = Sum(64)m =												767.0257 (64)
Heat gains from water heating, kWh/month	53.9689	47.3016	49.0487	43.0995	41.6057	36.2723	33.9786	38.4696	38.7749	44.7375	48.3981	52.3782 (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	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	147.8876	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4771	47.4979	38.6279	29.2438	21.8601	18.4552	19.9415	25.9207	34.7907	44.1748	51.5585	54.9634 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.8412	331.2431	322.6703	304.4197	281.3817	259.7291	245.2639	241.8619	250.4348	268.6854	291.7234	313.3760 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536	52.2536 (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)	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917	-98.5917 (71)	
Water heating gains (Table 5)	72.5389	70.3893	65.9257	59.8604	55.9216	50.3782	45.6702	51.7064	53.8540	60.1311	67.2196	70.4008 (72)	
Total internal gains	558.4066	553.6797	531.7733	498.0733	463.7128	433.1120	415.4250	424.0385	443.6289	477.5407	515.0510	543.2895 (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							
North	3.9300	13.4530	0.7300	0.7200	0.7700	19.2576 (74)						
South	6.1140	56.4170	0.7300	0.7200	0.7700	125.6389 (78)						
Solar gains	144.8964	209.6485	283.9556	363.8481	395.8123	428.0424	402.7724	370.3568	324.2890	246.8620	172.0364	122.5730 (83)
Total gains	703.3030	763.3282	815.7289	861.9214	859.5251	861.1544	818.1974	794.3953	767.9179	724.4027	687.0873	665.8626 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.9497	28.3086	28.5121	28.7689	28.7063	28.9498	28.8906	28.9498	28.7689	28.5121	28.5121	28.3086	
alpha	2.8633	2.8872	2.9008	2.9179	2.9138	2.9300	2.9260	2.9300	2.9179	2.9008	2.9008	2.8872	
util living area	0.9318	0.9156	0.8803	0.8114	0.6996	0.5363	0.4095	0.3910	0.6003	0.7898	0.8932	0.9372 (86)	
MIT	19.3871	19.5420	19.8756	20.2994	20.6686	20.8927	20.9639	20.9707	20.8478	20.4887	19.9425	19.3911 (87)	
Th 2	19.9461	19.9580	19.9647	19.9730	19.9710	19.9787	19.9768	19.9787	19.9730	19.9647	19.9647	19.9580 (88)	
util rest of house	0.9208	0.9024	0.8612	0.7803	0.6467	0.4575	0.3104	0.2874	0.5212	0.7466	0.8732	0.9268 (89)	
MIT 2	18.5154	18.6737	19.0007	19.4072	19.7372	19.9209	19.9641	19.9695	19.8868	19.5819	19.0713	18.5291 (90)	
Living area fraction									fLA = Living area / (4) =			0.2327 (91)	
MIT	18.7182	18.8758	19.2042	19.6148	19.9539	20.1470	20.1967	20.2024	20.1104	19.7929	19.2740	18.7297 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.5682	18.7258	19.0542	19.4648	19.8039	19.9970	20.0467	20.0524	19.9604	19.6429	19.1240	18.5797 (93)	

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9026	0.8832	0.8413	0.7628	0.6372	0.4590	0.3175	0.2951	0.5201	0.7311	0.8535	0.9093	(94)
Useful gains	634.7730	674.1707	686.2331	657.4500	547.6734	395.2905	259.7569	234.4508	399.4232	529.6252	586.4276	605.4860	(95)
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000	(96)
Heat loss rate W	1231.4728	1211.9364	1095.8866	905.3564	655.9405	424.0828	266.5956	239.4805	441.5901	700.6511	964.7761	1198.4490	(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	443.9446	361.3785	304.7822	178.4926	80.5507	0.0000	0.0000	0.0000	0.0000	127.2433	272.4109	441.1645	(98)
Space heating												2209.9672	(98)
Space heating per m2											(98) / (4) =	27.5894	(99)

8c. Space cooling requirement

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													2441.9527	(211)	
Space heating requirement	443.9446	361.3785	304.7822	178.4926	80.5507	0.0000	0.0000	0.0000	0.0000	127.2433	272.4109	441.1645	(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)	490.5465	399.3133	336.7759	197.2294	89.0063	0.0000	0.0000	0.0000	0.0000	140.6003	301.0065	487.4745	(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	138.1799	105.3842	81.9424	36.4677	13.4957	0.0000	0.0000	14.6012	39.4483	82.9566	116.2209	138.3288	(64)		
Efficiency of water heater (217)m	89.7194	89.7572	89.8025	89.9407	90.0265	87.3000	87.3000	87.3000	87.3000	89.2095	89.5187	87.3000	(216)		
Fuel for water heating, kWh/month	154.0135	117.4103	91.2473	40.5464	14.9908	0.0000	0.0000	16.7254	45.1871	92.9907	129.8286	154.1869	(219)		
Water heating fuel used												857.1270	(219)		
Annual totals kWh/year															
Space heating fuel - main system													2441.9527	(211)	
Space heating fuel - secondary													0.0000	(215)	
Electricity for pumps and fans:															
central heating pump														30.0000	(230c)
main heating flue fan														45.0000	(230e)
pump for solar water heating														50.0000	(230g)
Total electricity for the above, kWh/year														125.0000	(231)
Electricity for lighting (calculated in Appendix L)														377.7688	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 2.50 * 1254 * 0.80) =										-2006.7501			-2006.7501	(233)	
Total delivered energy for all uses													1795.0984	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year		
Space heating - main system 1	2441.9527	4.2600	104.0272	(240)	
Space heating - secondary	0.0000	0.0000	0.0000	(242)	
Water heating (other fuel)	857.1270	4.2600	36.5136	(247)	
Pumps and fans for heating	75.0000	22.5500	16.9125	(249)	
Pump for solar water heating	50.0000	22.5500	11.2750	(249)	
Energy for lighting	377.7688	22.5500	85.1869	(250)	
Additional standing charges			96.0000	(251)	
Energy saving/generation technologies					
PV Unit		-2006.7501	22.5500	-452.5221	(252)
Total energy cost			-102.6070	(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	2441.9527	0.2160	527.4618	(261)	
Space heating - secondary	0.0000	0.0000	0.0000	(263)	
Water heating (other fuel)	857.1270	0.2160	185.1394	(264)	
Space and water heating			712.6012	(265)	
Pumps and fans	125.0000	0.5190	64.8750	(267)	
Energy for lighting	377.7688	0.5190	196.0620	(268)	
Energy saving/generation technologies					
PV Unit		-2006.7501	0.5190	-1041.5033	(269)
Total kg/year			-67.9651	(272)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2441.9527	1.2200	2979.1823 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	857.1270	1.2200	1045.6949 (264)
Space and water heating			4024.8772 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	377.7688	3.0700	1159.7502 (268)
Energy saving/generation technologies			
PV Unit	-2006.7501	3.0700	-6160.7228 (269)
Primary energy kWh/year			-592.3454 (272)
Primary energy kWh/m2/year			-7.3949 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	South East England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	117.5 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.62 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	309.46 (P1)
Transmission heat loss coefficient	52.96 (37)
Summer heat loss coefficient	362.42 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.9300	86.6589	0.7300	0.7200	0.7650	123.2437
South	6.1140	118.3991	0.7300	0.7200	0.7650	261.9588

total: 385.2025

Solar gains	Jun 405	Jul 385	Aug 354	(P3)
Internal gains	430	412	421	
Total summer gains	835	798	775	(P5)

Summer gain/loss ratio	2.30	2.20	2.14	(P6)
Summer external temperature	15.40	17.40	17.50	
Thermal mass temperature increment (TMP = 117.5)	1.18	1.18	1.18	
Threshold temperature	18.88	20.78	20.82	(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	633 - PRJ012992		Issued on Date	01/02/2023	
Assessment Reference	633	Prop Type Ref	Bellflower		
Property	Lancing Phase 2, BN15				
SAP Rating	84 B	DER	17.21	TER	18.27
Environmental	87 B	% DER<TER	5.78		
CO₂ Emissions (t/year)	1.16	DFEE	43.82	TFEE	49.93
General Requirements Compliance	Pass	% DFEE<TFEE	12.24		
Assessor Details	Chris Nicholls, , Tel: ,		Assessor ID	T850-0001	
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)	18.27	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.21	kgCO ₂ /m ²	Pass
	-1.06 (-5.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.93	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.82	kWh/m ² /yr	
	-6.1 (-12.2%)	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	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.35 (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

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

3.93 m², No overhang

Windows facing South

6.11 m², No overhang

Air change rate

4.62 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

0.10

W/m²K

Door U-value

1.09

W/m²K