



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 1 Robert Place
West End, Southampton, SO30 3JY

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 05/07/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 17	Issued on Date	05/07/2022
Assessment Reference	As Built	Prop Type Ref	B (P)
Property	1 Robert Place, West End, Southampton, SO30 3JY		
SAP Rating	87 B	DER	15.23
Environmental	88 B	% DER<TER	20.50
CO ₂ Emissions (t/year)	0.92	DFEE	48.32
General Requirements Compliance	Pass	% DFEE<TFEE	16.70
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.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)	19.16	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.23	kgCO ₂ /m ²	Pass
	-3.93 (-20.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.01	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.32	kWh/m ² /yr	
	-9.7 (-16.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (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	4.05 (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

6.94 m², No overhang

Windows facing East

5.40 m², No overhang

Windows facing West

6.74 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

4.05 (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

0.66

kW

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THERMAL BRIDGING

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SAP Rating	87 B	DER	15.23
Environmental	88 B	TER	19.16
CO ₂ Emissions (t/year)	0.92	% DER<TER	20.50
General Requirements Compliance	Pass	DFEE	48.32
		TFEE	58.01
		% DFEE<TFEE	16.70
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.91	0.06	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.31	0.09	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.00	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	5.44	0.35	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.51	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	2.07	0.13	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	14.72	0.31	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	33.02	0.53	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	18.91	3.03	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.91	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.86	0.59	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	9.06	0.40	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	20.20	0.79	Knauf P23
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.120	10.10	1.21	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.78	1.40	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.78	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.180	8.78	1.58	Knauf P29

Total: **10.98** W/mK:
Y-Value: **0.061** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	88 B	% DER<TER	20.50			
CO ₂ Emissions (t/year)	0.92	DFEE	48.32	TFEE	58.01	
General Requirements Compliance	Pass	% DFEE<TFEE	16.70			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Semi-Detached House, total floor area 83 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) 19.16 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.23 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.3 kWh/m²/yr OK

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: 4.05 (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: 6.94 m², No overhang
Windows facing East: 5.40 m², No overhang
Windows facing West: 6.74 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 0.66 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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) = 0.1906 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3931 (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) =	0.3636 (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												
Effective ac	0.4636	0.4545	0.4454	0.4000	0.3909	0.3454	0.3454	0.3363	0.3636	0.3909	0.4090	0.4272 (22b)
	0.6075	0.6033	0.5992	0.5800	0.5764	0.5597	0.5597	0.5566	0.5661	0.5764	0.5837	0.5913 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			18.0000	746.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0744	Feb 41.7854	Mar 41.5021	Apr 40.1715	May 39.9225	Jun 38.7636	Jul 38.7636	Aug 38.5490	Sep 39.2100	Oct 39.9225	Nov 40.4262	Dec 40.9527 (38)
Heat transfer coeff	104.2378	103.9488	103.6655	102.3350	102.0860	100.9271	100.9271	100.7125	101.3735	102.0860	102.5896	103.1161 (39)
Average = Sum(39)m / 12 =												102.3338 (39)

HLP	Jan 1.2565	Feb 1.2530	Mar 1.2496	Apr 1.2335	May 1.2305	Jun 1.2166	Jul 1.2166	Aug 1.2140	Sep 1.2220	Oct 1.2305	Nov 1.2366	Dec 1.2430 (40)
HLP (average)												1.2335 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Daily hot water use	Jan 103.3669	Feb 99.6081	Mar 95.8493	Apr 92.0905	May 88.3317	Jun 84.5730	Jul 84.5730	Aug 88.3317	Sep 92.0905	Oct 95.8493	Nov 99.6081	Dec 103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (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	22.9935	20.1103	20.7520	18.0921	17.3598	14.9802	13.8814	15.9291	16.1193	18.7855	20.5058	22.2680 (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	27.5587	24.8877	27.5284	26.6110	27.4767	26.5658	27.4360	27.4624	26.5904	27.5070	26.6537	27.5506 (61)
Total heat required for water heating calculated for each month	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (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	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (64)
Heat gains from water heating, kWh/month	57.8587	50.7997	52.8824	46.7569	45.3501	39.8475	37.6293	42.1750	42.3787	48.5179	52.1180	56.2484 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1802.3416 (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	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1049	17.8570	14.5223	10.9943	8.2184	6.9383	7.4971	9.7450	13.0797	16.6076	19.3836	20.6636	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.5155	227.8556	221.9585	209.4043	193.5569	178.6626	168.7122	166.3721	172.2692	184.8234	200.6708	215.5652	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	(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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	(71)
Water heating gains (Table 5)	77.7670	75.5948	71.0785	64.9402	60.9544	55.3438	50.5771	56.6868	58.8593	65.2123	72.3861	75.6027	(72)
Total internal gains	387.1368	385.0569	371.3087	349.0882	326.4791	304.6941	290.5358	296.5533	307.9576	330.3927	356.1899	375.5809	(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				6.9400	10.6334	0.6300	0.7000	0.7700	22.5529 (74)			
East				5.4000	19.6403	0.6300	0.7000	0.7700	32.4125 (76)			
West				6.7400	19.6403	0.6300	0.7000	0.7700	40.4556 (80)			
Solar gains	95.4211	185.6454	307.9894	460.0098	578.0586	599.1704	567.3109	476.9196	361.0814	220.4471	118.6800	78.7245 (83)
Total gains	482.5579	570.7023	679.2981	809.0981	904.5377	903.8645	857.8467	773.4729	669.0390	550.8398	474.8699	454.3054 (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	39.8057	39.9164	40.0254	40.5459	40.6447	41.1114	41.1114	41.1991	40.9304	40.6447	40.4452	40.2387	
alpha	3.6537	3.6611	3.6684	3.7031	3.7096	3.7408	3.7408	3.7466	3.7287	3.7096	3.6963	3.6826	
util living area	0.9933	0.9871	0.9695	0.9171	0.8063	0.6418	0.4954	0.5604	0.8057	0.9558	0.9885	0.9947	(86)
MIT	19.2110	19.4242	19.8003	20.2925	20.6860	20.9058	20.9727	20.9573	20.7707	20.2364	19.6371	19.1784	(87)
Th 2	19.8751	19.8778	19.8805	19.8933	19.8956	19.9068	19.9068	19.9088	19.9025	19.8956	19.8908	19.8858	(88)
util rest of house	0.9916	0.9938	0.9614	0.8948	0.7559	0.5554	0.3820	0.4434	0.7351	0.9396	0.9850	0.9933	(89)
MIT 2	18.2512	18.4649	18.8379	19.3216	19.6775	19.8586	19.8981	19.8939	19.7646	19.2802	18.6877	18.2267	(90)
Living area fraction									fLA = Living area / (4) =			0.1850	(91)
MIT	18.4288	18.6424	19.0160	19.5012	19.8641	20.0524	20.0969	20.0906	19.9508	19.4571	18.8634	18.4028	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4288	18.6424	19.0160	19.5012	19.8641	20.0524	20.0969	20.0906	19.9508	19.4571	18.8634	18.4028	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	477.0239	558.6200	647.6149	716.3234	682.3016	513.1213	345.3313	358.8992	494.1965	512.9261	465.5880	450.0803	(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	1472.7540	1428.5034	1297.4757	1084.8756	833.4418	550.2931	352.9369	371.6911	593.1145	904.1856	1206.8001	1464.5370	(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	740.8232	584.5616	483.4964	265.3576	112.4483	0.0000	0.0000	0.0000	0.0000	291.0971	533.6727	754.7558	(98)
Space heating												3766.2127	(98)
Space heating per m2												(98) / (4) =	45.3979 (99)

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												4152.3844 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	740.8232	584.5616	483.4964	265.3576	112.4483	0.0000	0.0000	0.0000	0.0000	291.0971	533.6727	754.7558 (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)	816.7842	644.5001	533.0721	292.5662	123.9783	0.0000	0.0000	0.0000	0.0000	320.9450	588.3933	832.1453 (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	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (64)
Efficiency of water heater (217)m	90.1366	90.0865	89.9679	89.6806	89.1100	87.9000	87.9000	87.9000	87.9000	89.7165	90.0279	87.9000 (216)
Fuel for water heating, kWh/month	200.6386	176.4485	184.3714	164.1660	160.7102	143.8382	136.4941	152.0547	152.5056	170.2514	181.4540	195.2196 (219)
Water heating fuel used												2018.1524 (219)
Annual totals kWh/year												
Space heating fuel - main system												4152.3844 (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)												355.0583 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1068 * 1.00) =												-563.9412
Total delivered energy for all uses												-563.9412 (233)
												6036.6539 (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	4152.3844	0.2160	896.9150 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2018.1524	0.2160	435.9209 (264)
Space and water heating			1332.8359 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.0583	0.5190	184.2753 (268)
Energy saving/generation technologies			
PV Unit	-563.9412	0.5190	-292.6855 (269)
Total CO2, kg/year			1263.3507 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2300 (273)

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

DER		15.2300 ZC1
Total Floor Area	TFA	82.9600
Assumed number of occupants	N	2.5166
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.1085 ZC2
CO2 emissions from cooking, equation (L16)		2.1625 ZC3
Total CO2 emissions		33.5009 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		33.5009 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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) =	0.1429 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3929 (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) =					0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271	(22b)				
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5661	0.5763	0.5836	0.5912	(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)			18.6100	1.3258	24.6723		(27)					
Ground Floor			41.4800	0.1300	5.3924		(28a)					
Brick and Block	95.6800	20.7300	74.9500	0.1800	13.4910		(29a)					
Pitched Roof	41.4800		41.4800	0.1300	5.3924		(30)					
Total net area of external elements Aum(A, m2)			178.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0681		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5898 (36)					
Total fabric heat loss						(33) + (36) =	62.6579 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0689	Feb 41.7801	Mar 41.4970	Apr 40.1674	May 39.9187	Jun 38.7606	Jul 38.7606	Aug 38.5462	Sep 39.2067	Oct 39.9187	Nov 40.4219	Dec 40.9480 (38)
Heat transfer coeff	104.7269	104.4381	104.1550	102.8254	102.5766	101.4186	101.4186	101.2041	101.8646	102.5766	103.0799	103.6060 (39)
Average = Sum(39)m / 12 =												102.8242 (39)
HLP	Jan 1.2624	Feb 1.2589	Mar 1.2555	Apr 1.2395	May 1.2365	Jun 1.2225	Jul 1.2225	Aug 1.2199	Sep 1.2279	Oct 1.2365	Nov 1.2425	Dec 1.2489 (40)
HLP (average)												1.2394 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Daily hot water use	Jan 103.3669	Feb 99.6081	Mar 95.8493	Apr 92.0905	May 88.3317	Jun 84.5730	Jul 84.5730	Aug 88.3317	Sep 92.0905	Oct 95.8493	Nov 99.6081	Dec 103.3669 (44)
Energy content (annual)	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Distribution loss (46)m = 0.15 x (45)m												1478.5131 (45)
Water storage loss:	22.9935	20.1103	20.7520	18.0921	17.3598	14.9802	13.8814	15.9291	16.1193	18.7855	20.5058	22.2680 (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	50.9589	45.8470	48.8438	45.4145	45.0129	41.7072	43.0974	45.0129	45.4145	48.8438	49.1218	50.9589 (61)
Solar input	204.2491	179.9156	187.1905	166.0286	160.7450	141.5752	135.6398	151.2066	152.8765	174.0804	185.8274	199.4123 (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	204.2491	179.9156	187.1905	166.0286	160.7450	141.5752	135.6398	151.2066	152.8765	174.0804	185.8274	199.4123 (64)
	63.7087	56.0396	58.2112	51.4578	49.7341	43.6329	41.5447	46.5626	47.0847	53.8521	57.7350	62.1005 (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	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1028	17.8551	14.5208	10.9932	8.2175	6.9376	7.4963	9.7440	13.0783	16.6059	19.3816	20.6615	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.5155	227.8556	221.9585	209.4043	193.5569	178.6626	168.7122	166.3721	172.2692	184.8234	200.6708	215.5652	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	(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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	(71)
Water heating gains (Table 5)	85.6300	83.3922	78.2409	71.4692	66.8470	60.6013	55.8396	62.5842	65.3955	72.3819	80.1876	83.4684	(72)
Total internal gains	394.9977	392.8524	378.4697	355.6161	332.3708	309.9508	295.7976	302.4496	314.4924	337.5606	363.9894	383.4445	(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				6.7700	10.6334	0.6300	0.7000			0.7700			22.0005 (74)
East				5.2700	19.6403	0.6300	0.7000			0.7700			31.6322 (76)
West				6.5700	19.6403	0.6300	0.7000			0.7700			39.4352 (80)
Solar gains	93.0680	181.0671	300.3943	448.6676	563.8080	584.4005	553.3259	465.1612	352.1775	215.0105	115.7532	76.7831	(83)
Total gains	488.0657	573.9195	678.8639	804.2837	896.1788	894.3513	849.1235	767.6109	666.6699	552.5711	479.7426	460.2276	(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	55.0108	55.1629	55.3129	56.0281	56.1640	56.8053	56.8053	56.9257	56.5565	56.1640	55.8898	55.6060	
alpha	4.6674	4.6775	4.6875	4.7352	4.7443	4.7870	4.7870	4.7950	4.7704	4.7443	4.7260	4.7071	
util living area	0.9981	0.9957	0.9869	0.9512	0.8507	0.6749	0.5138	0.5835	0.8478	0.9782	0.9962	0.9986	(86)
MIT	19.6002	19.7678	20.0667	20.4663	20.7865	20.9492	20.9889	20.9803	20.8463	20.4135	19.9369	19.5755	(87)
Th 2	19.8704	19.8732	19.8759	19.8886	19.8909	19.9020	19.9020	19.9041	19.8978	19.8909	19.8861	19.8811	(88)
util rest of house	0.9975	0.9942	0.9821	0.9328	0.7983	0.5791	0.3916	0.4558	0.7731	0.9669	0.9946	0.9981	(89)
MIT 2	18.0120	18.2584	18.6940	19.2692	19.6872	19.8696	19.8982	19.8963	19.7749	19.2074	18.5151	17.9831	(90)
Living area fraction	18.3058	18.5377	18.9480	19.4907	19.8906	20.0694	20.1000	20.0969	19.9731	19.4306	18.7782	18.2778	(92)
Temperature adjustment	18.3058	18.5377	18.9480	19.4907	19.8906	20.0694	20.1000	20.0969	19.9731	19.4306	18.7782	18.2778	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	486.1464	569.0114	662.8807	743.5318	715.3593	531.8509	351.7662	367.9302	519.4311	530.6309	475.9907	458.8442	(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	1466.7866	1424.2936	1296.5222	1088.9885	840.1623	554.6947	354.9622	374.1394	598.2645	905.8081	1203.7834	1458.5404	(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	729.5963	574.7496	471.4293	248.7288	92.8534	0.0000	0.0000	0.0000	0.0000	279.1318	524.0107	743.7740	(98)
Space heating												3664.2739	(98)
Space heating per m2												44.1692	(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													3923.2055 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.5963	574.7496	471.4293	248.7288	92.8534	0.0000	0.0000	0.0000	0.0000	279.1318	524.0107	743.7740	(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)	781.1524	615.3636	504.7423	266.3049	99.4148	0.0000	0.0000	0.0000	0.0000	298.8564	561.0393	796.3319	(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	204.2491	179.9156	187.1905	166.0286	160.7450	141.5752	135.6398	151.2066	152.8765	174.0804	185.8274	199.4123	(64)
Efficiency of water heater (217)m	87.9797	87.7682	87.2799	86.0666	83.7250	80.3000	80.3000	80.3000	80.3000	86.2339	87.5183	80.3000	(216)
Fuel for water heating, kWh/month	232.1549	204.9896	214.4715	192.9071	191.9916	176.3078	168.9163	188.3021	190.3817	201.8700	212.3298	226.4548	(219)
Water heating fuel used												2401.0773	(219)
Annual totals kWh/year													
Space heating fuel - main system												3923.2055	(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)												355.0216	(232)
Total delivered energy for all uses												6754.3044	(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	3923.2055	0.2160	847.4124 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2401.0773	0.2160	518.6327 (264)
Space and water heating			1366.0451 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.0216	0.5190	184.2562 (268)
Total CO2, kg/m2/year			1589.2263 (272)
Emissions per m2 for space and water heating			16.4663 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2210 (272b)
Emissions per m2 for pumps and fans			0.4692 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4663 * 1.00) + 2.2210 + 0.4692, rounded to 2 d.p.			19.1600 (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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) = 0.1429 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3454 (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) =	0.3195 (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	0.4074	0.3994	0.3914	0.3515	0.3435	0.3035	0.3035	0.2956	0.3195	0.3435	0.3595	0.3754 (22b)
Effective ac	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5510	0.5590	0.5646	0.5705 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			9.0000	373.3200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14564.0136 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 175.5546 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9833 (36)
Total fabric heat loss (33) + (36) = 62.1635 (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	40.3795	40.1563	39.9375	38.9099	38.7177	37.8227	37.8227	37.6569	38.1674	38.7177	39.1066	39.5132 (38)
Heat transfer coeff	102.5429	102.3197	102.1010	101.0734	100.8811	99.9861	99.9861	99.8204	100.3309	100.8811	101.2701	101.6767 (39)
Average = Sum(39)m / 12 =												101.0725 (39)
HLP	1.2361	1.2334	1.2307	1.2183	1.2160	1.2052	1.2052	1.2032	1.2094	1.2160	1.2207	1.2256 (40)
HLP (average)												1.2183 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3669	99.6081	95.8493	92.0905	88.3317	84.5730	84.5730	88.3317	92.0905	95.8493	99.6081	103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (45)

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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	32.5742	28.4896	29.3987	25.6305	24.5931	21.2219	19.6653	22.5662	22.8357	26.6128	29.0499	31.5463 (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	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1049	17.8570	14.5223	10.9943	8.2184	6.9383	7.4971	9.7450	13.0797	16.6076	19.3836	20.6636	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.5155	227.8556	221.9585	209.4043	193.5569	178.6626	168.7122	166.3721	172.2692	184.8234	200.6708	215.5652	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	(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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	(71)
Water heating gains (Table 5)	43.7825	42.3952	39.5144	35.5979	33.0552	29.4749	26.4318	30.3309	31.7162	35.7699	40.3471	42.4010	(72)
Total internal gains	350.1523	348.8572	336.7446	316.7460	295.5799	275.8252	263.3905	267.1973	277.8145	297.9503	321.1509	339.3792	(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				6.9400	10.6334	0.6300	0.7000			0.7700			22.5529 (74)
East				5.4000	19.6403	0.6300	0.7000			0.7700			32.4125 (76)
West				6.7400	19.6403	0.6300	0.7000			0.7700			40.4556 (80)
Solar gains	95.4211	185.6454	307.9894	460.0098	578.0586	599.1704	567.3109	476.9196	361.0814	220.4471	118.6800	78.7245	(83)
Total gains	445.5734	534.5026	644.7340	776.7558	873.6385	874.9956	830.7014	744.1169	638.8959	518.3974	439.8309	418.1037	(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	39.4523	39.5384	39.6231	40.0260	40.1022	40.4612	40.4612	40.5284	40.3222	40.1022	39.9482	39.7885	
alpha	3.6302	3.6359	3.6415	3.6684	3.6735	3.6974	3.6974	3.7019	3.6881	3.6735	3.6632	3.6526	
util living area	0.9944	0.9887	0.9721	0.9216	0.8131	0.6511	0.5046	0.5729	0.8171	0.9606	0.9903	0.9956	(86)
MIT	19.1583	19.3756	19.7598	20.2611	20.6679	20.8974	20.9696	20.9520	20.7514	20.1965	19.5845	19.1210	(87)
Th 2	19.8913	19.8934	19.8955	19.9054	19.9072	19.9158	19.9158	19.9174	19.9125	19.9072	19.9035	19.8996	(88)
util rest of house	0.9930	0.9858	0.9647	0.9006	0.7644	0.5657	0.3910	0.4559	0.7494	0.9461	0.9873	0.9945	(89)
MIT 2	18.2136	18.4312	18.8123	19.3039	19.6738	19.8624	19.9059	19.9001	19.7601	19.2535	18.6478	18.1826	(90)
Living area fraction									fLA = Living area / (4) =			0.1850	(91)
MIT	18.3884	18.6059	18.9876	19.4811	19.8577	20.0539	20.1027	20.0947	19.9435	19.4280	18.8211	18.3563	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3884	18.6059	18.9876	19.4811	19.8577	20.0539	20.1027	20.0947	19.9435	19.4280	18.8211	18.3563	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9903	0.9812	0.9569	0.8908	0.7619	0.5774	0.4114	0.4763	0.7517	0.9378	0.9833	0.9922	(94)
Ext temp.	441.2465	524.4704	616.9519	691.9113	665.6630	505.2001	341.7681	354.4416	480.2427	486.1470	432.4678	414.8482	(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	1444.6653	1402.3846	1274.9935	1069.4627	822.9623	545.3153	350.2260	368.8091	586.2882	890.5768	1186.9998	1439.3622	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	746.5436	589.9583	489.5830	271.8370	117.0307	0.0000	0.0000	0.0000	0.0000	300.8958	543.2631	762.2384	(98)
												3821.3498	(98)
												46.0626	(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	939.8697	739.8974	758.6351	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8492	0.9026	0.8700	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	798.1324	667.8640	659.9821	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1116.7592	1063.0234	963.3973	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	229.4113	293.9986	225.7409	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												749.1508 (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	57.3528	73.4997	56.4352	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												187.2877 (107)
Space cooling per m2												2.2576 (108)
Energy for space heating												46.0626 (99)
Energy for space cooling												2.2576 (108)
Total												48.3201 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.3 (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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) =	0.1429 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3929 (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) =					0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271	(22b)				
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5661	0.5763	0.5836	0.5912	(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)			18.6100	1.3258	24.6723		(27)					
Ground Floor			41.4800	0.1300	5.3924		(28a)					
Brick and Block	95.6800	20.7300	74.9500	0.1800	13.4910		(29a)					
Pitched Roof	41.4800		41.4800	0.1300	5.3924		(30)					
Total net area of external elements Aum(A, m2)			178.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0681		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5898 (36)					
Total fabric heat loss						(33) + (36) =	62.6579 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0689	Feb 41.7801	Mar 41.4970	Apr 40.1674	May 39.9187	Jun 38.7606	Jul 38.7606	Aug 38.5462	Sep 39.2067	Oct 39.9187	Nov 40.4219	Dec 40.9480 (38)
Heat transfer coeff	104.7269	104.4381	104.1550	102.8254	102.5766	101.4186	101.4186	101.2041	101.8646	102.5766	103.0799	103.6060 (39)
Average = Sum(39)m / 12 =												102.8242 (39)
HLP	Jan 1.2624	Feb 1.2589	Mar 1.2555	Apr 1.2395	May 1.2365	Jun 1.2225	Jul 1.2225	Aug 1.2199	Sep 1.2279	Oct 1.2365	Nov 1.2425	Dec 1.2489 (40)
HLP (average)												1.2394 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Daily hot water use	Jan 103.3669	Feb 99.6081	Mar 95.8493	Apr 92.0905	May 88.3317	Jun 84.5730	Jul 84.5730	Aug 88.3317	Sep 92.0905	Oct 95.8493	Nov 99.6081	Dec 103.3669 (44)
Energy content (annual)	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Distribution loss (46)m = 0.15 x (45)m												1478.5131 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												

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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)
	32.5742	28.4896	29.3987	25.6305	24.5931	21.2219	19.6653	22.5662	22.8357	26.6128	29.0499	31.5463 (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	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	125.8315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1028	17.8551	14.5208	10.9932	8.2175	6.9376	7.4963	9.7440	13.0783	16.6059	19.3816	20.6615	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.5155	227.8556	221.9585	209.4043	193.5569	178.6626	168.7122	166.3721	172.2692	184.8234	200.6708	215.5652	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	35.5831	(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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	(71)
Water heating gains (Table 5)	43.7825	42.3952	39.5144	35.5979	33.0552	29.4749	26.4318	30.3309	31.7162	35.7699	40.3471	42.4010	(72)
Total internal gains	350.1502	348.8554	336.7431	316.7448	295.5790	275.8245	263.3897	267.1963	277.8131	297.9486	321.1489	339.3771	(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				6.7700	10.6334	0.6300			0.7000	0.7700		22.0005 (74)	
East				5.2700	19.6403	0.6300			0.7000	0.7700		31.6322 (76)	
West				6.5700	19.6403	0.6300			0.7000	0.7700		39.4352 (80)	
Solar gains	93.0680	181.0671	300.3943	448.6676	563.8080	584.4005	553.3259	465.1612	352.1775	215.0105	115.7532	76.7831	(83)
Total gains	443.2182	529.9225	637.1374	765.4124	859.3871	860.2250	816.7157	732.3576	629.9906	512.9591	436.9021	416.1602	(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	55.0108	55.1629	55.3129	56.0281	56.1640	56.8053	56.8053	56.9257	56.5565	56.1640	55.8898	55.6060		
alpha	4.6674	4.6775	4.6875	4.7352	4.7443	4.7870	4.7870	4.7950	4.7704	4.7443	4.7260	4.7071		
util living area	0.9988	0.9969	0.9898	0.9589	0.8661	0.6947	0.5322	0.6072	0.8687	0.9837	0.9975	0.9991	(86)	
MIT	19.5509	19.7199	20.0230	20.4316	20.7663	20.9425	20.9871	20.9767	20.8263	20.3734	19.8900	19.5268	(87)	
Th 2	19.8704	19.8732	19.8759	19.8886	19.8909	19.9020	19.9020	19.9041	19.8978	19.8909	19.8861	19.8811	(88)	
util rest of house	0.9983	0.9958	0.9860	0.9429	0.8165	0.5986	0.4066	0.4764	0.7990	0.9748	0.9964	0.9988	(89)	
MIT 2	18.5523	18.7231	19.0262	19.4338	19.7365	19.8766	19.8989	19.8977	19.8004	19.3861	18.9034	18.5366	(90)	
Living area fraction									fLA = Living area / (4) =			0.1850	(91)	
MIT	18.7371	18.9075	19.2106	19.6185	19.9271	20.0738	20.1003	20.0973	19.9902	19.5688	19.0860	18.7198	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7371	18.9075	19.2106	19.6185	19.9271	20.0738	20.1003	20.0973	19.9902	19.5688	19.0860	18.7198	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	442.1972	526.9889	626.2434	717.9391	703.2552	528.8703	351.2439	366.7216	507.7385	498.2450	434.8206	415.4491	(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	1511.9511	1462.9194	1323.8769	1102.1298	843.9051	555.1476	354.9924	374.1862	600.0032	919.9865	1235.5143	1504.3432	(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	795.8969	628.9453	519.0393	276.6173	104.6435	0.0000	0.0000	0.0000	0.0000	313.7756	576.4995	810.1372	(98)	
Space heating												4025.5547	(98)	
Space heating per m2										(98) / (4) =		48.5240	(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	953.3345	750.4973	769.1512	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8805	0.9326	0.9019	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	839.4077	699.9121	693.7146	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1099.4939	1046.6754	949.6512	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	187.2621	257.9919	190.4169	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												635.6708	(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	46.8155	64.4980	47.6042	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												158.9177 (107)
Space cooling per m2												1.9156 (108)
Energy for space heating												48.5240 (99)
Energy for space cooling												1.9156 (108)
Total												50.4396 (109)
Target Fabric Energy Efficiency (TFEE)												58.0 (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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) = 0.1906 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3931 (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)	=	0.3636 (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	0.4272	0.4000	0.4000	0.3636	0.3727	0.3545	0.3545	0.3454	0.3454	0.3727	0.3636	0.3727 (22b)
Effective ac	0.5913	0.5800	0.5800	0.5661	0.5694	0.5628	0.5628	0.5597	0.5597	0.5694	0.5661	0.5694 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			18.0000	746.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14937.3336 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 180.0546 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9833 (36)
Total fabric heat loss (33) + (36) = 62.1635 (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	40.9527	40.1715	40.1715	39.2100	39.4418	38.9840	38.9840	38.7636	38.7636	39.4418	39.2100	39.4418 (38)
Heat transfer coeff	103.1161	102.3350	102.3350	101.3735	101.6053	101.1474	101.1474	100.9271	100.9271	101.6053	101.3735	101.6053 (39)
Average = Sum(39)m / 12 =												101.6248 (39)
HLP	1.2430	1.2335	1.2335	1.2220	1.2248	1.2192	1.2192	1.2166	1.2166	1.2248	1.2220	1.2248 (40)
HLP (average)												1.2250 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3669	99.6081	95.8493	92.0905	88.3317	84.5730	84.5730	88.3317	92.0905	95.8493	99.6081	103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (45)

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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) = 0.1906 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3931 (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) =	0.3636 (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	0.4636	0.4545	0.4454	0.4000	0.3909	0.3454	0.3454	0.3363	0.3636	0.3909	0.4090	0.4272 (22b)
Effective ac	0.6075	0.6033	0.5992	0.5800	0.5764	0.5597	0.5597	0.5566	0.5661	0.5764	0.5837	0.5913 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			18.0000	746.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14937.3336 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 180.0546 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9833 (36)
Total fabric heat loss (33) + (36) = 62.1635 (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	42.0744	41.7854	41.5021	40.1715	39.9225	38.7636	38.7636	38.5490	39.2100	39.9225	40.4262	40.9527 (38)
Heat transfer coeff	104.2378	103.9488	103.6655	102.3350	102.0860	100.9271	100.9271	100.7125	101.3735	102.0860	102.5896	103.1161 (39)
Average = Sum(39)m / 12 =												102.3338 (39)
HLP	1.2565	1.2530	1.2496	1.2335	1.2305	1.2166	1.2166	1.2140	1.2220	1.2305	1.2366	1.2430 (40)
HLP (average)												1.2335 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3669	99.6081	95.8493	92.0905	88.3317	84.5730	84.5730	88.3317	92.0905	95.8493	99.6081	103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (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	22.9935	20.1103	20.7520	18.0921	17.3598	14.9802	13.8814	15.9291	16.1193	18.7855	20.5058	22.2680 (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	27.5587	24.8877	27.5284	26.6110	27.4767	26.5658	27.4360	27.4624	26.5904	27.5070	26.6537	27.5506 (61)
Total heat required for water heating calculated for each month	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (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	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (64)
Heat gains from water heating, kWh/month	57.8587	50.7997	52.8824	46.7569	45.3501	39.8475	37.6293	42.1750	42.3787	48.5179	52.1180	56.2484 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1802.3416 (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	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.2622	44.6424	36.3057	27.4857	20.5459	17.3457	18.7427	24.3624	32.6992	41.5191	48.4589	51.6591	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.5903	340.0830	331.2814	312.5438	288.8909	266.6605	251.8093	248.3165	257.1182	275.8558	299.5087	321.7390	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	(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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	(71)
Water heating gains (Table 5)	77.7670	75.5948	71.0785	64.9402	60.9544	55.3438	50.5771	56.6868	58.8593	65.2123	72.3861	75.6027	(72)
Total internal gains	570.5685	566.2693	544.6145	510.9187	476.3402	445.2991	427.0780	435.3148	454.6257	488.5361	526.3027	554.9498	(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				6.9400	10.6334		0.6300	0.7000	0.7700		22.5529 (74)	
East				5.4000	19.6403		0.6300	0.7000	0.7700		32.4125 (76)	
West				6.7400	19.6403		0.6300	0.7000	0.7700		40.4556 (80)	

Solar gains	95.4211	185.6454	307.9894	460.0098	578.0586	599.1704	567.3109	476.9196	361.0814	220.4471	118.6800	78.7245 (83)
Total gains	665.9896	751.9147	852.6039	970.9285	1054.3988	1044.4694	994.3889	912.2344	815.7070	708.9832	644.9827	633.6743 (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	39.8057	39.9164	40.0254	40.5459	40.6447	41.1114	41.1114	41.1991	40.9304	40.6447	40.4452	40.2387	
alpha	3.6537	3.6611	3.6684	3.7031	3.7096	3.7408	3.7408	3.7466	3.7287	3.7096	3.6963	3.6826	
util living area	0.9813	0.9698	0.9418	0.8713	0.7446	0.5749	0.4342	0.4873	0.7242	0.9127	0.9701	0.9842	(86)
MIT	19.4581	19.6596	20.0054	20.4407	20.7655	20.9349	20.9824	20.9731	20.8445	20.4085	19.8598	19.4228	(87)
Th 2	19.8751	19.8778	19.8805	19.8933	19.8956	19.9068	19.9068	19.9088	19.9025	19.8956	19.8908	19.8858	(88)
util rest of house	0.9769	0.9628	0.9279	0.8412	0.6888	0.4913	0.3318	0.3805	0.6456	0.8852	0.9618	0.9805	(89)
MIT 2	18.4953	18.6955	19.0340	19.4537	19.7381	19.8747	19.9014	19.8998	19.8144	19.4371	18.9051	18.4686	(90)
Living area fraction									fLA = Living area / (4) =			0.1850	(91)
MIT	18.6734	18.8739	19.2138	19.6364	19.9282	20.0709	20.1014	20.0984	20.0050	19.6168	19.0818	18.6452	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6734	18.8739	19.2138	19.6364	19.9282	20.0709	20.1014	20.0984	20.0050	19.6168	19.0818	18.6452	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9706	0.9546	0.9178	0.8331	0.6906	0.5045	0.3506	0.3998	0.6537	0.8767	0.9540	0.9749	(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	1498.2530	1452.5673	1317.9784	1098.7041	839.9886	552.1588	353.3863	372.4787	598.6124	920.4932	1229.2070	1489.5293	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	633.7678	493.7795	398.3859	208.6526	83.1981	0.0000	0.0000	0.0000	0.0000	222.3948	442.0265	648.6108	(98)
Space heating												3130.8161	(98)
Space heating per m2												(98) / (4) =	37.7389 (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													3451.8369 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	633.7678	493.7795	398.3859	208.6526	83.1981	0.0000	0.0000	0.0000	0.0000	222.3948	442.0265	648.6108	(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)	698.7517	544.4096	439.2348	230.0469	91.7289	0.0000	0.0000	0.0000	0.0000	245.1982	487.3500	715.1167	(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	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040	(64)
Efficiency of water heater (217)m	90.0631	90.0018	89.8585	89.5203	88.9086	87.9000	87.9000	87.9000	87.9000	89.5387	89.9270	87.9000	(216)
Fuel for water heating, kWh/month	200.8024	176.6145	184.5958	164.4600	161.0742	143.8382	136.4941	152.0547	152.5056	170.5895	181.6576	195.3700	(219)
Water heating fuel used												2020.0567	(219)
Annual totals kWh/year													
Space heating fuel - main system												3451.8369	(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)												355.0583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1068 * 1.00) =										-563.9412		-563.9412	(233)
Total delivered energy for all uses												5338.0107	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3451.8369	3.4800	120.1239 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2020.0567	3.4800	70.2980 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	355.0583	13.1900	46.8322 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-563.9412	13.1900	-74.3838 (252)
Total energy cost			292.7627 (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] =	0.9609 (257)
SAP value		86.5951
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	3451.8369	0.2160	745.5968 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2020.0567	0.2160	436.3322 (264)
Space and water heating			1181.9290 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.0583	0.5190	184.2753 (268)
Energy saving/generation technologies			
PV Unit	-563.9412	0.5190	-292.6855 (269)
Total kg/year			1112.4438 (272)
CO2 emissions per m2			13.4100 (273)
EI value			88.3505
EI rating			88 (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	$3.48 / 0.8913 = 3.905$, stars = 4
Water heating environmental impact	$0.216 / 0.8913 = 0.2424$, 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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1906 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3931 (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) =	0.3636 (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	0.4272	0.4000	0.4000	0.3636	0.3727	0.3545	0.3545	0.3454	0.3454	0.3727	0.3636	0.3727 (22b)
Effective ac	0.5913	0.5800	0.5800	0.5661	0.5694	0.5628	0.5628	0.5597	0.5597	0.5694	0.5661	0.5694 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			18.0000	746.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14937.3336 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.0546 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9833 (36)
Total fabric heat loss						(33) + (36) =	62.1635 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.9527	40.1715	40.1715	39.2100	39.4418	38.9840	38.9840	38.7636	38.7636	39.4418	39.2100	39.4418 (38)
Average = Sum(39)m / 12 =	103.1161	102.3350	102.3350	101.3735	101.6053	101.1474	101.1474	100.9271	100.9271	101.6053	101.3735	101.6053 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2430	1.2335	1.2335	1.2220	1.2248	1.2192	1.2192	1.2166	1.2166	1.2248	1.2220	1.2248 (40)
HLP (average)												1.2250 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.3669	99.6081	95.8493	92.0905	88.3317	84.5730	84.5730	88.3317	92.0905	95.8493	99.6081	103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (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	22.9935	20.1103	20.7520	18.0921	17.3598	14.9802	13.8814	15.9291	16.1193	18.7855	20.5058	22.2680 (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	27.5587	24.8877	27.5284	26.6110	27.4767	26.5658	27.4360	27.4624	26.5904	27.5070	26.6537	27.5506 (61)
Total heat required for water heating calculated for each month	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (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	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (64)
Heat gains from water heating, kWh/month	57.8587	50.7997	52.8824	46.7569	45.3501	39.8475	37.6293	42.1750	42.3787	48.5179	52.1180	56.2484 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1802.3416 (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	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.2622	44.6424	36.3057	27.4857	20.5459	17.3457	18.7427	24.3624	32.6992	41.5191	48.4589	51.6591 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.5903	340.0830	331.2814	312.5438	288.8909	266.6605	251.8093	248.3165	257.1182	275.8558	299.5087	321.7390 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164 (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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652 (71)
Water heating gains (Table 5)	77.7670	75.5948	71.0785	64.9402	60.9544	55.3438	50.5771	56.6868	58.8593	65.2123	72.3861	75.6027 (72)
Total internal gains	570.5685	566.2693	544.6145	510.9187	476.3402	445.2991	427.0780	435.3148	454.6257	488.5361	526.3027	554.9498 (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				6.9400	13.4684		0.6300	0.7000	0.7700		28.5659 (74)	
East				5.4000	25.1733		0.6300	0.7000	0.7700		41.5437 (76)	
West				6.7400	25.1733		0.6300	0.7000	0.7700		51.8527 (80)	

Solar gains	121.9622	202.4480	342.1854	511.8119	603.1970	690.6121	628.7397	553.1240	419.6786	259.5750	151.3225	95.1638 (83)
Total gains	692.5307	768.7173	886.8000	1022.7306	1079.5373	1135.9111	1055.8177	988.4388	874.3042	748.1111	677.6252	650.1136 (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	40.2387	40.5459	40.5459	40.9304	40.8370	41.0219	41.0219	41.1114	41.1114	40.8370	40.9304	40.8370
alpha	3.6826	3.7031	3.7031	3.7287	3.7225	3.7348	3.7348	3.7408	3.7408	3.7225	3.7287	3.7225
util living area	0.9729	0.9599	0.9193	0.8179	0.6595	0.4408	0.3132	0.3234	0.5953	0.8558	0.9514	0.9770 (86)
MIT	19.6994	19.8635	20.2072	20.6162	20.8704	20.9784	20.9956	20.9952	20.9360	20.6228	20.1246	19.6865 (87)
Th 2	19.8858	19.8933	19.8933	19.9025	19.9003	19.9046	19.9046	19.9068	19.9068	19.9003	19.9025	19.9003 (88)
util rest of house	0.9661	0.9501	0.8998	0.7770	0.5902	0.3517	0.2107	0.2146	0.4976	0.8104	0.9371	0.9711 (89)
MIT 2	18.7420	18.9075	19.2373	19.6180	19.8234	19.8967	19.9039	19.9060	19.8784	19.6341	19.1723	18.7409 (90)
Living area fraction									fLA = Living area / (4) =			0.1850 (91)
MIT	18.9191	19.0844	19.4168	19.8027	20.0172	20.0968	20.1059	20.1075	20.0741	19.8170	19.3485	18.9159 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9191	19.0844	19.4168	19.8027	20.0172	20.0968	20.1059	20.1075	20.0741	19.8170	19.3485	18.9159 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	663.7826	723.4520	789.0885	790.4443	645.6540	417.7001	242.5678	232.0944	448.9126	603.2423	628.8717	626.8212 (94)
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	1373.4149	1338.9934	1209.2709	983.5943	702.8195	424.4963	243.3485	232.8934	471.7398	784.0928	1089.6169	1342.8049 (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	527.9664	413.6438	312.6158	139.0680	42.5311	0.0000	0.0000	0.0000	0.0000	134.5528	331.7365	532.6918 (98)
Space heating												2434.8062 (98)
Space heating per m2												(98) / (4) = 29.3492 (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												2684.4610	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	527.9664	413.6438	312.6158	139.0680	42.5311	0.0000	0.0000	0.0000	0.0000	134.5528	331.7365	532.6918	(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)	582.1019	456.0571	344.6701	153.3274	46.8920	0.0000	0.0000	0.0000	0.0000	148.3492	365.7514	587.3118	(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	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040	(64)
Efficiency of water heater	89.9688	89.9050	89.7094	89.2382	88.5258	87.9000	87.9000	87.9000	87.9000	89.1895	89.7566	87.9000	(216)
(217)m												89.9881	(217)
Fuel for water heating, kWh/month	201.0129	176.8048	184.9028	164.9799	161.7707	143.8382	136.4941	152.0547	152.5056	171.2573	182.0024	195.5858	(219)
Water heating fuel used												2023.2094	(219)
Annual totals kWh/year													
Space heating fuel - main system												2684.4610	(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)												355.0583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1184 * 1.00) =										-625.1081		-625.1081	(233)
Total delivered energy for all uses												4512.6206	(238)

10a. Fuel costs - using BEDF prices (497)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2684.4610	3.6300	97.4459 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2023.2094	3.6300	73.4425 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	355.0583	19.4400	69.0233 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-625.1081	19.4400	-121.5210 (252)
Total energy cost			227.9707 (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	2684.4610	0.2160	579.8436 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2023.2094	0.2160	437.0132 (264)
Space and water heating			1016.8568 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.0583	0.5190	184.2753 (268)
Energy saving/generation technologies			
PV Unit	-625.1081	0.5190	-324.4311 (269)
Total kg/year			915.6259 (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	2684.4610	1.2200	3275.0425 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2023.2094	1.2200	2468.3154 (264)
Space and water heating			5743.3579 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	355.0583	3.0700	1090.0290 (268)
Energy saving/generation technologies			
PV Unit	-625.1081	3.0700	-1919.0820 (269)
Primary energy kWh/year			5144.5549 (272)
Primary energy kWh/m2/year			62.0125 (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 88

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	+ 1.2	-£ 26	-189 kg (20.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£26 2.28 kg/m²	B 88	B 90
Total Savings	£26 2.28 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 497 TEST (31 May 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	£84	£93	-£10
Mains gas	£266	£230	£36
Space heating	£207	£207	£0
Water heating	£73	£47	£26
Lighting	£69	£69	£0
Generated (PV)	-£122	-£122	£0
Total cost of fuels	£228	£201	£26
Total cost of uses	£227	£201	£26
Delivered energy	54 kWh/m²	43 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	49 kWh/m²	13 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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) = 0.1906 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3931 (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) =	0.3636 (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												
Effective ac	0.4636	0.4545	0.4454	0.4000	0.3909	0.3454	0.3454	0.3363	0.3636	0.3909	0.4090	0.4272 (22b)
	0.6075	0.6033	0.5992	0.5800	0.5764	0.5597	0.5597	0.5566	0.5661	0.5764	0.5837	0.5913 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			18.0000	746.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14937.3336 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 180.0546 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9833 (36)
Total fabric heat loss (33) + (36) = 62.1635 (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	42.0744	41.7854	41.5021	40.1715	39.9225	38.7636	38.7636	38.5490	39.2100	39.9225	40.4262	40.9527 (38)
Heat transfer coeff	104.2378	103.9488	103.6655	102.3350	102.0860	100.9271	100.9271	100.7125	101.3735	102.0860	102.5896	103.1161 (39)
Average = Sum(39)m / 12 =												102.3338 (39)
HLP	1.2565	1.2530	1.2496	1.2335	1.2305	1.2166	1.2166	1.2140	1.2220	1.2305	1.2366	1.2430 (40)
HLP (average)												1.2335 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3669	99.6081	95.8493	92.0905	88.3317	84.5730	84.5730	88.3317	92.0905	95.8493	99.6081	103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (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	22.9935	20.1103	20.7520	18.0921	17.3598	14.9802	13.8814	15.9291	16.1193	18.7855	20.5058	22.2680 (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	27.5587	24.8877	27.5284	26.6110	27.4767	26.5658	27.4360	27.4624	26.5904	27.5070	26.6537	27.5506 (61)
Total heat required for water heating calculated for each month	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (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												1.2266 (H8)
Utilisation factor												0.5575 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.9699 (H14)
Volume ratio Veff/V												0.7981 (H15)
Solar storage volume factor												0.9549 (H16)
Solar input	-24.6162	-41.0773	-69.9594	-93.7594	-115.8318	-113.8811	-112.3761	-98.1836	-76.8974	-52.5119	-29.1983	-848.8920 (H17)
Solar input (sum of months) = Sum (63)m =												-848.8920 (63)
Output from w/h	156.2327	117.8790	95.9157	53.4657	27.3770	12.5527	7.6022	35.4725	57.1550	100.2317	134.1609	155.4044 (64)
Total per year (kWh/year) = Sum (64)m =												953.4496 (64)
Heat gains from water heating, kWh/month	57.8587	50.7997	52.8824	46.7569	45.3501	39.8475	37.6293	42.1750	42.3787	48.5179	52.1180	56.2484 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.2622	44.6424	36.3057	27.4857	20.5459	17.3457	18.7427	24.3624	32.6992	41.5191	48.4589	51.6591 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.5903	340.0830	331.2814	312.5438	288.8909	266.6605	251.8093	248.3165	257.1182	275.8558	299.5087	321.7390 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164 (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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652 (71)
Water heating gains (Table 5)	77.7670	75.5948	71.0785	64.9402	60.9544	55.3438	50.5771	56.6868	58.8593	65.2123	72.3861	75.6027 (72)
Total internal gains	570.5685	566.2693	544.6145	510.9187	476.3402	445.2991	427.0780	435.3148	454.6257	488.5361	526.3027	554.9498 (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				6.9400	10.6334		0.6300	0.7000	0.7700		22.5529 (74)	
East				5.4000	19.6403		0.6300	0.7000	0.7700		32.4125 (76)	
West				6.7400	19.6403		0.6300	0.7000	0.7700		40.4556 (80)	
Solar gains	95.4211	185.6454	307.9894	460.0098	578.0586	599.1704	567.3109	476.9196	361.0814	220.4471	118.6800	78.7245 (83)
Total gains	665.9896	751.9147	852.6039	970.9285	1054.3988	1044.4694	994.3889	912.2344	815.7070	708.9832	644.9827	633.6743 (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	39.8057	39.9164	40.0254	40.5459	40.6447	41.1114	41.1114	41.1991	40.9304	40.6447	40.4452	40.2387
alpha	3.6537	3.6611	3.6684	3.7031	3.7096	3.7408	3.7408	3.7466	3.7287	3.7096	3.6963	3.6826
util living area	0.9813	0.9698	0.9418	0.8713	0.7446	0.5749	0.4342	0.4873	0.7242	0.9127	0.9701	0.9842 (86)
MIT	19.4581	19.6596	20.0054	20.4407	20.7655	20.9349	20.9824	20.9731	20.8445	20.4085	19.8598	19.4228 (87)
Th 2	19.8751	19.8778	19.8805	19.8933	19.8956	19.9068	19.9068	19.9088	19.9025	19.8956	19.8908	19.8858 (88)
util rest of house	0.9769	0.9628	0.9279	0.8412	0.6888	0.4913	0.3318	0.3805	0.6456	0.8852	0.9618	0.9805 (89)
MIT 2	18.4953	18.6955	19.0340	19.4537	19.7381	19.8747	19.9014	19.8998	19.8144	19.4371	18.9051	18.4686 (90)
Living area fraction												0.1850 (91)
MIT	18.6734	18.8739	19.2138	19.6364	19.9282	20.0709	20.1014	20.0984	20.0050	19.6168	19.0818	18.6452 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6734	18.8739	19.2138	19.6364	19.9282	20.0709	20.1014	20.0984	20.0050	19.6168	19.0818	18.6452 (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	0.9706	0.9546	0.9178	0.8331	0.6906	0.5045	0.3506	0.3998	0.6537	0.8767	0.9540	0.9749	(94)
Useful gains	646.4145	717.7764	782.5135	808.9089	728.1632	526.9512	348.5996	364.6809	533.2221	621.5755	615.2813	617.7406	(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	1498.2530	1452.5673	1317.9784	1098.7041	839.9886	552.1588	353.3863	372.4787	598.6124	920.4932	1229.2070	1489.5293	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	633.7678	493.7795	398.3859	208.6526	83.1981	0.0000	0.0000	0.0000	0.0000	222.3948	442.0265	648.6108	(98)
Space heating												3130.8161	(98)
Space heating per m2											(98) / (4) =	37.7389	(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													3451.8369	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	633.7678	493.7795	398.3859	208.6526	83.1981	0.0000	0.0000	0.0000	0.0000	222.3948	442.0265	648.6108	(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)	698.7517	544.4096	439.2348	230.0469	91.7289	0.0000	0.0000	0.0000	0.0000	245.1982	487.3500	715.1167	(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	156.2327	117.8790	95.9157	53.4657	27.3770	12.5527	7.6022	35.4725	57.1550	100.2317	134.1609	155.4044	(64)	
Efficiency of water heater	90.1322	90.1466	90.1428	90.1145	89.9903	87.9000	87.9000	87.9000	87.9000	89.8112	90.0322	90.1450	(217)	
Fuel for water heating, kWh/month	173.3373	130.7637	106.4042	59.3309	30.4222	14.2806	8.6487	40.3556	65.0227	111.6027	149.0143	172.3939	(219)	
Water heating fuel used												1061.5767	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3451.8369	(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)												355.0583	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1068 * 1.00) =										-563.9412		-563.9412	(233)	
Total delivered energy for all uses												4429.5307	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3451.8369	3.4800	120.1239	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1061.5767	3.4800	36.9429	(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	355.0583	13.1900	46.8322	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-563.9412	13.1900	-74.3838	(252)
Total energy cost			266.0026	(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] =	0.8731	(257)
SAP value			87.8203	
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	3451.8369	0.2160	745.5968 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1061.5767	0.2160	229.3006 (264)
Space and water heating			974.8973 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.0583	0.5190	184.2753 (268)
Energy saving/generation technologies			
PV Unit	-563.9412	0.5190	-292.6855 (269)
Total kg/year			931.3621 (272)
CO2 emissions per m2			11.2300 (273)
EI value			90.2468
EI rating			90 (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	41.4800 (1b)	x 2.3900 (2b)	= 99.1372 (1b) - (3b)
First floor	41.4800 (1c)	x 2.6700 (2c)	= 110.7516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.8888 (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) = 0.1906 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3931 (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) =	0.3636 (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	0.4272	0.4000	0.4000	0.3636	0.3727	0.3545	0.3545	0.3454	0.3454	0.3727	0.3636	0.3727 (22b)
Effective ac	0.5913	0.5800	0.5800	0.5661	0.5694	0.5628	0.5628	0.5597	0.5597	0.5694	0.5661	0.5694 (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)			19.0800	1.1450	21.8473		(27)
Ground Floor			41.4800	0.1200	4.9776	84.0000	3484.3200 (28a)
Brick and Block	95.6800	21.2000	74.4800	0.2400	17.8752	42.2200	3144.5456 (29a)
Pitched Roof	41.4800		41.4800	0.1000	4.1480	9.1000	377.4680 (30)
Total net area of external elements Aum(A, m ²)			178.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1801		(33)
Party Wall 1			44.6500	0.0000	0.0000	110.0000	4911.5000 (32)
GF Stud			70.8300			9.0000	637.4700 (32c)
First Floor			98.7500			9.0000	888.7500 (32c)
Internal Floor 1			41.4800			18.0000	746.6400 (32d)
Internal Ceiling 1			41.4800			18.0000	746.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14937.3336 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 180.0546 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9833 (36)
Total fabric heat loss (33) + (36) = 62.1635 (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	40.9527	40.1715	40.1715	39.2100	39.4418	38.9840	38.9840	38.7636	38.7636	39.4418	39.2100	39.4418 (38)
Heat transfer coeff	103.1161	102.3350	102.3350	101.3735	101.6053	101.1474	101.1474	100.9271	100.9271	101.6053	101.3735	101.6053 (39)
Average = Sum(39)m / 12 =												101.6248 (39)
HLP	1.2430	1.2335	1.2335	1.2220	1.2248	1.2192	1.2192	1.2166	1.2166	1.2248	1.2220	1.2248 (40)
HLP (average)												1.2250 (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												2.5166 (42)
Average daily hot water use (litres/day)												93.9699 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3669	99.6081	95.8493	92.0905	88.3317	84.5730	84.5730	88.3317	92.0905	95.8493	99.6081	103.3669 (44)
Energy conte	153.2902	134.0686	138.3468	120.6141	115.7321	99.8680	92.5424	106.1937	107.4620	125.2366	136.7055	148.4534 (45)
Energy content (annual)										Total = Sum(45)m =		1478.5131 (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	22.9935	20.1103	20.7520	18.0921	17.3598	14.9802	13.8814	15.9291	16.1193	18.7855	20.5058	22.2680 (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	27.5587	24.8877	27.5284	26.6110	27.4767	26.5658	27.4360	27.4624	26.5904	27.5070	26.6537	27.5506 (61)
Total heat required for water heating calculated for each month	180.8489	158.9563	165.8751	147.2251	143.2088	126.4338	119.9783	133.6561	134.0524	152.7436	163.3592	176.0040 (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												1.3704 (H8)
Utilisation factor												0.5180 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.9699 (H14)
Volume ratio Veff/V												0.7981 (H15)
Solar storage volume factor												0.9549 (H16)
Solar input	-28.7532	-40.8903	-70.9551	-95.4466	-110.9154	-120.6438	-114.3887	-104.3114	-81.6443	-56.4296	-34.0085	-881.1544 (H17)
Solar input (sum of months) = Sum (63)m =												-881.1544 (63)
Output from w/h	152.0957	118.0660	94.9200	51.7784	32.2933	5.7899	5.5896	29.3447	52.4081	96.3140	129.3507	153.2367 (64)
Total per year (kWh/year) = Sum (64)m =												921.1872 (64)
Heat gains from water heating, kWh/month	57.8587	50.7997	52.8824	46.7569	45.3501	39.8475	37.6293	42.1750	42.3787	48.5179	52.1180	56.2484 (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	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	150.9978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.2622	44.6424	36.3057	27.4857	20.5459	17.3457	18.7427	24.3624	32.6992	41.5191	48.4589	51.6591	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.5903	340.0830	331.2814	312.5438	288.8909	266.6605	251.8093	248.3165	257.1182	275.8558	299.5087	321.7390	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	52.6164	(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)	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	-100.6652	(71)
Water heating gains (Table 5)	77.7670	75.5948	71.0785	64.9402	60.9544	55.3438	50.5771	56.6868	58.8593	65.2123	72.3861	75.6027	(72)
Total internal gains	570.5685	566.2693	544.6145	510.9187	476.3402	445.2991	427.0780	435.3148	454.6257	488.5361	526.3027	554.9498	(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				6.9400	13.4684		0.6300	0.7000		0.7700		28.5659 (74)
East				5.4000	25.1733		0.6300	0.7000		0.7700		41.5437 (76)
West				6.7400	25.1733		0.6300	0.7000		0.7700		51.8527 (80)

Solar gains	121.9622	202.4480	342.1854	511.8119	603.1970	690.6121	628.7397	553.1240	419.6786	259.5750	151.3225	95.1638 (83)
Total gains	692.5307	768.7173	886.8000	1022.7306	1079.5373	1135.9111	1055.8177	988.4388	874.3042	748.1111	677.6252	650.1136 (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	40.2387	40.5459	40.5459	40.9304	40.8370	41.0219	41.0219	41.1114	41.1114	40.8370	40.9304	40.8370
alpha	3.6826	3.7031	3.7031	3.7287	3.7225	3.7348	3.7348	3.7408	3.7408	3.7225	3.7287	3.7225
util living area	0.9729	0.9599	0.9193	0.8179	0.6595	0.4408	0.3132	0.3234	0.5953	0.8558	0.9514	0.9770 (86)
MIT	19.6994	19.8635	20.2072	20.6162	20.8704	20.9784	20.9956	20.9952	20.9360	20.6228	20.1246	19.6865 (87)
Th 2	19.8858	19.8933	19.8933	19.9025	19.9003	19.9046	19.9046	19.9068	19.9068	19.9003	19.9025	19.9003 (88)
util rest of house	0.9661	0.9501	0.8998	0.7770	0.5902	0.3517	0.2107	0.2146	0.4976	0.8104	0.9371	0.9711 (89)
MIT 2	18.7420	18.9075	19.2373	19.6180	19.8234	19.8967	19.9039	19.9060	19.8784	19.6341	19.1723	18.7409 (90)
Living area fraction									fLA = Living area / (4) =			0.1850 (91)
MIT	18.9191	19.0844	19.4168	19.8027	20.0172	20.0968	20.1059	20.1075	20.0741	19.8170	19.3485	18.9159 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9191	19.0844	19.4168	19.8027	20.0172	20.0968	20.1059	20.1075	20.0741	19.8170	19.3485	18.9159 (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	0.9585	0.9411	0.8898	0.7729	0.5981	0.3677	0.2297	0.2348	0.5135	0.8064	0.9281	0.9642	(94)
Useful gains	663.7826	723.4520	789.0885	790.4443	645.6540	417.7001	242.5678	232.0944	448.9126	603.2423	628.8717	626.8212	(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	1373.4149	1338.9934	1209.2709	983.5943	702.8195	424.4963	243.3485	232.8934	471.7398	784.0928	1089.6169	1342.8049	(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	527.9664	413.6438	312.6158	139.0680	42.5311	0.0000	0.0000	0.0000	0.0000	134.5528	331.7365	532.6918	(98)
Space heating												2434.8062	(98)
Space heating per m2											(98) / (4) =	29.3492	(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													2684.4610	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	527.9664	413.6438	312.6158	139.0680	42.5311	0.0000	0.0000	0.0000	0.0000	134.5528	331.7365	532.6918	(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)	582.1019	456.0571	344.6701	153.3274	46.8920	0.0000	0.0000	0.0000	0.0000	148.3492	365.7514	587.3118	(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	152.0957	118.0660	94.9200	51.7784	32.2933	5.7899	5.5896	29.3447	52.4081	96.3140	129.3507	153.2367	(64)	
Efficiency of water heater	90.0584	90.0630	90.0320	89.9229	89.4700	87.9000	87.9000	87.9000	87.9000	89.5105	89.8967	90.0591	(217)	
Fuel for water heating, kWh/month	168.8856	131.0928	105.4291	57.5810	36.0941	6.5870	6.3591	33.3841	59.6224	107.6008	143.8883	170.1513	(219)	
Water heating fuel used												1026.6754	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2684.4610	(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)												355.0583	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1184 * 1.00) =									-625.1081			-625.1081	(233)	
Total delivered energy for all uses												3566.0866	(238)	

10a. Fuel costs - using BEDF prices (497)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2684.4610	3.6300	97.4459	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1026.6754	3.6300	37.2683	(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	355.0583	19.4400	69.0233	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-625.1081	19.4400	-121.5210	(252)
Total energy cost			201.5166	(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	2684.4610	0.2160	579.8436	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1026.6754	0.2160	221.7619	(264)
Space and water heating			801.6055	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.0583	0.5190	184.2753	(268)
Energy saving/generation technologies				
PV Unit	-625.1081	0.5190	-324.4311	(269)
Total kg/year			726.3246	(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	2684.4610	1.2200	3275.0425	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1026.6754	1.2200	1252.5440	(264)
Space and water heating			4527.5865	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.0583	3.0700	1090.0290	(268)
Energy saving/generation technologies				
PV Unit	-625.1081	3.0700	-1919.0820	(269)
Primary energy kWh/year			4082.2834	(272)
Primary energy kWh/m2/year			49.2079	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 17	Issued on Date	05/07/2022
Assessment Reference	As Built	Prop Type Ref	B (P)
Project	1 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	15.23	TER	19.16
Environmental	88 B	% DER<TER	20.50		
CO ₂ Emissions (t/year)	0.92	DFEE	48.32	TFEE	58.01
General Requirements Compliance	Pass	% DFEE<TFEE	16.70		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.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 17	Issued on Date	05/07/2022
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Project	1 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	15.23	TER	19.16
Environmental	88 B	% DER<TER	20.50		
CO ₂ Emissions (t/year)	0.92	DFEE	48.32	TFEE	58.01
General Requirements Compliance	Pass	% DFEE<TFEE	16.70		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.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 17	Issued on Date	05/07/2022
Assessment Reference	As Built	Prop Type Ref	B (P)
Project	1 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	15.23	TER	19.16
Environmental	88 B	% DER<TER	20.50		
CO ₂ Emissions (t/year)	0.92	DFEE	48.32	TFEE	58.01
General Requirements Compliance	Pass	% DFEE<TFEE	16.70		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.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 = 41.48 m², Perimeter = 18.91 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 17	Issued on Date	05/07/2022
Assessment Reference	As Built	Prop Type Ref	B (P)
Property	1 Robert Place, West End, Southampton, SO30 3JY		
SAP Rating	87 B	DER	15.23
Environmental	88 B	TER	19.16
CO ₂ Emissions (t/year)	0.92	% DER<TER	20.50
General Requirements Compliance	Pass	DfEE	48.32
		TFEE	58.01
		% DfEE<TFEE	16.70
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	North
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:	18.91 m	41.48 m ²	2.39 m
1st Storey:	18.91 m	41.48 m ²	2.67 m

7.0 Living Area	15.35	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	180.05	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	95.68	74.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	44.65

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
GF Stud	Plasterboard on timber frame	9.00	70.83
First Floor	Plasterboard on timber frame	9.00	98.75

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	41.48	41.48

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	41.48

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	41.48

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	41.48

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	North							2.12	
Front Elevation	Window	[1] Brick and Block	North	None	0.00					6.94	
East Elevation	Window	[1] Brick and Block	East	None	0.00					5.40	
West Elevation	Window	[1] Brick and Block	West	None	0.00					6.74	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	0.91	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.31	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.00	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.44	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.07	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	14.72	0.021	No	Knauf P5
Independently assessed	E4 Jamb	33.02	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	18.91	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.91	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.86	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	9.06	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	20.20	0.039	No	Knauf P23
Table K1 - Default	E25 Staggered party wall between dwellings	10.10	0.120	No	
Table K1 - Default	P1 Party wall - Ground floor	8.78	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.78	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.78	0.180	No	Knauf P29

Y-value	0.061	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
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SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Tested ? Yes
As Built AP₅₀ 4.05 m³/(h.m²) @ 50 Pa

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

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 22
Total number of L.E.L. fittings 22
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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Combi keep hot type	Gas/Oil, time clock			
25.0 Main Heating 2	None			
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
0.66	South	45°	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	£26	B 88	