



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 35 Shaw Road, West End
Southampton, SO30 3JZ

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 01/03/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 88			Issued on Date	01/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)		
Property	35 Shaw Road, West End, Southampton, SO30 3JZ				
SAP Rating	87 B	DER	14.86	TER	19.71
Environmental	89 B	% DER<TER	24.59		
CO ₂ Emissions (t/year)	0.74	DFEE	45.09	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	19.05		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

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)	19.71	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.86	kgCO ₂ /m ²	Pass
	-4.85 (-24.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.70	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.09	kWh/m ² /yr	
	-10.6 (-19.0%)	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	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (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	4.09 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

7.49 m², No overhang

Windows facing East

1.32 m², No overhang

Windows facing South

3.43 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

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

4.09 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.65

kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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Environmental	89 B	% DER<TER	24.59		
CO ₂ Emissions (t/year)	0.74	DFEE	45.09	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	19.05		

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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.098	1.26	0.12	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.053	3.75	0.20	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	3.60	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.060	1.51	0.09	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.034	7.61	0.26	CD0027
External wall	E4 Jamb	Independently assessed	0.039	27.30	1.06	CD0028
External wall	E5 Ground floor (normal)	Independently assessed	0.037	16.78	0.62	Knauf P7
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.78	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.40	0.50	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	8.46	0.46	CD0031
External wall	E16 Corner (normal)	Independently assessed	0.050	10.10	0.51	CD0035
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.10	0.61	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.46	1.35	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.46	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.049	8.46	0.41	CD0020

Total: **6.35** W/mK:
Y-Value: **0.041** W/m²K:

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 70 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) 19.71 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.86 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.1 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	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (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: 4.09 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Data from database

Worcester Greenstar 36CDi Compact ErP

Combi boiler

Efficiency: 89.8% 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 (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North: 7.49 m², No overhang

Windows facing East: 1.32 m², No overhang

Windows facing South: 3.43 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Photovoltaic array 0.65 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.0900
Infiltration rate					0.4295 (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) =	0.3973 (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	0.5066	0.4966	0.4867	0.4370	0.4271	0.3774	0.3774	0.3675	0.3973	0.4271	0.4470	0.4668 (22b)
Effective ac	0.6283	0.6233	0.6184	0.5955	0.5912	0.5712	0.5712	0.5675	0.5789	0.5912	0.5999	0.6090 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.1400			9.0000	739.2600 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11772.9940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5633 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3519 (36)
Total fabric heat loss (33) + (36) = 47.3598 (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	36.8566	36.5643	36.2778	34.9322	34.6805	33.5085	33.5085	33.2915	33.9600	34.6805	35.1898	35.7222 (38)
Heat transfer coeff	84.2163	83.9241	83.6376	82.2920	82.0403	80.8683	80.8683	80.6513	81.3197	82.0403	82.5496	83.0820 (39)
Average = Sum(39)m / 12 =												82.2908 (39)
HLP	1.1986	1.1945	1.1904	1.1712	1.1677	1.1510	1.1510	1.1479	1.1574	1.1677	1.1749	1.1825 (40)
HLP (average)												1.1712 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1703.3310 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	348.9929	346.9897	334.5953	314.6711	294.5432	275.0836	262.4070	268.0804	278.2877	298.4122	321.5150	338.7447	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)			
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	430.2642	489.2669	541.4015	594.4117	631.6072	620.7583	591.0316	551.8468	509.8093	458.7445	419.5121	407.8989 (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	38.8319	38.9671	39.1006	39.7399	39.8618	40.4395	40.4395	40.5483	40.2150	39.8618	39.6159	39.3620	
alpha	3.5888	3.5978	3.6067	3.6493	3.6575	3.6960	3.6960	3.7032	3.6810	3.6575	3.6411	3.6241	
util living area	0.9901	0.9833	0.9691	0.9325	0.8526	0.7105	0.5616	0.6124	0.8224	0.9494	0.9836	0.9918	(86)
MIT	19.2484	19.4440	19.7682	20.2061	20.5959	20.8617	20.9568	20.9402	20.7440	20.2481	19.6796	19.2221	(87)
Th 2	19.9211	19.9244	19.9277	19.9431	19.9460	19.9594	19.9594	19.9619	19.9542	19.9460	19.9401	19.9340	(88)
util rest of house	0.9877	0.9794	0.9614	0.9147	0.8114	0.6297	0.4452	0.4972	0.7587	0.9324	0.9790	0.9898	(89)
MIT 2	18.3300	18.5264	18.8490	19.2865	19.6507	19.8825	19.9440	19.9386	19.7931	19.3357	18.7735	18.3136	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	18.5224	18.7187	19.0416	19.4791	19.8487	20.0877	20.1562	20.1485	19.9923	19.5269	18.9633	18.5039	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5224	18.7187	19.0416	19.4791	19.8487	20.0877	20.1562	20.1485	19.9923	19.5269	18.9633	18.5039	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9736	0.9532	0.9051	0.8070	0.6406	0.4685	0.5195	0.7613	0.9239	0.9734	0.9863	(94)
Useful gains	423.2056	476.3436	516.0845	537.9942	509.7148	397.6386	276.9181	286.6753	388.1418	423.8202	408.3465	402.3015	(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	1197.7602	1159.7176	1048.9467	870.5775	668.5238	443.7774	287.5832	302.3184	479.1601	732.3627	979.3110	1188.3966	(97)
Month fracti	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	576.2686	459.2273	396.4495	239.4600	118.1539	0.0000	0.0000	0.0000	0.0000	229.5557	411.0944	584.8548	(98)
Space heating												3015.0641	(98)
Space heating per m2												42.9130	(99)
(98) / (4) =													

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3324.2163 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	576.2686	459.2273	396.4495	239.4600	118.1539	0.0000	0.0000	0.0000	0.0000	229.5557	411.0944	584.8548 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	635.3568	506.3146	437.0998	264.0132	130.2689	0.0000	0.0000	0.0000	0.0000	253.0933	453.2463	644.8233 (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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Efficiency of water heater (217)m	90.0448	89.9943	89.8892	89.6504	89.1827	87.9000	87.9000	87.9000	87.9000	89.5981	89.9187	87.9000 (216)
Fuel for water heating, kWh/month	189.4518	166.6489	174.2231	155.2101	151.8885	136.2303	129.4443	143.9639	144.3172	161.1132	171.4890	184.3884 (219)
Water heating fuel used												1908.3687 (219)
Annual totals kWh/year												
Space heating fuel - main system												3324.2163 (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)												319.9724 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.65 * 1080 * 1.00) =												-561.3528
Total delivered energy for all uses												-561.3528 (233)
												5066.2046 (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	3324.2163	0.2160	718.0307 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1908.3687	0.2160	412.2076 (264)
Space and water heating			1130.2384 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-561.3528	0.5190	-291.3421 (269)
Total CO2, kg/year			1043.8869 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8600 (273)

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

DER		14.8600 ZC1
Total Floor Area	TFA	70.2600
Assumed number of occupants	N	2.2524
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.6913 ZC2
CO2 emissions from cooking, equation (L16)		2.4631 ZC3
Total CO2 emissions		34.0144 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		34.0144 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) =	0.1688 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4188 (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) =					0.3874 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22)				
Adj infilt rate	0.4939	0.4842	0.4745	0.4261	0.4164	0.3680	0.3680	0.3583	0.3874	0.4164	0.4358	0.4551	(22a)				
Effective ac	0.6220	0.6172	0.6126	0.5908	0.5867	0.5677	0.5677	0.5642	0.5750	0.5867	0.5950	0.6036	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			12.2400	1.3258	16.2273		(27)					
Ground Floor			35.1300	0.1300	4.5669		(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.1800	12.6990		(29a)					
Pitched Roof	35.1300		35.1300	0.1300	4.5669		(30)					
Total net area of external elements Aum(A, m2)			155.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.1801		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1549 (36)					
Total fabric heat loss						(33) + (36) =	49.3350 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.4843	Feb 36.2065	Mar 35.9342	Apr 34.6552	May 34.4159	Jun 33.3019	Jul 33.3019	Aug 33.0956	Sep 33.7310	Oct 34.4159	Nov 34.9000	Dec 35.4061 (38)
Heat transfer coeff	85.8193	85.5415	85.2692	83.9901	83.7508	82.6369	82.6369	82.4306	83.0659	83.7508	84.2349	84.7411 (39)
Average = Sum(39)m / 12 =												83.9890 (39)
HLP	Jan 1.2215	Feb 1.2175	Mar 1.2136	Apr 1.1954	May 1.1920	Jun 1.1762	Jul 1.1762	Aug 1.1732	Sep 1.1823	Oct 1.1920	Nov 1.1989	Dec 1.2061 (40)
HLP (average)												1.1954 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	49.1572	42.7855	45.5822	42.3819	42.0071	38.9222	40.2196	42.0071	42.3819	45.5822	45.8417	49.1572 (61)
Solar input	192.2113	167.9015	174.6907	154.9418	150.0110	132.1213	126.5823	141.1096	142.6680	162.4559	173.4185	187.6975 (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	192.2113	167.9015	174.6907	154.9418	150.0110	132.1213	126.5823	141.1096	142.6680	162.4559	173.4185	187.6975 (64)
	59.8548	52.2975	54.3241	48.0216	46.4131	40.7193	38.7705	43.4534	43.9406	50.2561	53.8797	58.3539 (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	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	80.4500	77.8236	73.0163	66.6967	62.3832	56.5545	52.1109	58.4050	61.0286	67.5485	74.8329	78.4327	(72)
Total internal gains	356.2576	353.6590	340.6715	320.1555	299.4333	279.3804	266.7083	272.9746	283.7784	304.4947	328.1878	346.0118	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					7.4900	10.6334	0.6300	0.7000			0.7700			24.3403 (74)
East					1.3200	19.6403	0.6300	0.7000			0.7700			7.9231 (76)
South					3.4300	46.7521	0.6300	0.7000			0.7700			49.0080 (78)
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)	
Total gains	437.5289	495.9362	547.4778	599.8962	636.4972	625.0552	595.3329	556.7410	515.3000	464.8270	426.1850	415.1660	(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	56.8540	57.0386	57.2208	58.0921	58.2581	59.0435	59.0435	59.1912	58.7385	58.2581	57.9233	57.5774	
alpha	4.7903	4.8026	4.8147	4.8728	4.8839	4.9362	4.9362	4.9461	4.9159	4.8839	4.8616	4.8385	
util living area	0.9976	0.9952	0.9889	0.9671	0.9019	0.7554	0.5887	0.6449	0.8719	0.9777	0.9953	0.9982	(86)
MIT	19.6849	19.8332	20.0816	20.4218	20.7283	20.9246	20.9826	20.9732	20.8354	20.4475	20.0107	19.6646	(87)
Th 2	19.9029	19.9060	19.9091	19.9237	19.9264	19.9391	19.9391	19.9415	19.9342	19.9264	19.9209	19.9151	(88)
util rest of house	0.9968	0.9936	0.9848	0.9539	0.8612	0.6633	0.4579	0.5139	0.8045	0.9663	0.9934	0.9976	(89)
MIT 2	18.1579	18.3765	18.7397	19.2370	19.6528	19.8873	19.9326	19.9301	19.7978	19.2815	18.6467	18.1369	(90)
Living area fraction	18.4778	18.6817	19.0208	19.4852	19.8781	20.1046	20.1526	20.1487	20.0152	19.5258	18.9325	18.4570	(91)
MIT	18.4778	18.6817	19.0208	19.4852	19.8781	20.1046	20.1526	20.1487	20.0152	19.5258	18.9325	18.4570	(92)
Temperature adjustment	18.4778	18.6817	19.0208	19.4852	19.8781	20.1046	20.1526	20.1487	20.0152	19.5258	18.9325	18.4570	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	435.4355	491.4156	536.5493	568.0444	546.7324	424.4746	288.9633	301.2957	417.7010	446.4354	422.2356	413.6113	(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	1216.7311	1178.9039	1067.6399	889.0562	684.9212	454.8812	293.5717	309.0039	491.3525	747.5408	996.7108	1208.1499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	581.2840	461.9921	395.1314	231.1285	102.8125	0.0000	0.0000	0.0000	0.0000	224.0224	413.6221	591.1367	(98)
Space heating												3001.1297	(98)
Space heating per m2												42.7146	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3213.2009 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	581.2840	461.9921	395.1314	231.1285	102.8125	0.0000	0.0000	0.0000	0.0000	224.0224	413.6221	591.1367 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	622.3597	494.6382	423.0529	247.4609	110.0776	0.0000	0.0000	0.0000	0.0000	239.8527	442.8503	632.9086 (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	192.2113	167.9015	174.6907	154.9418	150.0110	132.1213	126.5823	141.1096	142.6680	162.4559	173.4185	187.6975 (64)
Efficiency of water heater (217)m	87.6601	87.4675	87.0436	86.0560	84.1220	80.3000	80.3000	80.3000	80.3000	85.8605	87.1614	80.3000 (216)
Fuel for water heating, kWh/month	219.2688	191.9588	200.6933	180.0476	178.3255	164.5346	157.6367	175.7280	177.6687	189.2092	198.9625	213.9237 (219)
Water heating fuel used												2247.9575 (219)
Annual totals kWh/year												
Space heating fuel - main system												3213.2009 (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)												319.9724 (232)
Total delivered energy for all uses												5856.1308 (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	3213.2009	0.2160	694.0514 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2247.9575	0.2160	485.5588 (264)
Space and water heating			1179.6102 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Total CO2, kg/m2/year			1384.6009 (272)
Emissions per m2 for space and water heating			16.7892 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3636 (272b)
Emissions per m2 for pumps and fans			0.5540 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7892 * 1.00) + 2.3636 + 0.5540, rounded to 2 d.p.			19.7100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) = 0.1688 (8)
Pressure test					Yes
Measured/design AP50					4.0900
Infiltration rate					0.3733 (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) =	0.3453 (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	0.4402	0.4316	0.4230	0.3798	0.3712	0.3280	0.3280	0.3194	0.3453	0.3712	0.3884	0.4057 (22b)
Effective ac	0.5969	0.5931	0.5894	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5754	0.5823 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.1400			9.0000	739.2600 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			9.0000	316.1700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11456.8240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 163.0633 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3519 (36)
Total fabric heat loss (33) + (36) = 47.3598 (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	35.0141	34.7934	34.5770	33.5609	33.3707	32.4857	32.4857	32.3218	32.8266	33.3707	33.7554	34.1575 (38)
Heat transfer coeff	82.3739	82.1532	81.9368	80.9206	80.7305	79.8455	79.8455	79.6816	80.1864	80.7305	81.1151	81.5172 (39)
Average = Sum(39)m / 12 =												80.9197 (39)
HLP	1.1724	1.1693	1.1662	1.1517	1.1490	1.1364	1.1364	1.1341	1.1413	1.1490	1.1545	1.1602 (40)
HLP (average)												1.1517 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.3990	26.5871	27.4356	23.9190	22.9508	19.8048	18.3521	21.0593	21.3108	24.8357	27.1101	29.4398 (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	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	40.8589	39.5642	36.8757	33.2208	30.8479	27.5067	24.6668	28.3055	29.5983	33.3813	37.6529	39.5696	(72)
Total internal gains	313.6664	312.3996	301.5310	283.6796	264.8980	247.3326	236.2642	239.8751	249.3481	267.3275	288.0078	304.1488	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)
East	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)
South	3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)
Total gains	394.9378	454.6768	508.3372	563.4202	601.9619	593.0073	564.8888	523.6415	480.8697	427.6598	386.0049	373.3030	(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	38.6342	38.7380	38.8403	39.3281	39.4207	39.8576	39.8576	39.9396	39.6882	39.4207	39.2338	39.0402	
alpha	3.5756	3.5825	3.5894	3.6219	3.6280	3.6572	3.6572	3.6626	3.6459	3.6280	3.6156	3.6027	
util living area	0.9917	0.9856	0.9723	0.9378	0.8611	0.7234	0.5754	0.6298	0.8361	0.9556	0.9863	0.9933	(86)
MIT	19.1962	19.3956	19.7261	20.1694	20.5714	20.8483	20.9514	20.9320	20.7206	20.2054	19.6248	19.1636	(87)
Th 2	19.9421	19.9447	19.9471	19.9588	19.9610	19.9712	19.9712	19.9731	19.9673	19.9610	19.9566	19.9520	(88)
util rest of house	0.9898	0.9822	0.9655	0.9214	0.8222	0.6446	0.4594	0.5154	0.7761	0.9407	0.9825	0.9917	(89)
MIT 2	18.2967	18.4965	18.8253	19.2664	19.6438	19.8850	19.9533	19.9457	19.7876	19.3093	18.7346	18.2716	(90)
Living area fraction	18.4852	18.6849	19.0140	19.4556	19.8382	20.0868	20.1624	20.1523	19.9830	19.4971	18.9211	18.4585	(91)
MIT	18.4852	18.6849	19.0140	19.4556	19.8382	20.0868	20.1624	20.1523	19.9830	19.4971	18.9211	18.4585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4852	18.6849	19.0140	19.4556	19.8382	20.0868	20.1624	20.1523	19.9830	19.4971	18.9211	18.4585	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9862	0.9769	0.9577	0.9117	0.8168	0.6544	0.4823	0.5370	0.7772	0.9322	0.9774	0.9886	(94)
Ext temp.	389.4930	444.1666	486.8228	513.6567	491.7008	388.0639	272.4664	281.2160	373.7178	398.6566	377.2815	369.0461	(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	1168.4890	1132.4698	1025.3585	854.1666	656.9988	438.0984	284.4426	298.9906	471.7389	718.2652	958.8710	1162.3124	(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	579.5731	462.5398	400.6706	245.1671	122.9818	0.0000	0.0000	0.0000	0.0000	237.7888	418.7445	590.1901	(98)
Space heating per m2												3057.6557	(98)
												43.5192	(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	750.5472	590.8563	605.5798	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7987	0.8647	0.8364	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	599.4351	510.9386	506.4849	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	776.9995	742.4568	695.6632	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	127.8464	172.2496	140.7487	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												440.8446 (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	31.9616	43.0624	35.1872	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												110.2112 (107)
Space cooling per m2												1.5686 (108)
Energy for space heating												43.5192 (99)
Energy for space cooling												1.5686 (108)
Total												45.0878 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) =	0.1688 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4188 (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) =					0.3874 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4939	0.4842	0.4745	0.4261	0.4164	0.3680	0.3680	0.3583	0.3874	0.4164	0.4358	0.4551	(22b)				
Effective ac	0.6220	0.6172	0.6126	0.5908	0.5867	0.5677	0.5677	0.5642	0.5750	0.5867	0.5950	0.6036	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			12.2400	1.3258	16.2273		(27)					
Ground Floor			35.1300	0.1300	4.5669		(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.1800	12.6990		(29a)					
Pitched Roof	35.1300		35.1300	0.1300	4.5669		(30)					
Total net area of external elements Aum(A, m2)			155.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.1801		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1549 (36)					
Total fabric heat loss						(33) + (36) =	49.3350 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.4843	Feb 36.2065	Mar 35.9342	Apr 34.6552	May 34.4159	Jun 33.3019	Jul 33.3019	Aug 33.0956	Sep 33.7310	Oct 34.4159	Nov 34.9000	Dec 35.4061 (38)
Heat transfer coeff	85.8193	85.5415	85.2692	83.9901	83.7508	82.6369	82.6369	82.4306	83.0659	83.7508	84.2349	84.7411 (39)
Average = Sum(39)m / 12 =												83.9890 (39)
HLP	Jan 1.2215	Feb 1.2175	Mar 1.2136	Apr 1.1954	May 1.1920	Jun 1.1762	Jul 1.1762	Aug 1.1732	Sep 1.1823	Oct 1.1920	Nov 1.1989	Dec 1.2061 (40)
HLP (average)												1.1954 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (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 Built)

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)
	30.3990	26.5871	27.4356	23.9190	22.9508	19.8048	18.3521	21.0593	21.3108	24.8357	27.1101	29.4398 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621 (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)												
	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968 (71)
Water heating gains (Table 5)												
	40.8589	39.5642	36.8757	33.2208	30.8479	27.5067	24.6668	28.3055	29.5983	33.3813	37.6529	39.5696 (72)
Total internal gains	313.6664	312.3996	301.5310	283.6796	264.8980	247.3326	236.2642	239.8751	249.3481	267.3275	288.0078	304.1488 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
North	7.4900											24.3403 (74)
East	1.3200											7.9231 (76)
South	3.4300											49.0080 (78)

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	394.9378	454.6768	508.3372	563.4202	601.9619	593.0073	564.8888	523.6415	480.8697	427.6598	386.0049	373.3030 (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	56.8540	57.0386	57.2208	58.0921	58.2581	59.0435	59.0435	59.1912	58.7385	58.2581	57.9233	57.5774
alpha	4.7903	4.8026	4.8147	4.8728	4.8839	4.9362	4.9362	4.9461	4.9159	4.8839	4.8616	4.8385
util living area	0.9985	0.9967	0.9918	0.9740	0.9173	0.7807	0.6155	0.6767	0.8949	0.9840	0.9970	0.9989 (86)
MIT	19.6292	19.7799	20.0324	20.3802	20.6993	20.9123	20.9789	20.9669	20.8102	20.4028	19.9586	19.6097 (87)
Th 2	19.9029	19.9060	19.9091	19.9237	19.9264	19.9391	19.9391	19.9415	19.9342	19.9264	19.9209	19.9151 (88)
util rest of house	0.9980	0.9956	0.9887	0.9632	0.8808	0.6905	0.4811	0.5433	0.8342	0.9754	0.9957	0.9985 (89)
MIT 2	18.6561	18.8088	19.0624	19.4157	19.7158	19.8969	19.9336	19.9316	19.8233	19.4436	18.9992	18.6462 (90)
Living area fraction									fLA = Living area / (4) =			0.2095 (91)
MIT	18.8600	19.0122	19.2656	19.6178	19.9219	20.1096	20.1526	20.1485	20.0300	19.6446	19.2002	18.8481 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8600	19.0122	19.2656	19.6178	19.9219	20.1096	20.1526	20.1485	20.0300	19.6446	19.2002	18.8481 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9972	0.9943	0.9862	0.9593	0.8807	0.7067	0.5096	0.5715	0.8408	0.9724	0.9944	0.9979 (94)
Useful gains	393.8515	452.0627	501.3234	540.4667	530.1195	419.0627	287.8831	299.2467	404.3172	415.8363	383.8607	372.5226 (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	1249.5249	1207.1793	1088.5133	900.1855	688.5881	455.2998	293.5734	308.9933	492.5833	757.4895	1019.2621	1241.2924 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	636.6210	507.4384	436.8693	258.9975	117.9006	0.0000	0.0000	0.0000	0.0000	254.1900	457.4890	646.3648 (98)
Space heating												3315.8706 (98)
Space heating per m2										(98) / (4) =		47.1943 (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	776.7864	611.5127	626.4723	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8317	0.9010	0.8722	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	646.0198	550.9993	546.4236	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	776.9995	742.4568	695.6632	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	94.3053	142.4444	111.0343	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												347.7840 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.5763	35.6111	27.7586	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.9460 (107)
Space cooling per m2												1.2375 (108)
Energy for space heating												47.1943 (99)
Energy for space cooling												1.2375 (108)
Total												48.4318 (109)
Target Fabric Energy Efficiency (TFEE)												55.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2250 (8)	
Pressure test															Yes		
Measured/design AP50															4.0900		
Infiltration rate															0.4295 (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) =					0.3973 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)					
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)					
Adj infilt rate	0.4668	0.4370	0.4370	0.3973	0.4072	0.3874	0.3874	0.3774	0.3774	0.4072	0.3973	0.4072 (22b)					
Effective ac	0.6090	0.5955	0.5955	0.5789	0.5829	0.5750	0.5750	0.5712	0.5712	0.5829	0.5789	0.5829 (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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			12.2400	1.1450	14.0153			(27)					
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200	(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210	(29a)					
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830	(30)					
Total net area of external elements Aum(A, m2)			155.1700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079			(33)					
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000	(32)					
GF Stud			58.6700			9.0000	528.0300	(32c)					
First Floor			82.1400			9.0000	739.2600	(32c)					
Internal Floor 1			35.1300			18.0000	632.3400	(32d)					
Internal Ceiling 1			35.1300			18.0000	632.3400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11772.9940	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							167.5633	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3519	(36)					
Total fabric heat loss						(33) + (36) =	47.3598	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.7222	Feb 34.9322	Mar 34.9322	Apr 33.9600	May 34.1943	Jun 33.7314	Jul 33.7314	Aug 33.5085	Sep 33.5085	Oct 34.1943	Nov 33.9600	Dec 34.1943	(38)
Heat transfer coeff	83.0820	82.2920	82.2920	81.3197	81.5541	81.0911	81.0911	80.8683	80.8683	81.5541	81.3197	81.5541	(39)
Average = Sum(39)m / 12 =												81.5739	(39)
HLP	Jan 1.1825	Feb 1.1712	Mar 1.1712	Apr 1.1574	May 1.1607	Jun 1.1542	Jul 1.1542	Aug 1.1510	Sep 1.1510	Oct 1.1607	Nov 1.1574	Dec 1.1607	(40)
HLP (average)												1.1610	(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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

Distribution loss	(46)m = 0.15 x (45)m												
	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)	
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Output from w/h	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	Solar input (sum of months) = Sum(63)m =					0.0000 (63)
								126.5443	126.8548	144.3544	154.2007	166.0703 (64)	
								Total per year (kWh/year) = Sum(64)m =					1703.3310 (64)
RHI water heating demand												1703 (64)	
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)	

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.0900
Infiltration rate					0.4295 (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) =	0.3973 (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	0.5066	0.4966	0.4867	0.4370	0.4271	0.3774	0.3774	0.3675	0.3973	0.4271	0.4470	0.4668 (22b)
Effective ac	0.6283	0.6233	0.6184	0.5955	0.5912	0.5712	0.5712	0.5675	0.5789	0.5912	0.5999	0.6090 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.1400			9.0000	739.2600 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11772.9940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.5633 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3519 (36)
Total fabric heat loss						(33) + (36) =	47.3598 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.8566	36.5643	36.2778	34.9322	34.6805	33.5085	33.5085	33.2915	33.9600	34.6805	35.1898	35.7222 (38)
Average = Sum(39)m / 12 =	84.2163	83.9241	83.6376	82.2920	82.0403	80.8683	80.8683	80.6513	81.3197	82.0403	82.5496	83.0820 (39)
												82.2908 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1986	1.1945	1.1904	1.1712	1.1677	1.1510	1.1510	1.1479	1.1574	1.1677	1.1749	1.1825 (40)
HLP (average)												1.1712 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1703.3310 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				7.4900	10.6334	0.6300	0.7000	0.7700		24.3403 (74)		
East				1.3200	19.6403	0.6300	0.7000	0.7700		7.9231 (76)		
South				3.4300	46.7521	0.6300	0.7000	0.7700		49.0080 (78)		
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	593.9452	650.9206	695.9987	738.8135	765.4068	746.3898	713.1175	675.9599	640.9791	600.1096	571.4794	568.0343 (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	38.8319	38.9671	39.1006	39.7399	39.8618	40.4395	40.4395	40.5483	40.2150	39.8618	39.6159	39.3620	
alpha	3.5888	3.5978	3.6067	3.6493	3.6575	3.6960	3.6960	3.7032	3.6810	3.6575	3.6411	3.6241	
util living area	0.9733	0.9612	0.9377	0.8843	0.7840	0.6265	0.4791	0.5203	0.7312	0.8984	0.9587	0.9768	(86)
MIT	19.5201	19.7025	19.9973	20.3841	20.7068	20.9097	20.9743	20.9651	20.8333	20.4346	19.9226	19.4917	(87)
Th 2	19.9211	19.9244	19.9277	19.9431	19.9460	19.9594	19.9594	19.9619	19.9542	19.9460	19.9401	19.9340	(88)
util rest of house	0.9676	0.9529	0.9239	0.8579	0.7344	0.5453	0.3742	0.4145	0.6576	0.8697	0.9485	0.9718	(89)
MIT 2	18.5974	18.7787	19.0683	19.4485	19.7400	19.9116	19.9507	19.9491	19.8558	19.5052	19.0094	18.5795	(90)
Living area fraction	18.7908	18.9723	19.2630	19.6446	19.9426	20.1207	20.1652	20.1620	20.0606	19.6999	19.2008	18.7706	(92)
MIT	18.7908	18.9723	19.2630	19.6446	19.9426	20.1207	20.1652	20.1620	20.0606	19.6999	19.2008	18.7706	(93)
Temperature adjustment													
adjusted MIT	18.7908	18.9723	19.2630	19.6446	19.9426	20.1207	20.1652	20.1620	20.0606	19.6999	19.2008	18.7706	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	570.0667	614.2933	635.8180	627.4263	561.9828	416.9633	282.1802	294.5949	426.8154	517.1319	536.8781	548.0043	(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	1220.3578	1181.0007	1067.4635	884.1914	676.2243	446.4525	288.3106	303.4077	484.7138	746.5591	998.9118	1210.5561	(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	483.8166	380.8274	321.1442	184.8709	84.9957	0.0000	0.0000	0.0000	0.0000	170.6939	332.6643	492.9385	(98)
Space heating												2451.9514	(98)
Space heating per m2												34.8983	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2703.3642	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	483.8166	380.8274	321.1442	184.8709	84.9957	0.0000	0.0000	0.0000	0.0000	170.6939	332.6643	492.9385	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	533.4251	419.8758	354.0730	203.8268	93.7108	0.0000	0.0000	0.0000	0.0000	188.1961	366.7743	543.4824	(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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703	(64)
Efficiency of water heater	89.9530	89.8910	89.7627	89.4760	88.9588	87.9000	87.9000	87.9000	87.9000	89.3952	89.7941	87.9000	(216)
(217)m	89.9530	89.8910	89.7627	89.4760	88.9588	87.9000	87.9000	87.9000	87.9000	89.3952	89.7941	89.9777	(217)
Fuel for water heating, kWh/month	189.6451	166.8404	174.4686	155.5127	152.2707	136.2303	129.4443	143.9639	144.3172	161.4789	171.7270	184.5683	(219)
Water heating fuel used												1910.4674	(219)
Annual totals kWh/year													
Space heating fuel - main system												2703.3642	(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)												319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1080 * 1.00) =										-561.3528		-561.3528	(233)
Total delivered energy for all uses												4447.4513	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2703.3642	3.4800	94.0771 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1910.4674	3.4800	66.4843 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	319.9724	13.1900	42.2044 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-561.3528	13.1900	-74.0424 (252)
Total energy cost			258.6158 (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] =	0.9424	(257)
SAP value		86.8538	
SAP rating (Section 12)		87	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2703.3642	0.2160	583.9267 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1910.4674	0.2160	412.6610 (264)
Space and water heating			996.5876 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-561.3528	0.5190	-291.3421 (269)
Total kg/year			910.2362 (272)
CO2 emissions per m2			12.9600 (273)
EI value			89.4177
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8907 = 3.907$, stars = 4
Water heating environmental impact	$0.216 / 0.8907 = 0.2425$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.2250 (8)
Pressure test											Yes	
Measured/design AP50											4.0900	
Infiltration rate											0.4295	(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) =	0.3973 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.4668	0.4370	0.4370	0.3973	0.4072	0.3874	0.3874	0.3774	0.3774	0.4072	0.3973	0.4072 (22b)
Effective ac	0.6090	0.5955	0.5955	0.5789	0.5829	0.5750	0.5750	0.5712	0.5712	0.5829	0.5789	0.5829 (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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			12.2400	1.1450	14.0153			(27)					
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200	(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210	(29a)					
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830	(30)					
Total net area of external elements Aum(A, m2)			155.1700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079			(33)					
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000	(32)					
GF Stud			58.6700			9.0000	528.0300	(32c)					
First Floor			82.1400			9.0000	739.2600	(32c)					
Internal Floor 1			35.1300			18.0000	632.3400	(32d)					
Internal Ceiling 1			35.1300			18.0000	632.3400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11772.9940	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							167.5633	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3519	(36)					
Total fabric heat loss						(33) + (36) =	47.3598	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.7222	Feb 34.9322	Mar 34.9322	Apr 33.9600	May 34.1943	Jun 33.7314	Jul 33.7314	Aug 33.5085	Sep 33.5085	Oct 34.1943	Nov 33.9600	Dec 34.1943	(38)
Heat transfer coeff	83.0820	82.2920	82.2920	81.3197	81.5541	81.0911	81.0911	80.8683	80.8683	81.5541	81.3197	81.5541	(39)
Average = Sum(39)m / 12 =												81.5739	(39)
HLP	Jan 1.1825	Feb 1.1712	Mar 1.1712	Apr 1.1574	May 1.1607	Jun 1.1542	Jul 1.1542	Aug 1.1510	Sep 1.1510	Oct 1.1607	Nov 1.1574	Dec 1.1607	(40)
HLP (average)												1.1610	(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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (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	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			7.4900		13.4684		0.6300		0.7000		0.7700		30.8298 (74)
East			1.3200		25.1733		0.6300		0.7000		0.7700		10.1551 (76)
South			3.4300		56.5862		0.6300		0.7000		0.7700		59.3166 (78)
Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253	(83)
Total gains	612.9754	658.6838	712.9574	765.6261	777.5898	797.5198	746.7709	717.5652	672.6683	622.7072	594.1489	579.6055	(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	39.3620	39.7399	39.7399	40.2150	40.0995	40.3284	40.3284	40.4395	40.4395	40.0995	40.2150	40.0995	
alpha	3.6241	3.6493	3.6493	3.6810	3.6733	3.6886	3.6886	3.6960	3.6960	3.6733	3.6810	3.6733	
util living area	0.9626	0.9502	0.9171	0.8399	0.7068	0.4953	0.3531	0.3553	0.6128	0.8418	0.9360	0.9671 (86)	
MIT	19.7634	19.9055	20.1927	20.5608	20.8293	20.9666	20.9929	20.9930	20.9266	20.6364	20.1838	19.7607 (87)	
Th 2	19.9340	19.9431	19.9431	19.9542	19.9515	19.9568	19.9568	19.9594	19.9594	19.9515	19.9542	19.9515 (88)	
util rest of house	0.9542	0.9392	0.8985	0.8039	0.6422	0.4031	0.2440	0.2424	0.5196	0.7968	0.9194	0.9595 (89)	
MIT 2	18.8470	18.9920	19.2683	19.6188	19.8444	19.9433	19.9555	19.9581	19.9247	19.6916	19.2737	18.8585 (90)	
Living area fraction									fLA = Living area / (4) =				0.2095 (91)
MIT	19.0390	19.1834	19.4620	19.8162	20.0508	20.1577	20.1728	20.1749	20.1346	19.8896	19.4644	19.0476 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0390	19.1834	19.4620	19.8162	20.0508	20.1577	20.1728	20.1749	20.1346	19.8896	19.4644	19.0476 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9453	0.9295	0.8885	0.7986	0.6488	0.4215	0.2670	0.2661	0.5363	0.7938	0.9099	0.9513 (94)
Useful gains	579.4168	612.2326	633.4278	611.4085	504.5266	336.1556	199.3718	190.9780	360.7622	494.3038	540.6240	551.3582 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1116.5409	1084.8904	976.1487	790.1175	566.8650	345.2613	200.5226	192.0579	382.8799	635.2713	883.4916	1088.5480 (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	399.6204	317.6260	254.9843	128.6705	46.3797	0.0000	0.0000	0.0000	0.0000	104.8798	246.8647	399.6692 (98)
Space heating												1898.6946 (98)
Space heating per m2											(98) / (4) =	27.0238 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2093.3788 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	399.6204	317.6260	254.9843	128.6705	46.3797	0.0000	0.0000	0.0000	0.0000	104.8798	246.8647	399.6692	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	440.5958	350.1941	281.1294	141.8638	51.1353	0.0000	0.0000	0.0000	0.0000	115.6337	272.1772	440.6496	(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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703	(64)
Efficiency of water heater (217)m	89.8438	89.7827	89.6138	89.2233	88.5976	87.9000	87.9000	87.9000	87.9000	89.0569	89.6026	87.9000	(216)
Fuel for water heating, kWh/month	189.8758	167.0415	174.7584	155.9531	152.8915	136.2303	129.4443	143.9639	144.3172	162.0923	172.0939	184.8106	(219)
Water heating fuel used												1913.4729	(219)
Annual totals kWh/year													
Space heating fuel - main system												2093.3788	(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)												319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1206 * 1.00) =										-627.1253		-627.1253	(233)
Total delivered energy for all uses												3774.6988	(238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2093.3788	3.6300	75.9897 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.4729	3.6300	69.4591 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	319.9724	19.4400	62.2026 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-627.1253	19.4400	-121.9132 (252)
Total energy cost			195.3182 (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	2093.3788	0.2160	452.1698 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.4729	0.2160	413.3101 (264)
Space and water heating			865.4800 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-627.1253	0.5190	-325.4780 (269)
Total kg/year			744.9926 (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	2093.3788	1.2200	2553.9222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.4729	1.2200	2334.4369 (264)
Space and water heating			4888.3591 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	319.9724	3.0700	982.3153 (268)
Energy saving/generation technologies			
PV Unit	-627.1253	3.0700	-1925.2747 (269)
Primary energy kWh/year			4175.6496 (272)
Primary energy kWh/m2/year			59.4314 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 25	-182 kg (24.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£25 2.60 kg/m²	B 88	B 91
Total Savings	£25 2.60 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£77	£87	-£10
Mains gas	£240	£205	£35
Space heating	£186	£186	£0
Water heating	£69	£44	£25
Lighting	£62	£62	£0
Generated (PV)	-£122	-£122	£0
Total cost of fuels	£195	£170	£25
Total cost of uses	£195	£170	£25
Delivered energy	54 kWh/m²	41 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	59 kWh/m²	45 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.0900
Infiltration rate					0.4295 (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) =	0.3973 (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	0.5066	0.4966	0.4867	0.4370	0.4271	0.3774	0.3774	0.3675	0.3973	0.4271	0.4470	0.4668 (22b)
Effective ac	0.6283	0.6233	0.6184	0.5955	0.5912	0.5712	0.5712	0.5675	0.5789	0.5912	0.5999	0.6090 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.1400			9.0000	739.2600 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11772.9940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5633 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3519 (36)
Total fabric heat loss (33) + (36) = 47.3598 (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	36.8566	36.5643	36.2778	34.9322	34.6805	33.5085	33.5085	33.2915	33.9600	34.6805	35.1898	35.7222 (38)
Heat transfer coeff	84.2163	83.9241	83.6376	82.2920	82.0403	80.8683	80.8683	80.6513	81.3197	82.0403	82.5496	83.0820 (39)
Average = Sum(39)m / 12 =												82.2908 (39)
HLP	1.1986	1.1945	1.1904	1.1712	1.1677	1.1510	1.1510	1.1479	1.1574	1.1677	1.1749	1.1825 (40)
HLP (average)												1.1712 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3144 (H8)
Utilisation factor												0.5327 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6950 (H14)
Volume ratio Veff/V												0.8552 (H15)
Solar storage volume factor												0.9687 (H16)
Solar input	-23.8634	-39.8211	-67.8200	-90.8921	-112.2895	-110.3985	-108.9395	-95.1810	-74.5458	-50.9060	-28.3054	-822.9321 (H17)
Solar input (sum of months) = Sum (63)m =												-822.9321 (63)
Output from w/h	146.7282	110.1533	88.7878	48.2545	23.1687	9.3479	4.8420	31.3633	52.3090	93.4484	125.8952	146.1008 (64)
Total per year (kWh/year) = Sum (64)m =												880.3989 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)			
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	593.9452	650.9206	695.9987	738.8135	765.4068	746.3898	713.1175	675.9599	640.9791	600.1096	571.4794	568.0343 (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	38.8319	38.9671	39.1006	39.7399	39.8618	40.4395	40.4395	40.5483	40.2150	39.8618	39.6159	39.3620	
alpha	3.5888	3.5978	3.6067	3.6493	3.6575	3.6960	3.6960	3.7032	3.6810	3.6575	3.6411	3.6241	
util living area	0.9733	0.9612	0.9377	0.8843	0.7840	0.6265	0.4791	0.5203	0.7312	0.8984	0.9587	0.9768	(86)
MIT	19.5201	19.7025	19.9973	20.3841	20.7068	20.9097	20.9743	20.9651	20.8333	20.4346	19.9226	19.4917	(87)
Th 2	19.9211	19.9244	19.9277	19.9431	19.9460	19.9594	19.9594	19.9619	19.9542	19.9460	19.9401	19.9340	(88)
util rest of house	0.9676	0.9529	0.9239	0.8579	0.7344	0.5453	0.3742	0.4145	0.6576	0.8697	0.9485	0.9718	(89)
MIT 2	18.5974	18.7787	19.0683	19.4485	19.7400	19.9116	19.9507	19.9491	19.8558	19.5052	19.0094	18.5795	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	18.7908	18.9723	19.2630	19.6446	19.9426	20.1207	20.1652	20.1620	20.0606	19.6999	19.2008	18.7706	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7908	18.9723	19.2630	19.6446	19.9426	20.1207	20.1652	20.1620	20.0606	19.6999	19.2008	18.7706	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	0.9598	0.9437	0.9135	0.8492	0.7342	0.5586	0.3957	0.4358	0.6659	0.8617	0.9395	0.9647	(94)
Useful gains	570.0667	614.2933	635.8180	627.4263	561.9828	416.9633	282.1802	294.5949	426.8154	517.1319	536.8781	548.0043	(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	1220.3578	1181.0007	1067.4635	884.1914	676.2243	446.4525	288.3106	303.4077	484.7138	746.5591	998.9118	1210.5561	(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	483.8166	380.8274	321.1442	184.8709	84.9957	0.0000	0.0000	0.0000	0.0000	170.6939	332.6643	492.9385	(98)
Space heating												2451.9514	(98)
Space heating per m2											(98) / (4) =	34.8983	(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 %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2703.3642	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	483.8166	380.8274	321.1442	184.8709	84.9957	0.0000	0.0000	0.0000	0.0000	170.6939	332.6643	492.9385	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	533.4251	419.8758	354.0730	203.8268	93.7108	0.0000	0.0000	0.0000	0.0000	188.1961	366.7743	543.4824	(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	146.7282	110.1533	88.7878	48.2545	23.1687	9.3479	4.8420	31.3633	52.3090	93.4484	125.8952	146.1008	(64)	
Efficiency of water heater	90.0326	90.0564	90.0785	90.1059	90.0853	87.9000	87.9000	87.9000	87.9000	89.6893	89.9137	90.0442	(217)	
Fuel for water heating, kWh/month	162.9722	122.3159	98.5671	53.5531	25.7186	10.6347	5.5085	35.6806	59.5096	104.1913	140.0179	162.2544	(219)	
Water heating fuel used												980.9240	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2703.3642	(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)													319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.65 * 1080 * 1.00) =										-561.3528		-561.3528	(233)	
Total delivered energy for all uses												3567.9079	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2703.3642	3.4800	94.0771	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	980.9240	3.4800	34.1362	(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	319.9724	13.1900	42.2044	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-561.3528	13.1900	-74.0424	(252)
Total energy cost			232.8627	(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] =	0.8485	(257)
SAP value			88.1629	
SAP rating (Section 12)			88	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2703.3642	0.2160	583.9267 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	980.9240	0.2160	211.8796 (264)
Space and water heating			795.8063 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-561.3528	0.5190	-291.3421 (269)
Total kg/year			735.4048 (272)
CO2 emissions per m2			10.4700 (273)
EI value			91.4503
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.2250 (8)
Pressure test											Yes	
Measured/design AP50											4.0900	
Infiltration rate											0.4295 (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) =	0.3973 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.4668	0.4370	0.4370	0.3973	0.4072	0.3874	0.3874	0.3774	0.3774	0.4072	0.3973	0.4072 (22b)
Effective ac	0.6090	0.5955	0.5955	0.5789	0.5829	0.5750	0.5750	0.5712	0.5712	0.5829	0.5789	0.5829 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.1400			9.0000	739.2600 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11772.9940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5633 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3519 (36)
Total fabric heat loss (33) + (36) = 47.3598 (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	35.7222	34.9322	34.9322	33.9600	34.1943	33.7314	33.7314	33.5085	33.5085	34.1943	33.9600	34.1943 (38)
Heat transfer coeff	83.0820	82.2920	82.2920	81.3197	81.5541	81.0911	81.0911	80.8683	80.8683	81.5541	81.3197	81.5541 (39)
Average = Sum(39)m / 12 =												81.5739 (39)
HLP	1.1825	1.1712	1.1712	1.1574	1.1607	1.1542	1.1542	1.1510	1.1510	1.1607	1.1574	1.1607 (40)
HLP (average)												1.1610 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (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												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4684 (H8)
Utilisation factor												0.4939 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6950 (H14)
Volume ratio Veff/V												0.8552 (H15)
Solar storage volume factor												0.9687 (H16)
Solar input	-27.8138	-39.5544	-68.6370	-92.3284	-107.2918	-116.7024	-110.6517	-100.9036	-78.9770	-54.5861	-32.8974	-852.3671 (H17)
Solar input (sum of months) = Sum (63)m =												-852.3671 (63)
Output from w/h	142.7778	110.4200	87.9707	46.8182	28.1664	3.0440	3.1299	25.6407	47.8778	89.7683	121.3032	144.0469 (64)
Total per year (kWh/year) = Sum (64)m =												850.9639 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.4900	13.4684	0.6300	0.7000	0.7700	30.8298 (74)			
East				1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)			
South				3.4300	56.5862	0.6300	0.7000	0.7700	59.3166 (78)			
Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253 (83)
Total gains	612.9754	658.6838	712.9574	765.6261	777.5898	797.5198	746.7709	717.5652	672.6683	622.7072	594.1489	579.6055 (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	39.3620	39.7399	39.7399	40.2150	40.0995	40.3284	40.3284	40.4395	40.4395	40.0995	40.2150	40.0995
alpha	3.6241	3.6493	3.6493	3.6810	3.6733	3.6886	3.6886	3.6960	3.6960	3.6733	3.6810	3.6733
util living area	0.9626	0.9502	0.9171	0.8399	0.7068	0.4953	0.3531	0.3553	0.6128	0.8418	0.9360	0.9671 (86)
MIT	19.7634	19.9055	20.1927	20.5608	20.8293	20.9666	20.9929	20.9930	20.9266	20.6364	20.1838	19.7607 (87)
Th 2	19.9340	19.9431	19.9431	19.9542	19.9515	19.9568	19.9568	19.9594	19.9594	19.9515	19.9542	19.9515 (88)
util rest of house	0.9542	0.9392	0.8985	0.8039	0.6422	0.4031	0.2440	0.2424	0.5196	0.7968	0.9194	0.9595 (89)
MIT 2	18.8470	18.9920	19.2683	19.6188	19.8444	19.9433	19.9555	19.9581	19.9247	19.6916	19.2737	18.8585 (90)
Living area fraction									fLA = Living area / (4) =			0.2095 (91)
MIT	19.0390	19.1834	19.4620	19.8162	20.0508	20.1577	20.1728	20.1749	20.1346	19.8896	19.4644	19.0476 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0390	19.1834	19.4620	19.8162	20.0508	20.1577	20.1728	20.1749	20.1346	19.8896	19.4644	19.0476 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	0.9453	0.9295	0.8885	0.7986	0.6488	0.4215	0.2670	0.2661	0.5363	0.7938	0.9099	0.9513	(94)
Useful gains	579.4168	612.2326	633.4278	611.4085	504.5266	336.1556	199.3718	190.9780	360.7622	494.3038	540.6240	551.3582	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1116.5409	1084.8904	976.1487	790.1175	566.8650	345.2613	200.5226	192.0579	382.8799	635.2713	883.4916	1088.5480	(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	399.6204	317.6260	254.9843	128.6705	46.3797	0.0000	0.0000	0.0000	0.0000	104.8798	246.8647	399.6692	(98)
Space heating												1898.6946	(98)
Space heating per m2												27.0238	(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 %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2093.3788	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	399.6204	317.6260	254.9843	128.6705	46.3797	0.0000	0.0000	0.0000	0.0000	104.8798	246.8647	399.6692	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	440.5958	350.1941	281.1294	141.8638	51.1353	0.0000	0.0000	0.0000	0.0000	115.6337	272.1772	440.6496	(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	142.7778	110.4200	87.9707	46.8182	28.1664	3.0440	3.1299	25.6407	47.8778	89.7683	121.3032	144.0469	(64)	
Efficiency of water heater	89.9458	89.9608	89.9649	89.9357	89.6213	87.9000	87.9000	87.9000	87.9000	89.3868	89.7580	89.9410	(217)	
Fuel for water heating, kWh/month	158.7376	122.7424	97.7834	52.0574	31.4282	3.4631	3.5607	29.1703	54.4685	100.4268	135.1448	160.1572	(219)	
Water heating fuel used												949.1403	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2093.3788	(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)												319.9724	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.65 * 1206 * 1.00) =									-627.1253			-627.1253	(233)	
Total delivered energy for all uses												2860.3662	(238)	

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2093.3788	3.6300	75.9897	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.1403	3.6300	34.4538	(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	319.9724	19.4400	62.2026	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-627.1253	19.4400	-121.9132	(252)
Total energy cost			170.0329	(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	2093.3788	0.2160	452.1698	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	949.1403	0.2160	205.0143	(264)
Space and water heating			657.1841	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	319.9724	0.5190	166.0657	(268)
Energy saving/generation technologies				
PV Unit	-627.1253	0.5190	-325.4780	(269)
Total kg/year			562.6468	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	2093.3788	1.2200	2553.9222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.1403	1.2200	1157.9512 (264)
Space and water heating			3711.8733 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	319.9724	3.0700	982.3153 (268)
Energy saving/generation technologies			
PV Unit	-627.1253	3.0700	-1925.2747 (269)
Primary energy kWh/year			3152.6639 (272)
Primary energy kWh/m2/year			44.8714 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 88	Issued on Date	01/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Project	35 Shaw Road, West End, Southampton, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.86	TER	19.71
Environmental	89 B	% DER<TER	24.59		
CO ₂ Emissions (t/year)	0.74	DFEE	45.09	TREE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	19.05		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 11.200 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 88	Issued on Date	01/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Project	35 Shaw Road, West End, Southampton, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.86	TER	19.71
Environmental	89 B	% DER<TER	24.59		
CO ₂ Emissions (t/year)	0.74	DFEE	45.09	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	19.05		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 88	Issued on Date	01/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Project	35 Shaw Road, West End, Southampton, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.86	TER	19.71
Environmental	89 B	% DER<TER	24.59		
CO ₂ Emissions (t/year)	0.74	DFEE	45.09	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	19.05		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 88	Issued on Date	01/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Property	35 Shaw Road, West End, Southampton, SO30 3JZ		
SAP Rating	87 B	DER	14.86
Environmental	89 B	TER	19.71
CO ₂ Emissions (t/year)	0.74	% DER<TER	24.59
General Requirements Compliance	Pass	DfEE	45.09
		TfEE	55.70
		% DfEE<TfEE	19.05
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	16.78 m	35.13 m ²	2.39 m
	1st Storey:	16.78 m	35.13 m ²	2.67 m

7.0 Living Area	14.72	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	167.56	kJ/m ² K

9.0 External Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Brick and Block	Cavity Wall	Other		0.24	42.22	84.91	70.55

9.1 Party Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction				
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		0.00	70.00	42.74

9.2 Internal Walls				Kappa (kJ/m ² K)	Area (m ²)
Description	Construction				
GF Stud	Plasterboard on timber frame			9.00	58.67
First Floor	Plasterboard on timber frame			9.00	82.14

10.0 External Roofs				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Pitched Roof	External Plane Roof	Other		0.10	9.10	35.13	35.13

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.13

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	35.13

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.13

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					3.43	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.49	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.26	0.098	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.75	0.053	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.60	0.043	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.060	No	Birtley Supatherm
Independently assessed	E3 Sill	7.61	0.034	No	CD0027
Independently assessed	E4 Jamb	27.30	0.039	No	CD0028
Independently assessed	E5 Ground floor (normal)	16.78	0.037	No	Knauf P7
Independently assessed	E6 Intermediate floor within a dwelling	16.78	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.40	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.46	0.054	No	CD0031
Independently assessed	E16 Corner (normal)	10.10	0.050	No	CD0035
Table K1 - Approved	E18 Party wall between dwellings	10.10	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	8.46	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.46	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.46	0.049	No	CD0020

Y-value	0.041	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.09	m ³ /(h.m ²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	17	
Total number of L.E.L. fittings	17	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1		Database	
Description		Gas Combi	
Percentage of Heat		100	%
Database Ref. No.		17515	
Fuel Type		Mains gas	
Main Heating		BGW	
SAP Code		104	
In Winter		90.7	
In Summer		87.9	
Controls		CBE Programmer, room thermostat and TRVs	
PCDF Controls		0	
Delayed Start Stat		No	
Sap Code		2106	
Flue Type		Balanced	
Fan Assisted Flue		Yes	
Is MHS Pumped		Pump in heated space	
Heat Emitter		Radiators	
Flow Temperature		Normal (> 45°C)	
Combi boiler type		Standard Combi	
Combi keep hot type		Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.65	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£25	B 88	