

PREDICTED ENERGY ASSESSMENT

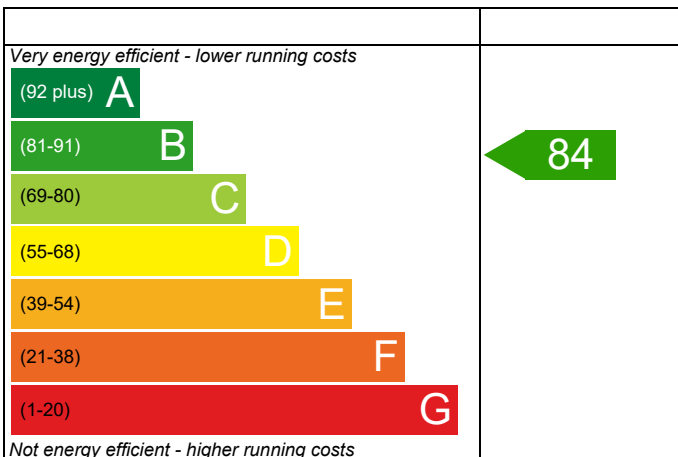
Plot 181

Dwelling type: House, Semi-Detached
Date of assessment: 27/09/2022
Produced by: Scott Binstead
Total floor area: 93.02 m²

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

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

Energy Efficiency Rating

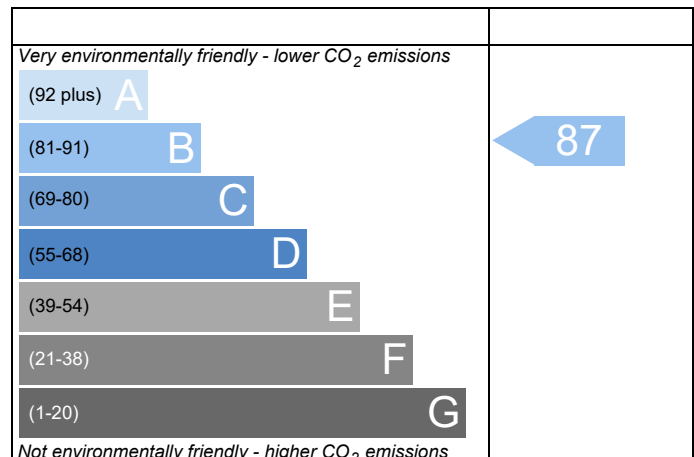


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	181 - PRJ010636				Issued on Date	27/09/2022
Assessment Reference	181 S	Prop Type Ref	Sutherland			
Property	Plot 181					
SAP Rating		84 B	DER	16.64	TER	17.70
Environmental		87 B	% DER<TER	6.00		
CO ₂ Emissions (t/year)		1.27	DFEE	41.97	TFEE	49.69
General Requirements Compliance		Pass	% DFEE<TFEE	15.54		
Assessor Details	Chris Nicholls, , Tel: ,				Assessor ID	U903-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 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) 17.70 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.64 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.27 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South West England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 4.05 m², No overhang
Windows facing South West: 3.95 m², No overhang
Air change rate: 3.87 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
Thermal bridging y-value 0.024 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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4520	0.4431	0.4342	0.3899	0.3811	0.3368	0.3368	0.3279	0.3545	0.3811	0.3988	0.4165 (22b)
Effective ac	0.6021	0.5982	0.5943	0.5760	0.5726	0.5567	0.5567	0.5538	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
129.7215 (35)
4.4280 (36)
(33) + (36) = 53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.9148	44.6190	44.3290	42.9670	42.7122	41.5259	41.5259	41.3062	41.9829	42.7122	43.2277	43.7667 (38)
Heat transfer coeff	98.3876	98.0917	97.8018	96.4398	96.1849	94.9987	94.9987	94.7790	95.4556	96.1849	96.7004	97.2394 (39)
Average = Sum(39)m / 12 =												96.4385 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0577	1.0545	1.0514	1.0368	1.0340	1.0213	1.0213	1.0189	1.0262	1.0340	1.0396	1.0454 (40)
HLP (average)												1.0368 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838 (61)
Total heat required for water heating calculated for each month											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (64)
Heat gains from water heating, kWh/month											
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8110	22.9251	18.6440	14.1147	10.5509	8.9075	9.6249	12.5108	16.7919	21.3212	24.8850	26.5284	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	412.3194	409.7139	394.3506	369.8319	344.9436	321.3222	306.3007	312.9955	325.9288	350.6702	378.8652	400.0000	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			4.0460	11.2829	0.7600	0.7200	0.7700	17.3112 (75)				
Southwest			3.9540	36.7938	0.7600	0.7200	0.7700	55.1685 (79)				
Solar gains	72.4797	129.2098	192.0638	263.5766	318.5946	326.5689	310.5700	267.9527	216.5813	146.9224	87.8611	61.3499 (83)
Total gains	484.7991	538.9237	586.4144	633.4085	663.5381	647.8911	616.8706	580.9482	542.5102	497.5927	466.7263	461.3500 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.0679	34.1707	34.2720	34.7560	34.8481	35.2832	35.2832	35.3650	35.1143	34.8481	34.6623	34.4702
alpha	3.2712	3.2780	3.2848	3.3171	3.3232	3.3522	3.3522	3.3577	3.3410	3.3232	3.3108	3.2980
util living area	0.9869	0.9804	0.9670	0.9351	0.8680	0.7452	0.6050	0.6504	0.8380	0.9481	0.9801	0.9889 (86)
MIT	19.0495	19.2383	19.5720	20.0315	20.4627	20.7880	20.9242	20.9015	20.6550	20.1084	19.5068	19.0207 (87)
Th 2	20.0355	20.0381	20.0407	20.0528	20.0551	20.0656	20.0656	20.0676	20.0616	20.0551	20.0505	20.0457 (88)
util rest of house	0.9845	0.9767	0.9604	0.9210	0.8362	0.6789	0.5013	0.5504	0.7877	0.9341	0.9758	0.9868 (89)
MIT 2	18.2420	18.4313	18.7636	19.2232	19.6354	19.9312	20.0318	20.0204	19.8219	19.3051	18.7085	18.2208 (90)
Living area fraction	18.3909	18.5800	18.9127	19.3722	19.7879	20.0892	20.1963	20.1828	19.9755	19.4532	18.8557	18.3683 (91)
MIT	18.3909	18.5800	18.9127	19.3722	19.7879	20.0892	20.1963	20.1828	19.9755	19.4532	18.8557	18.3683 (92)
Temperature adjustment	18.2409	18.4300	18.7627	19.2222	19.6379	19.9392	20.0463	20.0328	19.8255	19.3032	18.7057	-0.1500
adjusted MIT	18.2409	18.4300	18.7627	19.2222	19.6379	19.9392	20.0463	20.0328	19.8255	19.3032	18.7057	18.2183 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9782	0.9684	0.9489	0.9054	0.8194	0.6687	0.4989	0.5462	0.7725	0.9195	0.9673	0.9813	(94)
Useful gains	474.2357	521.8819	556.4421	573.4746	543.7257	433.2493	307.7732	317.3398	419.0723	457.5392	451.4497	452.7003	(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	1371.6120	1327.1854	1199.3098	995.4745	763.5110	507.2150	327.3930	344.3163	546.5305	837.1135	1122.2757	1363.1314	(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	667.6480	541.1639	478.2936	303.8399	163.5202	0.0000	0.0000	0.0000	0.0000	282.4032	482.9947	677.3608	(98)
Space heating												3597.2244	(98)
Space heating per m2												(98) / (4) =	38.6715 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3974.8336 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	667.6480	541.1639	478.2936	303.8399	163.5202	0.0000	0.0000	0.0000	0.0000	282.4032	482.9947	677.3608	(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)	737.7326	597.9712	528.5012	335.7347	180.6853	0.0000	0.0000	0.0000	0.0000	312.0478	533.6958	748.4650	(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	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(64)
Efficiency of water heater (217)m	89.8202	89.7771	89.6830	89.4693	89.0266	87.3000	87.3000	87.3000	87.3000	89.3907	89.6973	87.3000	(216)
Fuel for water heating, kWh/month	193.4157	169.6970	176.3703	155.6389	151.2069	134.7537	126.5505	142.8310	143.8320	161.6861	173.9297	187.7637	(219)
Water heating fuel used												1917.6754	(219)
Annual totals kWh/year													
Space heating fuel - main system												3974.8336	(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)												455.8311	(232)
Total delivered energy for all uses												6423.3401	(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	3974.8336	0.2160	858.5640 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1917.6754	0.2160	414.2179 (264)
Space and water heating			1272.7819 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Total CO2, kg/year			1548.2833 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6400 (273)

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

DER		16.6400	ZC1
Total Floor Area	TFA	93.0200	
Assumed number of occupants	N	2.6648	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5774	ZC2
CO2 emissions from cooking, equation (L16)		1.9668	ZC3
Total CO2 emissions		34.1842	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1842	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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1327 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3827 (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) =					0.3540 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.4514	0.4425	0.4337	0.3894	0.3806	0.3363	0.3363	0.3275	0.3540	0.3806	0.3983	0.4160 (22b)					
Effective ac	0.6019	0.5979	0.5940	0.5758	0.5724	0.5566	0.5566	0.5536	0.5627	0.5724	0.5793	0.5865 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			4.2000	1.0000	4.2000		(26)					
TER Opening Type (Uw = 1.40)			8.0000	1.3258	10.6061		(27)					
Flr - Ground			46.5070	0.1300	6.0459		(28a)					
Wl - Brick	94.2940	12.2040	82.0900	0.1800	14.7762		(29a)					
Rf - Ins Joist	46.5070		46.5070	0.1300	6.0459		(30)					
Total net area of external elements Aum(A, m2)			187.3040				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.6741		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3555 (36)					
Total fabric heat loss						(33) + (36) =	51.0296 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.8950	Feb 44.5999	Mar 44.3107	Apr 42.9522	May 42.6981	Jun 41.5149	Jul 41.5149	Aug 41.2958	Sep 41.9706	Oct 42.6981	Nov 43.2122	Dec 43.7498 (38)
Heat transfer coeff	95.9246	95.6295	95.3403	93.9818	93.7277	92.5445	92.5445	92.3254	93.0002	93.7277	94.2418	94.7794 (39)
Average = Sum(39)m / 12 =												93.9806 (39)
HLP	Jan 1.0312	Feb 1.0281	Mar 1.0249	Apr 1.0103	May 1.0076	Jun 0.9949	Jul 0.9949	Aug 0.9925	Sep 0.9998	Oct 1.0076	Nov 1.0131	Dec 1.0189 (40)
HLP (average)												1.0103 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)												Total = Sum(45)m = 1533.8973 (45)
Distribution loss	$(46)m = 0.15 \times (45)m$											
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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												

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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	46.0274	50.6734	47.1157	46.6990	43.2695	44.7119	46.6990	47.1157	50.6734	49.3151	50.9589 (61)
Solar input	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732 (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	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732 (64)
	65.6180	57.7545	60.3918	53.3854	51.5971	45.2674	43.1009	48.3068	48.8485	55.8694	59.4861	63.9495 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9541	23.0522	18.7473	14.1929	10.6094	8.9569	9.6782	12.5801	16.8850	21.4394	25.0230	26.6755	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	88.1962	85.9442	81.1718	74.1464	69.3510	62.8713	57.9314	64.9285	67.8451	75.0932	82.6195	85.9536	(72)
Total internal gains	424.6483	422.0318	406.5603	381.3680	355.8058	331.5238	316.5161	323.8777	337.4934	362.9084	391.2015	412.3380	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.0460	11.2829	0.6300	0.7000	0.7700	13.9515 (75)			
Southwest				3.9540	36.7938	0.6300	0.7000	0.7700	44.4614 (79)			
Solar gains	58.4129	104.1329	154.7882	212.4220	256.7621	263.1888	250.2949	215.9488	174.5474	118.4079	70.8091	49.4432 (83)
Total gains	483.0612	526.1647	561.3485	593.7900	612.5679	594.7126	566.8109	539.8265	512.0409	481.3163	462.0106	461.7812 (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	67.3417	67.5495	67.7544	68.7337	68.9201	69.8013	69.8013	69.9669	69.4592	68.9201	68.5441	68.1554	
alpha	5.4894	5.5033	5.5170	5.5822	5.5947	5.6534	5.6534	5.6645	5.6306	5.5947	5.5696	5.5437	
util living area	0.9990	0.9982	0.9959	0.9871	0.9542	0.8480	0.6833	0.7327	0.9270	0.9901	0.9980	0.9993	(86)
MIT	19.8449	19.9526	20.1493	20.4291	20.7024	20.9086	20.9793	20.9697	20.8266	20.4836	20.1211	19.8303	(87)
Th 2	20.0574	20.0600	20.0626	20.0747	20.0770	20.0876	20.0876	20.0896	20.0835	20.0770	20.0724	20.0676	(88)
util rest of house	0.9987	0.9976	0.9943	0.9816	0.9319	0.7754	0.5590	0.6130	0.8821	0.9849	0.9972	0.9990	(89)
MIT 2	18.5020	18.6613	18.9505	19.3655	19.7517	20.0165	20.0786	20.0748	19.9242	19.4482	18.9171	18.4881	(90)
Living area fraction	18.7496	18.8994	19.1715	19.5616	19.9270	20.1810	20.2447	20.2398	20.0906	19.6391	19.1391	18.7356	(91)
MIT	18.7496	18.8994	19.1715	19.5616	19.9270	20.1810	20.2447	20.2398	20.0906	19.6391	19.1391	18.7356	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7496	18.8994	19.1715	19.5616	19.9270	20.1810	20.2447	20.2398	20.0906	19.6391	19.1391	18.7356	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9964	0.9921	0.9773	0.9273	0.7839	0.5818	0.6345	0.8826	0.9813	0.9960	0.9984	(94)
Ext temp.	482.0943	524.2886	556.9392	580.3232	568.0636	466.2038	329.7983	342.5411	451.9163	472.3104	460.1674	461.0637	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1386.0684	1338.7547	1208.1076	1001.9994	771.0944	516.4880	337.2956	354.5079	557.1259	847.2099	1134.5823	1377.6747	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	672.5567	547.3212	484.4693	303.6069	151.0549	0.0000	0.0000	0.0000	0.0000	278.9252	485.5787	681.9586	(98)
Space heating per m2												3605.4715	(98)
												38.7602	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													3860.2479 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	672.5567	547.3212	484.4693	303.6069	151.0549	0.0000	0.0000	0.0000	0.0000	278.9252	485.5787	681.9586	(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)	720.0821	585.9970	518.7037	325.0609	161.7290	0.0000	0.0000	0.0000	0.0000	298.6351	519.8915	730.1484	(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	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732	(64)
Efficiency of water heater (217)m	87.7732	87.6148	87.2594	86.4634	84.8032	80.3000	80.3000	80.3000	80.3000	86.1418	87.2986	87.8465	(216)
Fuel for water heating, kWh/month	239.2431	211.2864	222.5578	199.2147	196.6511	182.9122	175.2438	195.3558	197.5133	209.6559	218.9514	233.3311	(219)
Water heating fuel used												2481.9166	(219)
Annual totals kWh/year													
Space heating fuel - main system												3860.2479	(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)												458.3582	(232)
Total delivered energy for all uses												6875.5226	(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	3860.2479	0.2160	833.8135 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2481.9166	0.2160	536.0940 (264)
Space and water heating			1369.9075 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	458.3582	0.5190	237.8879 (268)
Total CO2, kg/m2/year			1646.7204 (272)
Emissions per m2 for space and water heating			14.7270 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5574 (272b)
Emissions per m2 for pumps and fans			0.4185 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7270 * 1.00) + 2.5574 + 0.4185, rounded to 2 d.p.			17.7000 (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4520	0.4431	0.4342	0.3899	0.3811	0.3368	0.3368	0.3279	0.3545	0.3811	0.3988	0.4165 (22b)
Effective ac	0.6021	0.5982	0.5943	0.5760	0.5726	0.5567	0.5567	0.5538	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss						(33) + (36) =	53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.9148	44.6190	44.3290	42.9670	42.7122	41.5259	41.5259	41.3062	41.9829	42.7122	43.2277	43.7667 (38)
Heat transfer coeff	98.3876	98.0917	97.8018	96.4398	96.1849	94.9987	94.9987	94.7790	95.4556	96.1849	96.7004	97.2394 (39)
Average = Sum(39)m / 12 =												96.4385 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0577	1.0545	1.0514	1.0368	1.0340	1.0213	1.0213	1.0189	1.0262	1.0340	1.0396	1.0454 (40)
HLP (average)												1.0368 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.7944	29.5568	30.4999	26.5906	25.5143	22.0169	20.4019	23.4115	23.6911	27.6097	30.1381	32.7280 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8110	22.9251	18.6440	14.1147	10.5509	8.9075	9.6249	12.5108	16.7919	21.3212	24.8850	26.5284	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	45.4225	43.9833	40.9945	36.9314	34.2934	30.5790	27.4219	31.4670	32.9043	37.1098	41.8585	43.9893	(72)
Total internal gains	378.7316	376.9438	363.2797	341.0748	317.6898	296.1821	282.9532	287.3469	299.4595	321.8067	347.3025	367.2266	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast				4.0460	11.2829	0.7600	0.7200			0.7700			17.3112 (75)
Southwest				3.9540	36.7938	0.7600	0.7200			0.7700			55.1685 (79)
Solar gains	72.4797	129.2098	192.0638	263.5766	318.5946	326.5689	310.5700	267.9527	216.5813	146.9224	87.8611	61.3499 (83)	
Total gains	451.2113	506.1536	555.3435	604.6514	636.2843	622.7510	593.5232	555.2996	516.0408	468.7291	435.1636	428.5765 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.0679	34.1707	34.2720	34.7560	34.8481	35.2832	35.2832	35.3650	35.1143	34.8481	34.6623	34.4702	
alpha	3.2712	3.2780	3.2848	3.3171	3.3232	3.3522	3.3522	3.3577	3.3410	3.3232	3.3108	3.2980	
util living area	0.9894	0.9836	0.9715	0.9422	0.8792	0.7609	0.6221	0.6702	0.8533	0.9555	0.9837	0.9910	(86)
MIT	18.9959	19.1871	19.5257	19.9934	20.4348	20.7729	20.9174	20.8918	20.6309	20.0681	19.4574	18.9678	(87)
Th 2	20.0355	20.0381	20.0407	20.0528	20.0551	20.0656	20.0656	20.0676	20.0616	20.0551	20.0505	20.0457	(88)
util rest of house	0.9874	0.9805	0.9657	0.9293	0.8492	0.6959	0.5176	0.5702	0.8057	0.9432	0.9801	0.9893	(89)
MIT 2	18.1888	18.3808	18.7185	19.1871	19.6109	19.9203	20.0283	20.0151	19.8024	19.2668	18.6598	18.1683	(90)
Living area fraction	18.3376	18.5294	18.8673	19.3357	19.7628	20.0775	20.1923	20.1767	19.9552	19.4145	18.8069	18.3157	(91)
MIT	18.3376	18.5294	18.8673	19.3357	19.7628	20.0775	20.1923	20.1767	19.9552	19.4145	18.8069	18.3157	(92)
Temperature adjustment	18.3376	18.5294	18.8673	19.3357	19.7628	20.0775	20.1923	20.1767	19.9552	19.4145	18.8069	18.3157	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	443.3238	492.9177	531.1926	554.5619	533.3440	433.9756	316.3303	323.7907	412.4903	437.0416	423.6729	422.1910	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1381.1273	1336.9344	1209.5472	1006.4199	775.5225	520.3537	341.2600	357.9540	558.9078	847.8240	1132.0579	1372.6025	(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	697.7258	567.1792	504.6958	325.3377	180.1808	0.0000	0.0000	0.0000	0.0000	305.6221	510.0372	707.1062	(98)
Space heating													3797.8849 (98)
Space heating per m2													40.8287 (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	892.9874	702.9901	720.3203	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7416	0.8149	0.7869	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	662.2495	572.8716	566.8048	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	830.6412	794.4742	752.1346	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	121.2420	164.8724	137.8854	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												423.9997 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	30.3105	41.2181	34.4713	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												105.9999 (107)
Space cooling per m2												1.1395 (108)
Energy for space heating												40.8287 (99)
Energy for space cooling												1.1395 (108)
Total												41.9682 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1327 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3827 (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) =					0.3540 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.4514	0.4425	0.4337	0.3894	0.3806	0.3363	0.3363	0.3275	0.3540	0.3806	0.3983	0.4160 (22b)					
Effective ac	0.6019	0.5979	0.5940	0.5758	0.5724	0.5566	0.5566	0.5536	0.5627	0.5724	0.5793	0.5865 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			4.2000	1.0000	4.2000		(26)					
TER Opening Type (Uw = 1.40)			8.0000	1.3258	10.6061		(27)					
Flr - Ground			46.5070	0.1300	6.0459		(28a)					
Wl - Brick	94.2940	12.2040	82.0900	0.1800	14.7762		(29a)					
Rf - Ins Joist	46.5070		46.5070	0.1300	6.0459		(30)					
Total net area of external elements Aum(A, m2)			187.3040				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.6741		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3555 (36)					
Total fabric heat loss						(33) + (36) =	51.0296 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.8950	Feb 44.5999	Mar 44.3107	Apr 42.9522	May 42.6981	Jun 41.5149	Jul 41.5149	Aug 41.2958	Sep 41.9706	Oct 42.6981	Nov 43.2122	Dec 43.7498 (38)
Heat transfer coeff	95.9246	95.6295	95.3403	93.9818	93.7277	92.5445	92.5445	92.3254	93.0002	93.7277	94.2418	94.7794 (39)
Average = Sum(39)m / 12 =												93.9806 (39)
HLP	Jan 1.0312	Feb 1.0281	Mar 1.0249	Apr 1.0103	May 1.0076	Jun 0.9949	Jul 0.9949	Aug 0.9925	Sep 0.9998	Oct 1.0076	Nov 1.0131	Dec 1.0189 (40)
HLP (average)												1.0103 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
Daily hot water use	Jan 107.2390	Feb 103.3394	Mar 99.4398	Apr 95.5402	May 91.6406	Jun 87.7410	Jul 87.7410	Aug 91.6406	Sep 95.5402	Oct 99.4398	Nov 103.3394	Dec 107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)												Total = Sum(45)m = 1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (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 (59)
	33.7944	29.5568	30.4999	26.5906	25.5143	22.0169	20.4019	23.4115	23.6911	27.6097	30.1381	32.7280 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9541	23.0522	18.7473	14.1929	10.6094	8.9569	9.6782	12.5801	16.8850	21.4394	25.0230	26.6755	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	45.4225	43.9833	40.9945	36.9314	34.2934	30.5790	27.4219	31.4670	32.9043	37.1098	41.8585	43.9893	(72)
Total internal gains	378.8747	377.0709	363.3831	341.1530	317.7482	296.2315	283.0066	287.4162	299.5526	321.9249	347.4405	367.3737	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.0460	11.2829	0.6300	0.7000	0.7700	13.9515 (75)
Southwest	3.9540	36.7938	0.6300	0.7000	0.7700	44.4614 (79)

Solar gains	58.4129	104.1329	154.7882	212.4220	256.7621	263.1888	250.2949	215.9488	174.5474	118.4079	70.8091	49.4432	(83)
Total gains	437.2876	481.2038	518.1713	553.5750	574.5103	559.4203	533.3015	503.3650	474.1000	440.3328	418.2496	416.8169	(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	67.3417	67.5495	67.7544	68.7337	68.9201	69.8013	69.8013	69.9669	69.4592	68.9201	68.5441	68.1554	
alpha	5.4894	5.5033	5.5170	5.5822	5.5947	5.6534	5.6534	5.6645	5.6306	5.5947	5.5696	5.5437	
util living area	0.9994	0.9989	0.9972	0.9907	0.9646	0.8728	0.7164	0.7694	0.9451	0.9935	0.9988	0.9996	(86)
MIT	19.7979	19.9065	20.1056	20.3901	20.6709	20.8919	20.9739	20.9611	20.7990	20.4431	20.0762	19.7840	(87)
Th 2	20.0574	20.0600	20.0626	20.0747	20.0770	20.0876	20.0876	20.0896	20.0835	20.0770	20.0724	20.0676	(88)
util rest of house	0.9992	0.9985	0.9961	0.9865	0.9464	0.8057	0.5907	0.6509	0.9082	0.9900	0.9983	0.9994	(89)
MIT 2	18.9485	19.0592	19.2599	19.5525	19.8268	20.0283	20.0796	20.0760	19.9528	19.6081	19.2389	18.9429	(90)
Living area fraction	19.1051	19.2154	19.4158	19.7069	19.9824	20.1875	20.2445	20.2392	fLA = Living area / (4) =			0.1844	(91)
MIT	19.1051	19.2154	19.4158	19.7069	19.9824	20.1875	20.2445	20.2392	20.1088	19.7621	19.3932	19.0980	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1051	19.2154	19.4158	19.7069	19.9824	20.1875	20.2445	20.2392	20.1088	19.7621	19.3932	19.0980	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	436.8167	480.2133	515.6310	544.9072	542.3769	455.5608	327.5141	338.5382	431.1977	435.1573	417.3312	416.4776	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1420.1705	1368.9742	1231.4004	1015.6534	776.2904	517.0926	337.2743	354.4566	558.8238	858.7399	1158.5380	1412.0221	(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	731.6152	597.2473	532.5324	338.9373	174.0317	0.0000	0.0000	0.0000	0.0000	315.1454	533.6689	740.6851	(98)
Space heating												3963.8634	(98)
Space heating per m2												42.6130	(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	869.9181	684.8291	701.6728	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7847	0.8724	0.8437	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.6285	597.4211	591.9939	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	756.6840	724.1562	691.5241	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	53.3199	94.2909	74.0505	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												221.6614	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

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	13.3300	23.5727	18.5126	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											55.4153 (107)
Space cooling per m2											0.5957 (108)
Energy for space heating											42.6130 (99)
Energy for space cooling											0.5957 (108)
Total											43.2088 (109)
Target Fabric Energy Efficiency (TFEE)											49.7 (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =		0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000 (22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750 (22a)
Adj infilt rate	0.5317	0.4963	0.4963	0.4431	0.4431	0.3899	0.3899	0.3811	0.4165	0.4785	0.4874	0.5229 (22b)
Effective ac	0.6414	0.6231	0.6231	0.5982	0.5982	0.5760	0.5760	0.5726	0.5867	0.6145	0.6188	0.6367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
129.7215 (35)
4.4280 (36)
(33) + (36) = 53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.8410	46.4819	46.4819	44.6190	44.6190	42.9670	42.9670	42.7122	43.7667	45.8375	46.1568	47.4924 (38)
Heat transfer coeff	101.3137	99.9546	99.9546	98.0917	98.0917	96.4398	96.4398	96.1849	97.2394	99.3102	99.6295	100.9652 (39)
Average = Sum(39)m / 12 =												98.6346 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0892	1.0745	1.0745	1.0545	1.0545	1.0368	1.0368	1.0340	1.0454	1.0676	1.0711	1.0854 (40)
HLP (average)												1.0604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838	14.6790 (61)
Total heat required for water heating calculated for each month	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]			Area m2			Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast			4.0460			15.4538	0.7600	0.7200			0.7700			23.7105 (75)
Southwest			3.9540			47.2368	0.7600	0.7200			0.7700			70.8266 (79)

Solar gains	94.5371	142.9050	213.4086	298.7868	344.3441	377.4980	332.0507	305.1288	247.8182	165.3513	110.5208	76.9627	(83)	
Total gains	709.9891	752.6723	798.2416	845.6024	852.4623	851.5753	786.8685	769.7205	734.9144	690.6875	677.8610	675.8573	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.0840	33.5338	33.5338	34.1707	34.1707	34.7560	34.7560	34.8481	34.4702	33.7514	33.6433	33.1982
alpha	3.2056	3.2356	3.2356	3.2780	3.2780	3.3171	3.3171	3.3232	3.2980	3.2501	3.2429	3.2132
util living area	0.9507	0.9395	0.9162	0.8674	0.7836	0.6403	0.5419	0.5414	0.7000	0.8587	0.9244	0.9541 (86)
MIT	19.6155	19.7466	19.9702	20.3056	20.6234	20.8624	20.9385	20.9403	20.8186	20.4647	20.0510	19.6227 (87)
Th 2	20.0097	20.0217	20.0217	20.0381	20.0381	20.0528	20.0528	20.0551	20.0457	20.0274	20.0245	20.0128 (88)
util rest of house	0.9416	0.9285	0.9007	0.8425	0.7405	0.5709	0.4507	0.4483	0.6301	0.8245	0.9081	0.9453 (89)
MIT 2	18.7809	18.9174	19.1342	19.4666	19.7581	19.9697	20.0243	20.0279	19.9340	19.6139	19.2192	18.7912 (90)
Living area fraction	18.9347	19.0703	19.2883	19.6213	19.9176	20.1343	20.1928	20.1961	20.0971	19.7708	19.3726	18.9445 (91)
MIT	18.9347	19.0703	19.2883	19.6213	19.9176	20.1343	20.1928	20.1961	20.0971	19.7708	19.3726	18.9445 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7847	18.9203	19.1383	19.4713	19.7676	19.9843	20.0428	20.0461	19.9471	19.6208	19.2226	18.7945 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	658.3025	687.1734	705.3290	697.8142	619.5784	481.5604	353.8170	344.3365	457.1802	557.6957	604.2265	629.4553	(94)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	1285.1389	1251.4622	1163.3028	997.7197	771.7512	528.9020	370.6001	360.3195	519.9483	776.6829	1018.4699	1251.4095	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	466.3663	379.2020	340.7325	215.9319	113.2166	0.0000	0.0000	0.0000	0.0000	162.9264	298.2553	462.7339	(98)
Space heating												2439.3651	(98)
RHI space heating demand												2439	(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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4520	0.4431	0.4342	0.3899	0.3811	0.3368	0.3368	0.3279	0.3545	0.3811	0.3988	0.4165 (22b)
Effective ac	0.6021	0.5982	0.5943	0.5760	0.5726	0.5567	0.5567	0.5538	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
129.7215 (35)
4.4280 (36)
(33) + (36) = 53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.9148	44.6190	44.3290	42.9670	42.7122	41.5259	41.5259	41.3062	41.9829	42.7122	43.2277	43.7667 (38)
Heat transfer coeff	98.3876	98.0917	97.8018	96.4398	96.1849	94.9987	94.9987	94.7790	95.4556	96.1849	96.7004	97.2394 (39)
Average = Sum(39)m / 12 =												96.4385 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0577	1.0545	1.0514	1.0368	1.0340	1.0213	1.0213	1.0189	1.0262	1.0340	1.0396	1.0454 (40)
HLP (average)												1.0368 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838 (61)
Total heat required for water heating calculated for each month											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (64)
Heat gains from water heating, kWh/month											
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					4.0460	11.2829	0.7600	0.7200			0.7700			17.3112 (75)
Southwest					3.9540	36.7938	0.7600	0.7200			0.7700			55.1685 (79)
Solar gains	72.4797	129.2098	192.0638	263.5766	318.5946	326.5689	310.5700	267.9527	216.5813	146.9224	87.8611	61.3499 (83)		
Total gains	687.9317	738.9771	776.8967	810.3922	826.7128	800.6462	765.3878	732.5444	703.6775	672.2586	655.2013	660.2445 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.0679	34.1707	34.2720	34.7560	34.8481	35.2832	35.2832	35.3650	35.1143	34.8481	34.6623	34.4702
alpha	3.2712	3.2780	3.2848	3.3171	3.3232	3.3522	3.3522	3.3577	3.3410	3.3232	3.3108	3.2980
util living area	0.9655	0.9541	0.9322	0.8850	0.7980	0.6554	0.5110	0.5481	0.7436	0.8933	0.9503	0.9693 (86)
MIT	19.3606	19.5345	19.8357	20.2420	20.6039	20.8590	20.9544	20.9415	20.7710	20.3256	19.7850	19.3297 (87)
Th 2	20.0355	20.0381	20.0407	20.0528	20.0551	20.0656	20.0656	20.0676	20.0616	20.0551	20.0505	20.0457 (88)
util rest of house	0.9596	0.9463	0.9202	0.8633	0.7577	0.5856	0.4153	0.4533	0.6823	0.8690	0.9405	0.9641 (89)
MIT 2	18.5483	18.7211	19.0181	19.4192	19.7561	19.9803	20.0464	20.0412	19.9112	19.5064	18.9793	18.5256 (90)
Living area fraction	fLA = Living area / (4) =											0.1844 (91)
MIT	18.6980	18.8711	19.1689	19.5709	19.9124	20.1423	20.2138	20.2072	20.0697	19.6575	19.1279	18.6739 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5480	18.7211	19.0189	19.4209	19.7624	19.9923	20.0638	20.0572	19.9197	19.5075	18.9779	18.5239 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9479	0.9328	0.9044	0.8462	0.7435	0.5796	0.4151	0.4522	0.6719	0.8519	0.9265	0.9533	(94)
Useful gains	652.0829	689.2814	702.5897	685.7635	614.6801	464.0704	317.6946	331.2340	472.7823	572.7012	607.0400	629.3856	(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	1401.8303	1355.7333	1224.3676	1014.6337	775.4831	512.2630	329.0552	346.6287	555.5244	856.7637	1148.5947	1392.8429	(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	557.8121	447.8557	388.2028	236.7866	119.6374	0.0000	0.0000	0.0000	0.0000	211.3425	389.9194	568.0122	(98)
Space heating												2919.5686	(98)
Space heating per m2												(98) / (4) =	31.3865 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3226.0427 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	557.8121	447.8557	388.2028	236.7866	119.6374	0.0000	0.0000	0.0000	0.0000	211.3425	389.9194	568.0122 (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)	616.3670	494.8682	428.9533	261.6426	132.1961	0.0000	0.0000	0.0000	0.0000	233.5276	430.8502	627.6378 (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	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (64)
Efficiency of water heater (217)m	89.7190	89.6657	89.5497	89.2880	88.7771	87.3000	87.3000	87.3000	87.3000	89.1725	89.5618	87.3000 (216)
Fuel for water heating, kWh/month	193.6338	169.9078	176.6328	155.9550	151.6318	134.7537	126.5505	142.8310	143.8320	162.0818	174.1927	187.9660 (219)
Water heating fuel used												1919.9688 (219)
Annual totals kWh/year												
Space heating fuel - main system												3226.0427 (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)												455.8311 (232)
Total delivered energy for all uses												5676.8426 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3226.0427	3.4800	112.2663 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1919.9688	3.4800	66.8149 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	455.8311	13.1900	60.1241 (250)
Additional standing charges			120.0000 (251)
Total energy cost			369.0978 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)	
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.1232 (257)	
SAP value	84.3317	
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	3226.0427	0.2160	696.8252 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1919.9688	0.2160	414.7133 (264)
Space and water heating			1111.5385 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Total kg/year			1387.0398 (272)
CO2 emissions per m2			14.9100 (273)
EI value			86.5336
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	$3.48 / 0.8872 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8872 = 0.2435$, 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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =		0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000 (22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750 (22a)
Adj infilt rate	0.5317	0.4963	0.4963	0.4431	0.4431	0.3899	0.3899	0.3811	0.4165	0.4785	0.4874	0.5229 (22b)
Effective ac	0.6414	0.6231	0.6231	0.5982	0.5982	0.5760	0.5760	0.5726	0.5867	0.6145	0.6188	0.6367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss							(33) + (36) = 53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.8410	46.4819	46.4819	44.6190	44.6190	42.9670	42.9670	42.7122	43.7667	45.8375	46.1568	47.4924 (38)
Heat transfer coeff	101.3137	99.9546	99.9546	98.0917	98.0917	96.4398	96.4398	96.1849	97.2394	99.3102	99.6295	100.9652 (39)
Average = Sum(39)m / 12 =												98.6346 (39)
HLP	1.0892	1.0745	1.0745	1.0545	1.0545	1.0368	1.0368	1.0340	1.0454	1.0676	1.0711	1.0854 (40)
HLP (average)												1.0604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838 (61)
Total heat required for water heating calculated for each month											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102 (64)
Heat gains from water heating, kWh/month	56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032 (64)
Total per year (kWh/year) = Sum(64)m =	1705.7242 (64)										
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

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

Northeast					4.0460	15.4538	0.7600	0.7200			0.7700			23.7105 (75)
Southwest					3.9540	47.2368	0.7600	0.7200			0.7700			70.8266 (79)

Solar gains	94.5371	142.9050	213.4086	298.7868	344.3441	377.4980	332.0507	305.1288	247.8182	165.3513	110.5208	76.9627	(83)	
Total gains	709.9891	752.6723	798.2416	845.6024	852.4623	851.5753	786.8685	769.7205	734.9144	690.6875	677.8610	675.8573	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.0840	33.5338	33.5338	34.1707	34.1707	34.7560	34.7560	34.8481	34.4702	33.7514	33.6433	33.1982	
alpha	3.2056	3.2356	3.2356	3.2780	3.2780	3.3171	3.3171	3.3232	3.2980	3.2501	3.2429	3.2132	
util living area	0.9507	0.9395	0.9162	0.8674	0.7836	0.6403	0.5419	0.5414	0.7000	0.8587	0.9244	0.9541	(86)
MIT	19.6155	19.7466	19.9702	20.3056	20.6234	20.8624	20.9385	20.9403	20.8186	20.4647	20.0510	19.6227	(87)
Th 2	20.0097	20.0217	20.0217	20.0381	20.0381	20.0528	20.0528	20.0551	20.0457	20.0274	20.0245	20.0128	(88)
util rest of house	0.9416	0.9285	0.9007	0.8425	0.7405	0.5709	0.4507	0.4483	0.6301	0.8245	0.9081	0.9453	(89)
MIT 2	18.7809	18.9174	19.1342	19.4666	19.7581	19.9697	20.0243	20.0279	19.9340	19.6139	19.2192	18.7912	(90)
Living area fraction	18.9347	19.0703	19.2883	19.6213	19.9176	20.1343	20.1928	20.1961	20.0971	19.7708	19.3726	18.9445	(91)
MIT	18.9347	19.0703	19.2883	19.6213	19.9176	20.1343	20.1928	20.1961	20.0971	19.7708	19.3726	18.9445	(92)
Temperature adjustment	18.7847	18.9203	19.1383	19.4713	19.7676	19.9843	20.0428	20.0461	19.9471	19.6208	19.2226	18.7945	(93)
adjusted MIT	18.7847	18.9203	19.1383	19.4713	19.7676	19.9843	20.0428	20.0461	19.9471	19.6208	19.2226	18.7945	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9272	0.9130	0.8836	0.8252	0.7268	0.5655	0.4497	0.4474	0.6221	0.8075	0.8914	0.9313	(94)
Useful gains	658.3025	687.1734	705.3290	697.8142	619.5784	481.5604	353.8170	344.3365	457.1802	557.6957	604.2265	629.4553	(95)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	1285.1389	1251.4622	1163.3028	997.7197	771.7512	528.9020	370.6001	360.3195	519.9483	776.6829	1018.4699	1251.4095	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	466.3663	379.2020	340.7325	215.9319	113.2166	0.0000	0.0000	0.0000	0.0000	162.9264	298.2553	462.7339	(98)
Space heating												2439.3651	(98)
Space heating per m2												26.2241	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2695.4310 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.3663	379.2020	340.7325	215.9319	113.2166	0.0000	0.0000	0.0000	0.0000	162.9264	298.2553	462.7339	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	515.3219	419.0078	376.5000	238.5988	125.1012	0.0000	0.0000	0.0000	0.0000	180.0292	329.5639	511.3082	(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	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(64)
Efficiency of water heater (217)m	89.6085	89.5591	89.4604	89.2179	88.7333	87.3000	87.3000	87.3000	87.3000	88.9670	89.3749	87.3000	(216)
Fuel for water heating, kWh/month	193.8726	170.1101	176.8093	156.0776	151.7066	134.7537	126.5505	142.8310	143.8320	162.4562	174.5571	188.2268	(219)
Water heating fuel used												1921.7833	(219)
Annual totals kWh/year													
Space heating fuel - main system												2695.4310	(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)												455.8311	(232)
Total delivered energy for all uses												5148.0454	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2695.4310	3.6300	97.8441 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1921.7833	3.6300	69.7607 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	455.8311	19.4400	88.6136 (250)
Additional standing charges			95.0000 (251)
Total energy cost			365.7984 (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	2695.4310	0.2160	582.2131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1921.7833	0.2160	415.1052 (264)
Space and water heating			997.3183 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Total kg/year			1272.8196 (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	2695.4310	1.2200	3288.4258 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1921.7833	1.2200	2344.5756 (264)
Space and water heating			5633.0014 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	455.8311	3.0700	1399.4015 (268)
Primary energy kWh/year			7262.6529 (272)
Primary energy kWh/m2/year			78.0763 (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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2	Wind turbine
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 27	-193 kg (15.2%)
U Solar photovoltaic panels	+ 9.7	-£ 380	-1014 kg (93.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£27	2.08 kg/m²	B 85 B 88
Solar photovoltaic panels	£380	10.90 kg/m²	A 95 A 97
Total Savings	£407	12.97 kg/m²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 97

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

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

	Current	Potential	Saving
Electricity	£103	£113	-£10
Mains gas	£263	£226	£37
Space heating	£207	£207	£0
Water heating	£70	£43	£27
Lighting	£89	£89	£0
Generated (PV)	-£0	-£380	£380
Total cost of fuels	£366	-£41	£407
Total cost of uses	£366	-£41	£407
Delivered energy	55 kWh/m²	24 kWh/m²	31 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m²	14 kg/m²	1 kg/m²	13 kg/m²
Primary energy	78 kWh/m²	2 kWh/m²	76 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4520	0.4431	0.4342	0.3899	0.3811	0.3368	0.3368	0.3279	0.3545	0.3811	0.3988	0.4165 (22b)
Effective ac	0.6021	0.5982	0.5943	0.5760	0.5726	0.5567	0.5567	0.5538	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss							(33) + (36) = 53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.9148	44.6190	44.3290	42.9670	42.7122	41.5259	41.5259	41.3062	41.9829	42.7122	43.2277	43.7667 (38)
Heat transfer coeff	98.3876	98.0917	97.8018	96.4398	96.1849	94.9987	94.9987	94.7790	95.4556	96.1849	96.7004	97.2394 (39)
Average = Sum(39)m / 12 =												96.4385 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0577	1.0545	1.0514	1.0368	1.0340	1.0213	1.0213	1.0189	1.0262	1.0340	1.0396	1.0454 (40)
HLP (average)												1.0368 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838 (61)
Total heat required for water heating calculated for each month											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-25.0098	-41.7341	-71.0780	-95.2585	-117.6839	-115.7020	-114.1730	-99.7535	-78.1270	-53.3515	-29.6652
Solar input (sum of months) = Sum(63)m =											
Output from w/h	148.7166	110.6149	87.0962	43.9906	16.9304	1.9380	0.0000	24.9379	47.4383	91.1808	126.3450
Heat gains from water heating, kWh/month	56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.0460	11.2829		0.7600		0.7200		0.7700		17.3112 (75)
Southwest				3.9540	36.7938		0.7600		0.7200		0.7700		55.1685 (79)
Solar gains	72.4797	129.2098	192.0638	263.5766	318.5946	326.5689	310.5700	267.9527	216.5813	146.9224	87.8611		61.3499 (83)
Total gains	687.9317	738.9771	776.8967	810.3922	826.7128	800.6462	765.3878	732.5444	703.6775	672.2586	655.2013		660.2445 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.0679	34.1707	34.2720	34.7560	34.8481	35.2832	35.2832	35.3650	35.1143	34.8481	34.6623	34.4702	
alpha	3.2712	3.2780	3.2848	3.3171	3.3232	3.3522	3.3522	3.3577	3.3410	3.3232	3.3108	3.2980	
util living area	0.9655	0.9541	0.9322	0.8850	0.7980	0.6554	0.5110	0.5481	0.7436	0.8933	0.9503	0.9693	(86)
MIT	19.3606	19.5345	19.8357	20.2420	20.6039	20.8590	20.9544	20.9415	20.7710	20.3256	19.7850	19.3297	(87)
Th 2	20.0355	20.0381	20.0407	20.0528	20.0551	20.0656	20.0656	20.0676	20.0616	20.0551	20.0505	20.0457	(88)
util rest of house	0.9596	0.9463	0.9202	0.8633	0.7577	0.5856	0.4153	0.4533	0.6823	0.8690	0.9405	0.9641	(89)
MIT 2	18.5483	18.7211	19.0181	19.4192	19.7561	19.9803	20.0464	20.0412	19.9112	19.5064	18.9793	18.5256	(90)
Living area fraction	18.6980	18.8711	19.1689	19.5709	19.9124	20.1423	20.2138	20.2072	20.0697	19.6575	19.1279	18.6739	(91)
MIT	18.6980	18.8711	19.1689	19.5709	19.9124	20.1423	20.2138	20.2072	20.0697	19.6575	19.1279	18.6739	(92)
Temperature adjustment	18.5480	18.7211	19.0189	19.4209	19.7624	19.9923	20.0638	20.0572	19.9197	19.5075	18.9779	18.5239	(93)
adjusted MIT	18.5480	18.7211	19.0189	19.4209	19.7624	19.9923	20.0638	20.0572	19.9197	19.5075	18.9779	18.5239	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9479	0.9328	0.9044	0.8462	0.7435	0.5796	0.4151	0.4522	0.6719	0.8519	0.9265	0.9533	(94)
Useful gains	652.0829	689.2814	702.5897	685.7635	614.6801	464.0704	317.6946	331.2340	472.7823	572.7012	607.0400	629.3856	(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	1401.8303	1355.7333	1224.3676	1014.6337	775.4831	512.2630	329.0552	346.6287	555.5244	856.7637	1148.5947	1392.8429	(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	557.8121	447.8557	388.2028	236.7866	119.6374	0.0000	0.0000	0.0000	0.0000	211.3425	389.9194	568.0122	(98)
Space heating												2919.5686	(98)
Space heating per m2												31.3865	(99)

(98) / (4) = 31.3865 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3226.0427 (211)
Space heating requirement	557.8121	447.8557	388.2028	236.7866	119.6374	0.0000	0.0000	0.0000	0.0000	211.3425	389.9194	568.0122	(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)	616.3670	494.8682	428.9533	261.6426	132.1961	0.0000	0.0000	0.0000	0.0000	233.5276	430.8502	627.6378	(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	148.7166	110.6149	87.0962	43.9906	16.9304	1.9380	0.0000	24.9379	47.4383	91.1808	126.3450	147.7644	(64)
Efficiency of water heater	89.8071	89.8477	89.8962	89.9832	90.0906	87.3000	87.3000	87.3000	87.3000	89.5111	89.6954	89.8203	(217)
Fuel for water heating, kWh/month	165.5956	123.1138	96.8853	48.8875	18.7926	2.2199	0.0000	28.5658	54.3394	101.8654	140.8601	164.5111	(219)
Water heating fuel used												945.6366	(219)
Annual totals kWh/year													
Space heating fuel - main system													3226.0427 (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)													455.8311 (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													3025.2710 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3226.0427	3.4800	112.2663 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	945.6366	3.4800	32.9082 (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	455.8311	13.1900	60.1241 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			113.9632 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.3468 (257)
SAP value			95.1622
SAP rating (Section 12)			95 (258)
SAP band			A

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

Energy Emission factor Emissions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3226.0427	0.2160	696.8252 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	945.6366	0.2160	204.2575 (264)
Space and water heating			901.0827 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			306.0968 (272)
CO2 emissions per m2			3.2900 (273)
EI value			97.0282
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (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) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000 (22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750 (22a)
Adj infilt rate	0.5317	0.4963	0.4963	0.4431	0.4431	0.3899	0.3899	0.3811	0.4165	0.4785	0.4874	0.5229 (22b)
Effective ac	0.6414	0.6231	0.6231	0.5982	0.5982	0.5760	0.5760	0.5726	0.5867	0.6145	0.6188	0.6367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
129.7215 (35)
4.4280 (36)
(33) + (36) = 53.4727 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.8410	46.4819	46.4819	44.6190	44.6190	42.9670	42.9670	42.7122	43.7667	45.8375	46.1568	47.4924 (38)
Heat transfer coeff	101.3137	99.9546	99.9546	98.0917	98.0917	96.4398	96.4398	96.1849	97.2394	99.3102	99.6295	100.9652 (39)
Average = Sum(39)m / 12 =												98.6346 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0892	1.0745	1.0745	1.0545	1.0545	1.0368	1.0368	1.0340	1.0454	1.0676	1.0711	1.0854 (40)
HLP (average)												1.0604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum (45)m = 1533.8973 (45)											
Distribution loss (46)m = 0.15 x (45)m												
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021	(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	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838	(61)
Total heat required for water heating calculated for each month												
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(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												1220.6462 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2050.6856 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3369 (H8)
Utilisation factor												0.5267 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4900 (H14)
Volume ratio Veff/V												0.7693 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input												-899.8793 (H17)
Solar input	-30.5351	-43.0841	-73.2535	-99.4252	-116.6614	-122.5577	-111.8944	-104.3839	-82.6599	-55.9281	-34.9072	-24.5889 (63)
Solar input (sum of months) = Sum (63)m =												-899.8793 (63)
Output from w/h												
143.1912	109.2650	84.9207	39.8239	17.9529	0.0000	0.0000	20.3076	42.9054	88.6043	121.1030	144.1044	(64)
Total per year (kWh/year) = Sum (64)m =												812.1785 (64)
Heat gains from water heating, kWh/month												
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795	(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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF			Access factor Table 6d	Gains W	
Northeast					4.0460	15.4538	0.7600		0.7200			0.7700	23.7105	(75)
Southwest					3.9540	47.2368	0.7600		0.7200			0.7700	70.8266	(79)
Solar gains	94.5371	142.9050	213.4086	298.7868	344.3441	377.4980	332.0507	305.1288	247.8182	165.3513	110.5208		76.9627	(83)
Total gains	709.9891	752.6723	798.2416	845.6024	852.4623	851.5753	786.8685	769.7205	734.9144	690.6875	677.8610		675.8573	(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	33.0840	33.5338	33.5338	34.1707	34.1707	34.7560	34.7560	34.8481	34.4702	33.7514	33.6433	33.1982	
alpha	3.2056	3.2356	3.2356	3.2780	3.2780	3.3171	3.3171	3.3232	3.2980	3.2501	3.2429	3.2132	
util living area	0.9507	0.9395	0.9162	0.8674	0.7836	0.6403	0.5419	0.5414	0.7000	0.8587	0.9244	0.9541	(86)
MIT	19.6155	19.7466	19.9702	20.3056	20.6234	20.8624	20.9385	20.9403	20.8186	20.4647	20.0510	19.6227	(87)
Th 2	20.0097	20.0217	20.0217	20.0381	20.0381	20.0528	20.0528	20.0551	20.0457	20.0274	20.0245	20.0128	(88)
util rest of house	0.9416	0.9285	0.9007	0.8425	0.7405	0.5709	0.4507	0.4483	0.6301	0.8245	0.9081	0.9453	(89)
MIT 2	18.7809	18.9174	19.1342	19.4666	19.7581	19.9697	20.0243	20.0279	19.9340	19.6139	19.2192	18.7912	(90)
Living area fraction	18.9347	19.0703	19.2883	19.6213	19.9176	20.1343	20.1928	20.1961	fLA = Living area / (4) =	19.7708	19.3726	18.9445	(91)
MIT	18.9347	19.0703	19.2883	19.6213	19.9176	20.1343	20.1928	20.1961	20.0971	19.7708	19.3726	18.9445	(92)
Temperature adjustment	18.7847	18.9203	19.1383	19.4713	19.7676	19.9843	20.0428	20.0461	19.9471	19.6208	19.2226	18.7945	(93)
adjusted MIT	18.7847	18.9203	19.1383	19.4713	19.7676	19.9843	20.0428	20.0461	19.9471	19.6208	19.2226	18.7945	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9272	0.9130	0.8836	0.8252	0.7268	0.5655	0.4497	0.4474	0.6221	0.8075	0.8914	0.9313	(94)
Useful gains	658.3025	687.1734	705.3290	697.8142	619.5784	481.5604	353.8170	344.3365	457.1802	557.6957	604.2265	629.4553	(95)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	1285.1389	1251.4622	1163.3028	997.7197	771.7512	528.9020	370.6001	360.3195	519.9483	776.6829	1018.4699	1251.4095	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	466.3663	379.2020	340.7325	215.9319	113.2166	0.0000	0.0000	0.0000	0.0000	162.9264	298.2553	462.7339	(98)
Space heating												2439.3651	(98)
Space heating per m2											(98) / (4) =	26.2241	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2695.4310	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	466.3663	379.2020	340.7325	215.9319	113.2166	0.0000	0.0000	0.0000	0.0000	162.9264	298.2553	462.7339	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	515.3219	419.0078	376.5000	238.5988	125.1012	0.0000	0.0000	0.0000	0.0000	180.0292	329.5639	511.3082	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	143.1912	109.2650	84.9207	39.8239	17.9529	0.0000	0.0000	20.3076	42.9054	88.6043	121.1030	144.1044	(64)	
Efficiency of water heater	89.7274	89.7640	89.8430	89.9864	90.0482	87.3000	87.3000	87.3000	87.3000	89.3463	89.5521	89.7190	(217)	
Fuel for water heating, kWh/month	159.5848	121.7247	94.5213	44.2555	19.9370	0.0000	0.0000	23.2618	49.1470	99.1695	135.2320	160.6174	(219)	
Water heating fuel used												907.4510	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2695.4310	(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)													455.8311	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1221 * 0.80) =									-1953.0339			-1953.0339	(233)	
Total delivered energy for all uses												2230.6792	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2695.4310	3.6300	97.8441	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	907.4510	3.6300	32.9405	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	455.8311	19.4400	88.6136	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1953.0339	19.4400	-379.6698	(252)
Total energy cost			-40.9716	(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	2695.4310	0.2160	582.2131	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	907.4510	0.2160	196.0094	(264)
Space and water heating			778.2225	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	455.8311	0.5190	236.5763	(268)
Energy saving/generation technologies				
PV Unit	-1953.0339	0.5190	-1013.6246	(269)
Total kg/year			66.0493	(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	2695.4310	1.2200	3288.4258 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	907.4510	1.2200	1107.0902 (264)
Space and water heating			4395.5160 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	455.8311	3.0700	1399.4015 (268)
Energy saving/generation technologies			
PV Unit	-1953.0339	3.0700	-5995.8141 (269)
Primary energy kWh/year			182.8534 (272)
Primary energy kWh/m2/year			1.9657 (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 West England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	129.7 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	3.87 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	288.53 (P1)
Transmission heat loss coefficient	53.47 (37)
Summer heat loss coefficient	342.01 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Shading	Gains W
North East	4.0460	99.9042	0.7600	0.7200	0.7650	152.2859
South West	3.9540	119.2277	0.7600	0.7200	0.7650	177.6086
total:						329.8945

	Jun	Jul	Aug	
Solar gains	375	330	303	(P3/P4)
Internal gains	471	452	462	
Total summer gains	846	782	765	(P5)
Summer gain/loss ratio	2.47	2.29	2.24	(P6)
Summer external temperature	14.50	16.20	16.30	
Thermal mass temperature increment (TMP = 129.7)	1.09	1.09	1.09	
Threshold temperature	18.07	19.58	19.63	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	181 - PRJ010636				Issued on Date	27/09/2022
Assessment Reference	181 S			Prop Type Ref	Sutherland	
Property	Plot 181					
SAP Rating	84 B	DER	16.64	TER	17.70	
Environmental	87 B	% DER<TER	6.00			
CO ₂ Emissions (t/year)	1.27	DFEE	41.97	TFEE	49.69	
General Requirements Compliance	Pass	% DFEE<TFEE	15.54			
Assessor Details	Chris Nicholls , Tel: ,				Assessor ID	U903-0001
Client						

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.70	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.64	kgCO ₂ /m ²	Pass
	-1.06 (-6.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.69	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	41.97	kWh/m ² /yr	
	-7.7 (-15.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.27 (max. 2.00)	1.30 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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 West England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North East

4.05 m², No overhang

Windows facing South West

3.95 m², No overhang

Air change rate

3.87 ach

Blinds/curtains

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

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Thermal bridging y-value

0.024

W/m²K