



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

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Report Issue Date: 29/11/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

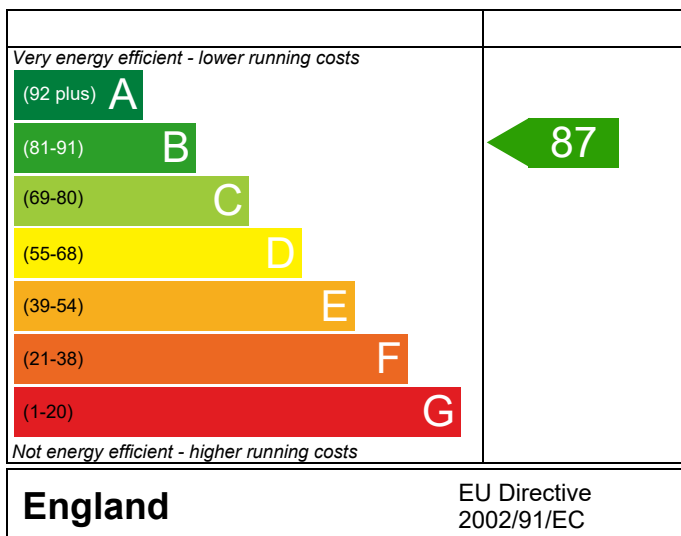
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, End-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.54 m²
DRRN: 1972-2961-7263

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

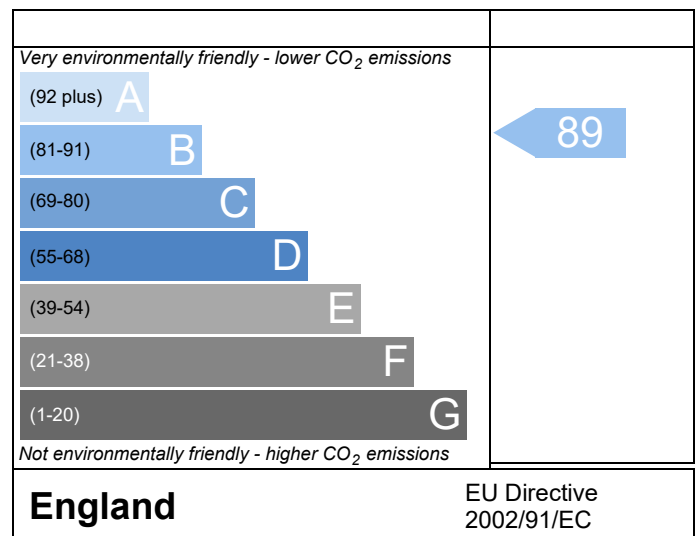
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

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 Designed)

Property Reference	SAP 0906 Plot 44				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv			
Property						
SAP Rating	87 B	DER	14.63	TER	18.36	
Environmental	89 B	% DER<TER	20.34			
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57	
General Requirements Compliance	Pass	% DFEE<TFEE	15.78			
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 Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.63	kgCO ₂ /m ²	Pass
	-3.73 (-20.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.57	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.27	kWh/m ² /yr	
	-8.3 (-15.8%)	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	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

7.82 m², No overhang

Windows facing East

1.44 m², No overhang

Windows facing South

3.62 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

5.00 (design value)

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

0.75

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£85	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£85	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 44	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Property			

SAP Rating	87 B	DER	14.63	TER	18.36
Environmental	89 B	% DER<TER	20.34		
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57
General Requirements Compliance	Pass	% DFEE<TFEE	15.78		

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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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.093	0.46	0.04	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.37	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.75	0.27	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.74	0.24	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	8.31	0.17	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	28.80	0.46	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	18.74	3.00	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.74	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	13.92	0.99	Knauf P16
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	4.82	0.21	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	14.99	0.58	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	5.00	0.18	Knauf P25 Halved
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.055	5.00	0.28	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.45	1.35	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.45	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.45	0.30	Knauf P29 Halved

Total: **8.28** W/mK:
Y-Value: **0.046** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 85 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.63 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 7.82 m², No overhang
Windows facing East: 1.44 m², No overhang
Windows facing South: 3.62 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 0.75 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14791.6644 (34)
174.9665 (35)
8.2819 (36)
(33) + (36) = 53.5752 (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	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7400	94.4957	94.2562	93.1313	92.9208	91.9411	91.9411	91.7597	92.3185	92.9208	93.3466	93.7917 (39)
Average = Sum(39)m / 12 =												93.1303 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1207	1.1178	1.1149	1.1016	1.0991	1.0875	1.0875	1.0854	1.0920	1.0991	1.1042	1.1094 (40)
HLP (average)												1.1016 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum (45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	391.7754	389.5607	375.4667	352.7818	329.7301	307.6063	293.3118	299.4970	311.2294	334.1304	360.3941	380.1025	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					7.8200	10.6334	0.6300	0.7000			0.7700			25.4127 (74)
East					1.4400	19.6403	0.6300	0.7000			0.7700			8.6433 (76)
South					3.6200	46.7521	0.6300	0.7000			0.7700			51.7227 (78)
Solar gains	85.7787	150.1816	218.2726	295.1195	355.4168	364.4063	346.4699	299.3045	244.3236	169.2392	103.4361	72.9863	(83)	
Total gains	477.5541	539.7423	593.7393	647.9013	685.1469	672.0126	639.7817	598.8015	555.5530	503.3696	463.8302	453.0887	(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	43.3692	43.4813	43.5918	44.1183	44.2182	44.6894	44.6894	44.7778	44.5068	44.2182	44.0166	43.8077
alpha	3.8913	3.8988	3.9061	3.9412	3.9479	3.9793	3.9793	3.9852	3.9671	3.9479	3.9344	3.9205
util living area	0.9934	0.9886	0.9778	0.9487	0.8787	0.7429	0.5905	0.6423	0.8493	0.9620	0.9887	0.9946 (86)
MIT	19.3752	19.5501	19.8453	20.2452	20.6135	20.8682	20.9605	20.9446	20.7561	20.2891	19.7646	19.3454 (87)
Th 2	19.9840	19.9864	19.9887	19.9995	20.0015	20.0110	20.0110	20.0128	20.0074	20.0015	19.9974	19.9931 (88)
util rest of house	0.9918	0.9858	0.9721	0.9343	0.8422	0.6655	0.4751	0.5289	0.7912	0.9486	0.9855	0.9933 (89)
MIT 2	18.4992	18.6749	18.9690	19.3683	19.7150	19.9366	19.9968	19.9909	19.8511	19.4175	18.8976	18.4765 (90)
Living area fraction	18.6858	18.8613	19.1557	19.5551	19.9064	20.1351	20.2021	20.1941	20.0439	19.6032	19.0823	18.6616 (91)
MIT	18.6858	18.8613	19.1557	19.5551	19.9064	20.1351	20.2021	20.1941	20.0439	19.6032	19.0823	18.6616 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6858	18.8613	19.1557	19.5551	19.9064	20.1351	20.2021	20.1941	20.0439	19.6032	19.0823	18.6616 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	472.2820	529.8371	573.5383	600.1931	574.2928	454.3910	319.0954	330.1507	440.9493	474.0077	455.2129	448.9709	(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	1362.9145	1319.2842	1192.8780	992.3214	762.5487	508.9024	331.1776	348.1410	548.7316	836.5841	1118.5085	1356.3781	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	662.6306	530.5084	460.7888	282.3324	140.0624	0.0000	0.0000	0.0000	0.0000	269.7569	477.5728	675.1109	(98)
Space heating												3498.7632	(98)
Space heating per m2												41.3859	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													3857.5118	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	662.6306	530.5084	460.7888	282.3324	140.0624	0.0000	0.0000	0.0000	0.0000	269.7569	477.5728	675.1109	(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)	730.5740	584.9046	508.0361	311.2816	154.4238	0.0000	0.0000	0.0000	0.0000	297.4166	526.5411	744.3340	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)	
Efficiency of water heater (217)m	89.9301	89.8728	89.7520	89.4767	88.9054	87.2000	87.2000	87.2000	87.2000	89.4103	89.7867	89.9575	(216)	
Fuel for water heating, kWh/month	199.7609	175.6283	183.3484	162.9963	159.3921	143.2162	135.6606	151.4705	152.0293	169.2486	180.5517	194.2727	(219)	
Water heating fuel used												2007.5755	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3857.5118	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.75 * 853 * 1.00) =										-511.8180			-511.8180	(233)
Total delivered energy for all uses													5807.6129	(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	3857.5118	0.2160	833.2226	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2007.5755	0.2160	433.6363	(264)
Space and water heating			1266.8588	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-511.8180	0.5190	-265.6335	(269)
Total CO2, kg/year			1237.0297	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6300	(273)

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

DER			14.6300	ZC1
Total Floor Area		TFA	84.5400	
Assumed number of occupants		N	2.5434	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.0283	ZC2
CO2 emissions from cooking, equation (L16)			2.1297	ZC3
Total CO2 emissions			32.7880	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			32.7880	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			12.8800	1.3258	17.0758		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.7300	12.8500	62.8800	0.1800	11.3184		(29a)
Tile Hung	17.9700	2.1800	15.7900	0.1800	2.8422		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3766	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1629 (36)
Total fabric heat loss						(33) + (36) =	54.5395 (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	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	95.7043	95.4600	95.2205	94.0956	93.8851	92.9054	92.9054	92.7240	93.2828	93.8851	94.3109	94.7560 (39)
Average = Sum(39)m / 12 =												94.0946 (39)
HLP	1.1321	1.1292	1.1263	1.1130	1.1105	1.0990	1.0990	1.0968	1.1034	1.1105	1.1156	1.1208 (40)
HLP (average)												1.1130 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	50.9589	46.0274	49.1740	45.7216	45.3173	41.9892	43.3889	45.3173	45.7216	49.1740	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(64)
Heat gains from water heating, kWh/month	64.0534	56.3861	58.6049	51.8058	50.0704	43.9279	41.8256	46.8775	47.4031	54.2162	58.0907	62.4342	(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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	86.0932	83.9079	78.7700	71.9524	67.2990	61.0110	56.2172	63.0074	65.8377	72.8713	80.6815	83.9170	(72)
Total internal gains	400.3911	398.1769	383.4967	360.1803	336.4921	313.7340	299.4478	306.2668	318.6394	342.1719	369.0169	388.7225	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				7.8200	10.6334	0.6300	0.7000	0.7700	25.4127 (74)				
East				1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (76)				
South				3.6200	46.7521	0.6300	0.7000	0.7700	51.7227 (78)				
Solar gains	85.7787	150.1816	218.2726	295.1195	355.4168	364.4063	346.4699	299.3045	244.3236	169.2392	103.4361	72.9863	(83)
Total gains	486.1698	548.3585	601.7694	655.2998	691.9089	678.1403	645.9177	605.5713	562.9629	511.4112	472.4530	461.7088	(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	61.3435	61.5005	61.6552	62.3922	62.5321	63.1915	63.1915	63.3152	62.9359	62.5321	62.2498	61.9574	
alpha	5.0896	5.1000	5.1103	5.1595	5.1688	5.2128	5.2128	5.2210	5.1957	5.1688	5.1500	5.1305	
util living area	0.9984	0.9966	0.9919	0.9746	0.9181	0.7793	0.6101	0.6667	0.8892	0.9829	0.9967	0.9988	(86)
MIT	19.7596	19.8956	20.1255	20.4409	20.7339	20.9258	20.9835	20.9744	20.8397	20.4699	20.0609	19.7371	(87)
Th 2	19.9747	19.9771	19.9794	19.9902	19.9922	20.0017	20.0017	20.0034	19.9980	19.9922	19.9881	19.9838	(88)
util rest of house	0.9978	0.9955	0.9888	0.9642	0.8830	0.6927	0.4832	0.5404	0.8288	0.9740	0.9953	0.9983	(89)
MIT 2	18.3178	18.5179	18.8543	19.3158	19.7176	19.9490	19.9952	19.9921	19.8609	19.3634	18.7679	18.2914	(90)
Living area fraction	18.6249	18.8114	19.1251	19.5555	19.9341	20.1571	20.2058	20.2014	20.0694	19.5991	19.0433	18.5994	(92)
Temperature adjustment	18.6249	18.8114	19.1251	19.5555	19.9341	20.1571	20.2058	20.2014	20.0694	19.5991	19.0433	18.5994	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	484.5633	544.8049	592.8888	628.0154	609.2757	479.8474	329.6432	343.4352	469.4994	495.6286	469.3121	460.5306	(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	1370.9586	1327.9841	1202.1709	1002.6364	773.0619	516.2818	334.9958	352.4800	556.8414	844.8837	1126.3857	1364.4253	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	659.4781	526.2964	453.3058	269.7271	121.8569	0.0000	0.0000	0.0000	0.0000	259.8458	473.0930	672.4977	(98)
Space heating												3436.1009	(98)
Space heating per m2												40.6447	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													3678.9089 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	659.4781	526.2964	453.3058	269.7271	121.8569	0.0000	0.0000	0.0000	0.0000	259.8458	473.0930	672.4977	(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)	706.0793	563.4865	485.3381	288.7871	130.4678	0.0000	0.0000	0.0000	0.0000	278.2075	506.5236	720.0190	(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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(64)
Efficiency of water heater (217)m	87.7791	87.5810	87.1800	86.2494	84.3480	80.3000	80.3000	80.3000	80.3000	86.0409	87.2903	87.8627	(216)
Fuel for water heating, kWh/month	233.8663	206.6687	216.1692	193.7999	191.8622	177.5000	170.0585	189.5754	191.6690	203.6908	214.1646	228.1014	(219)
Water heating fuel used												2417.1261	(219)
Annual totals kWh/year													
Space heating fuel - main system												3678.9089	(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)												379.3436	(232)
Total delivered energy for all uses												6550.3787	(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	3678.9089	0.2160	794.6443 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2417.1261	0.2160	522.0992 (264)
Space and water heating			1316.7436 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Total CO2, kg/m2/year			1552.5479 (272)
Emissions per m2 for space and water heating			15.5754 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3288 (272b)
Emissions per m2 for pumps and fans			0.4604 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5754 * 1.00) + 2.3288 + 0.4604, rounded to 2 d.p.			18.3600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			9.0000	380.4300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14411.2344 (34)
170.4665 (35)
8.2819 (36)
(33) + (36) = 53.5752 (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	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7400	94.4957	94.2562	93.1313	92.9208	91.9411	91.9411	91.7597	92.3185	92.9208	93.3466	93.7917 (39)
Average = Sum(39)m / 12 =												93.1303 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1207	1.1178	1.1149	1.1016	1.0991	1.0875	1.0875	1.0854	1.0920	1.0991	1.1042	1.1094 (40)
HLP (average)												1.1016 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1488.5106 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877	(72)
Total internal gains	355.3764	353.9509	341.5083	321.0664	299.4718	279.3972	266.8411	270.7954	281.7324	302.3124	325.9553	344.4932	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					7.8200	10.6334	0.6300	0.7000			0.7700			25.4127 (74)
East					1.4400	19.6403	0.6300	0.7000			0.7700			8.6433 (76)
South					3.6200	46.7521	0.6300	0.7000			0.7700			51.7227 (78)
Solar gains	85.7787	150.1816	218.2726	295.1195	355.4168	364.4063	346.4699	299.3045	244.3236	169.2392	103.4361	72.9863	(83)	
Total gains	441.1551	504.1325	559.7810	616.1859	654.8887	643.8035	613.3110	570.0998	526.0559	471.5516	429.3914	417.4795	(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	42.2538	42.3630	42.4706	42.9836	43.0810	43.5401	43.5401	43.6261	43.3621	43.0810	42.8845	42.6810	
alpha	3.8169	3.8242	3.8314	3.8656	3.8721	3.9027	3.9027	3.9084	3.8908	3.8721	3.8590	3.8454	
util living area	0.9945	0.9902	0.9804	0.9536	0.8883	0.7588	0.6087	0.6634	0.8639	0.9672	0.9906	0.9955	(86)
MIT	19.2907	19.4709	19.7757	20.1901	20.5756	20.8494	20.9530	20.9338	20.7252	20.2331	19.6909	19.2611	(87)
Th 2	19.9840	19.9864	19.9887	19.9995	20.0015	20.0110	20.0110	20.0128	20.0074	20.0015	19.9974	19.9931	(88)
util rest of house	0.9932	0.9878	0.9754	0.9405	0.8542	0.6833	0.4924	0.5501	0.8096	0.9555	0.9879	0.9945	(89)
MIT 2	18.4178	18.5987	18.9028	19.3174	19.6830	19.9242	19.9935	19.9858	19.8275	19.3658	18.8271	18.3951	(90)
Living area fraction	18.6037	18.7845	19.0887	19.5033	19.8732	20.1213	20.1979	20.1877	20.0188	19.5506	19.0111	18.5796	(91)
MIT	18.6037	18.7845	19.0887	19.5033	19.8732	20.1213	20.1979	20.1877	20.0188	19.5506	19.0111	18.5796	(92)
Temperature adjustment	18.6037	18.7845	19.0887	19.5033	19.8732	20.1213	20.1979	20.1877	20.0188	19.5506	19.0111	18.5796	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	437.0326	496.0469	542.7028	574.5676	556.0540	445.9079	316.4041	326.0548	426.2910	447.3365	422.6203	414.2961	(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	1355.1352	1312.0269	1186.5665	987.5009	759.4574	507.6336	330.7958	347.5604	546.4116	831.6972	1111.8637	1348.6856	(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	683.0684	548.3386	479.0346	297.3120	151.3321	0.0000	0.0000	0.0000	0.0000	285.9644	496.2552	695.1858	(98)
Space heating												3636.4910	(98)
Space heating per m2												43.0150	(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	864.2463	680.3641	697.3735	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7885	0.8593	0.8299	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	681.4588	584.6064	578.7415	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	848.1943	810.5997	761.8593	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	120.0495	168.1390	136.2396	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												424.4281 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	30.0124	42.0347	34.0599	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												106.1070 (107)
Space cooling per m2												1.2551 (108)
Energy for space heating												43.0150 (99)
Energy for space cooling												1.2551 (108)
Total												44.2701 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			12.8800	1.3258	17.0758		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.7300	12.8500	62.8800	0.1800	11.3184		(29a)
Tile Hung	17.9700	2.1800	15.7900	0.1800	2.8422		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3766	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1629 (36)
Total fabric heat loss						(33) + (36) =	54.5395 (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	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	95.7043	95.4600	95.2205	94.0956	93.8851	92.9054	92.9054	92.7240	93.2828	93.8851	94.3109	94.7560 (39)
Average = Sum(39)m / 12 =												94.0946 (39)
HLP	1.1321	1.1292	1.1263	1.1130	1.1105	1.0990	1.0990	1.0968	1.1034	1.1105	1.1156	1.1208 (40)
HLP (average)												1.1130 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m												1488.5106 (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 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877	(72)
Total internal gains	355.3764	353.9509	341.5083	321.0664	299.4718	279.3972	266.8411	270.7954	281.7324	302.3124	325.9553	344.4932	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					7.8200	10.6334		0.6300	0.7000	0.7700		25.4127 (74)	
East					1.4400	19.6403		0.6300	0.7000	0.7700		8.6433 (76)	
South					3.6200	46.7521		0.6300	0.7000	0.7700		51.7227 (78)	
Solar gains	85.7787	150.1816	218.2726	295.1195	355.4168	364.4063	346.4699	299.3045	244.3236	169.2392	103.4361	72.9863	(83)
Total gains	441.1551	504.1325	559.7810	616.1859	654.8887	643.8035	613.3110	570.0998	526.0559	471.5516	429.3914	417.4795	(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	61.3435	61.5005	61.6552	62.3922	62.5321	63.1915	63.1915	63.3152	62.9359	62.5321	62.2498	61.9574		
alpha	5.0896	5.1000	5.1103	5.1595	5.1688	5.2128	5.2128	5.2210	5.1957	5.1688	5.1500	5.1305		
util living area	0.9990	0.9977	0.9941	0.9802	0.9319	0.8039	0.6374	0.6986	0.9102	0.9879	0.9979	0.9992	(86)	
MIT	19.7098	19.8470	20.0804	20.4021	20.7059	20.9136	20.9799	20.9683	20.8153	20.4287	20.0135	19.6880	(87)	
Th 2	19.9747	19.9771	19.9794	19.9902	19.9922	20.0017	20.0017	20.0034	19.9980	19.9922	19.9881	19.9838	(88)	
util rest of house	0.9986	0.9969	0.9918	0.9719	0.9010	0.7199	0.5073	0.5706	0.8568	0.9813	0.9970	0.9990	(89)	
MIT 2	18.7938	18.9326	19.1668	19.4929	19.7813	19.9587	19.9962	19.9936	19.8866	19.5233	19.1079	18.7793	(90)	
Living area fraction														
MIT	18.9889	19.1274	19.3614	19.6866	19.9783	20.1621	20.2058	20.2012	20.0845	19.7162	19.3008	18.9729	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9889	19.1274	19.3614	19.6866	19.9783	20.1621	20.2058	20.2012	20.0845	19.7162	19.3008	18.9729	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9960	0.9900	0.9686	0.9004	0.7350	0.5354	0.5981	0.8624	0.9789	0.9961	0.9986	(94)
Useful gains	440.3240	502.1047	554.1721	596.8536	589.6829	473.2203	328.3406	340.9569	453.6881	461.5784	427.7074	416.8888	(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	1405.7926	1358.1440	1224.6712	1014.9682	777.2084	516.7499	334.9942	352.4630	558.2469	855.8758	1150.6686	1399.8169	(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	718.3086	575.2584	498.8513	301.0425	139.5190	0.0000	0.0000	0.0000	0.0000	293.3573	520.5320	731.2985	(98)
Space heating												3778.1677	(98)
Space heating per m2											(98) / (4) =	44.6909	(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	873.3106	687.4999	704.7020	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8266	0.8995	0.8701	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	721.8373	618.4366	613.1669	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	848.1943	810.5997	761.8593	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	90.9770	142.9693	110.6271	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											344.5734 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	22.7443	35.7423	27.6568	0.0000	0.0000	0.0000 (107)
Space cooling											86.1434 (107)
Space cooling per m2											1.0190 (108)
Energy for space heating											44.6909 (99)
Energy for space cooling											1.0190 (108)
Total											45.7099 (109)
Target Fabric Energy Efficiency (TFEE)											52.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14791.6644 (34)
174.9665 (35)
8.2819 (36)
(33) + (36) = 53.5752 (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	41.1648	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7400	93.7917	93.5667	92.9208	92.9208	92.3185	92.3185	92.1274	92.3185	93.3466	93.1313	93.7917 (39)
Average = Sum(39)m / 12 =												93.1077 (39)
HLP	1.1207	1.1094	1.1068	1.0991	1.0991	1.0920	1.0920	1.0897	1.0920	1.1042	1.1016	1.1094 (40)
HLP (average)												1.1013 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037 (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)												
	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)												
	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970 (72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					7.8200	13.8645	0.6300	0.7000	0.7700	33.1348 (74)		
East					1.4400	25.9136	0.6300	0.7000	0.7700	11.4041 (76)		
South					3.6200	58.2505	0.6300	0.7000	0.7700	64.4437 (78)		
Solar gains	108.9826	163.6556	238.3414	331.0612	382.8629	425.4888	394.6239	346.8877	283.9085	195.5317	130.3299	88.4799 (83)
Total gains	688.1257	738.1502	790.4527	848.5639	864.9506	875.9627	826.7294	787.6122	744.6547	691.1026	664.5278	651.8762 (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	43.3692	43.8077	43.9130	44.2182	44.2182	44.5068	44.5068	44.5991	44.5068	44.0166	44.1183	43.8077
alpha	3.8913	3.9205	3.9275	3.9479	3.9479	3.9671	3.9671	3.9733	3.9671	3.9344	3.9412	3.9205
util living area	0.9720	0.9627	0.9368	0.8756	0.7550	0.5580	0.4058	0.4238	0.6674	0.8737	0.9509	0.9758 (86)
MIT	19.8133	19.9347	20.2032	20.5337	20.8120	20.9583	20.9910	20.9896	20.9159	20.6245	20.2020	19.7974 (87)
Th 2	19.9840	19.9931	19.9953	20.0015	20.0015	20.0074	20.0074	20.0092	20.0074	19.9974	19.9995	19.9931 (88)
util rest of house	0.9655	0.9543	0.9219	0.8462	0.6980	0.4709	0.3005	0.3146	0.5816	0.8358	0.9376	0.9700 (89)
MIT 2	18.9319	19.0575	19.3197	19.6353	19.8777	19.9884	20.0051	20.0066	19.9643	19.7212	19.3258	18.9239 (90)
Living area fraction	fLA = Living area / (4) = 0.2130 (91)											
MIT	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9585	0.9464	0.9133	0.8404	0.7027	0.4881	0.3230	0.3379	0.5964	0.8321	0.9297	0.9636 (94)
Useful gains	659.5958	698.6090	721.9481	713.1100	607.7761	427.5582	266.9992	266.1658	444.1147	575.0839	617.7970	628.1217 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	1299.8044	1270.3470	1142.2518	950.2697	694.7421	442.6731	269.1221	268.6433	477.0090	757.3807	1034.9218	1276.5040 (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	476.3153	384.2080	312.7060	170.7549	64.7027	0.0000	0.0000	0.0000	0.0000	135.6289	300.3298	482.3964 (98)
Space heating												2327.0419 (98)
RHI space heating demand												2327 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14791.6644 (34)
174.9665 (35)
8.2819 (36)
(33) + (36) = 53.5752 (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	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7400	94.4957	94.2562	93.1313	92.9208	91.9411	91.9411	91.7597	92.3185	92.9208	93.3466	93.7917 (39)
Average = Sum(39)m / 12 =												93.1303 (39)
HLP	1.1207	1.1178	1.1149	1.1016	1.0991	1.0875	1.0875	1.0854	1.0920	1.0991	1.1042	1.1094 (40)
HLP (average)												1.1016 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(65)
Total per year (kWh/year) = Sum(64)m =												1785.6304 (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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North					7.8200	10.6334	0.6300	0.7000	0.7700	25.4127 (74)				
East					1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (76)				
South					3.6200	46.7521	0.6300	0.7000	0.7700	51.7227 (78)				
Solar gains	85.7787	150.1816	218.2726	295.1195	355.4168	364.4063	346.4699	299.3045	244.3236	169.2392	103.4361	72.9863	(83)	
Total gains	664.9218	724.6762	770.3840	812.6222	837.5046	814.8802	778.5754	740.0290	705.0698	664.8102	637.6340	636.3825	(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	43.3692	43.4813	43.5918	44.1183	44.2182	44.6894	44.6894	44.7778	44.5068	44.2182	44.0166	43.8077
alpha	3.8913	3.8988	3.9061	3.9412	3.9479	3.9793	3.9793	3.9852	3.9671	3.9479	3.9344	3.9205
util living area	0.9798	0.9702	0.9505	0.9040	0.8102	0.6536	0.5004	0.5425	0.7562	0.9154	0.9680	0.9828 (86)
MIT	19.6350	19.7989	20.0682	20.4220	20.7263	20.9175	20.9779	20.9695	20.8467	20.4725	19.9982	19.6024 (87)
Th 2	19.9840	19.9864	19.9887	19.9995	20.0015	20.0110	20.0110	20.0128	20.0074	20.0015	19.9974	19.9931 (88)
util rest of house	0.9753	0.9635	0.9391	0.8809	0.7638	0.5740	0.3963	0.4377	0.6857	0.8903	0.9597	0.9789 (89)
MIT 2	18.7558	18.9188	19.1839	19.5311	19.8074	19.9670	20.0035	20.0015	19.9160	19.5862	19.1256	18.7308 (90)
Living area fraction	18.9431	19.1062	19.3723	19.7209	20.0032	20.1695	20.2111	20.2078	20.1143	19.7750	19.3115	18.9165 (92)
MIT	18.9431	19.1062	19.3723	19.7209	20.0032	20.1695	20.2111	20.2078	20.1143	19.7750	19.3115	18.9165 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9431	19.1062	19.3723	19.7209	20.0032	20.1695	20.2111	20.2078	20.1143	19.7750	19.3115	18.9165 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9694	0.9563	0.9306	0.8734	0.7639	0.5876	0.4181	0.4593	0.6941	0.8835	0.9525	0.9735	(94)
Useful gains	644.5715	692.9869	716.9234	709.7205	639.7877	478.8203	325.5055	339.9055	489.4030	587.3459	607.3345	619.5277	(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	1387.2843	1342.4287	1213.2908	1007.7645	771.5375	512.0682	332.0078	349.3980	555.2282	852.5475	1139.9027	1380.2822	(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	552.5783	436.4249	369.2974	214.5917	98.0219	0.0000	0.0000	0.0000	0.0000	197.3100	383.4491	566.0013	(98)
Space heating												2817.6745	(98)
Space heating per m2												33.3295	(99)
												(98) / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													3106.5872	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	552.5783	436.4249	369.2974	214.5917	98.0219	0.0000	0.0000	0.0000	0.0000	197.3100	383.4491	566.0013	(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)	609.2374	481.1741	407.1636	236.5951	108.0726	0.0000	0.0000	0.0000	0.0000	217.5413	422.7664	624.0368	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)	
Efficiency of water heater (217)m	89.8155	89.7433	89.5916	89.2505	88.5979	87.2000	87.2000	87.2000	87.2000	89.1469	89.6310	89.8492	(216)	
Fuel for water heating, kWh/month	200.0157	175.8818	183.6768	163.4094	159.9452	143.2162	135.6606	151.4705	152.0293	169.7487	180.8653	194.5070	(219)	
Water heating fuel used												2010.4265	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3106.5872	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.75 * 853 * 1.00) =										-511.8180			-511.8180	(233)
Total delivered energy for all uses													5059.5394	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3106.5872	3.4800	108.1092 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2010.4265	3.4800	69.9628 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	379.3436	13.1900	50.0354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-511.8180	13.1900	-67.5088 (252)
Total energy cost			290.4912 (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] =	0.9418 (257)
SAP value		86.8613
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	3106.5872	0.2160	671.0228 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2010.4265	0.2160	434.2521 (264)
Space and water heating			1105.2750 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-511.8180	0.5190	-265.6335 (269)
Total kg/year			1075.4458 (272)
CO2 emissions per m2			12.7200 (273)
EI value			88.8753
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	$3.48 / 0.8870 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14791.6644 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							174.9665 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2819 (36)
Total fabric heat loss						(33) + (36) =	53.5752 (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	41.1648	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7400	93.7917	93.5667	92.9208	92.9208	92.3185	92.3185	92.1274	92.3185	93.3466	93.1313	93.7917 (39)
Average = Sum(39)m / 12 =												93.1077 (39)
HLP	1.1207	1.1094	1.1068	1.0991	1.0991	1.0920	1.0920	1.0897	1.0920	1.1042	1.1016	1.1094 (40)
HLP (average)												1.1013 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.8200				13.8645		0.6300		0.7000		0.7700		33.1348 (74)	
East	1.4400				25.9136		0.6300		0.7000		0.7700		11.4041 (76)	
South	3.6200				58.2505		0.6300		0.7000		0.7700		64.4437 (78)	
Solar gains	108.9826	163.6556	238.3414	331.0612	382.8629	425.4888	394.6239	346.8877	283.9085	195.5317	130.3299	88.4799	83	88.4799 (83)
Total gains	688.1257	738.1502	790.4527	848.5639	864.9506	875.9627	826.7294	787.6122	744.6547	691.1026	664.5278	651.8762	84	651.8762 (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	43.3692	43.8077	43.9130	44.2182	44.2182	44.5068	44.5068	44.5991	44.5068	44.0166	44.1183	43.8077
alpha	3.8913	3.9205	3.9275	3.9479	3.9479	3.9671	3.9671	3.9733	3.9671	3.9344	3.9412	3.9205
util living area	0.9720	0.9627	0.9368	0.8756	0.7550	0.5580	0.4058	0.4238	0.6674	0.8737	0.9509	0.9758 (86)
MIT	19.8133	19.9347	20.2032	20.5337	20.8120	20.9583	20.9910	20.9896	20.9159	20.6245	20.2020	19.7974 (87)
Th 2	19.9840	19.9931	19.9953	20.0015	20.0015	20.0074	20.0074	20.0092	20.0074	19.9974	19.9995	19.9931 (88)
util rest of house	0.9655	0.9543	0.9219	0.8462	0.6980	0.4709	0.3005	0.3146	0.5816	0.8358	0.9376	0.9700 (89)
MIT 2	18.9319	19.0575	19.3197	19.6353	19.8777	19.9884	20.0051	20.0066	19.9643	19.7212	19.3258	18.9239 (90)
Living area fraction	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (91)
MIT	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (92)
Temperature adjustment	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (93)
adjusted MIT	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9585	0.9464	0.9133	0.8404	0.7027	0.4881	0.3230	0.3379	0.5964	0.8321	0.9297	0.9636	(94)
Useful gains	659.5958	698.6090	721.9481	713.1100	607.7761	427.5582	266.9992	266.1658	444.1147	575.0839	617.7970	628.1217	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1299.8044	1270.3470	1142.2518	950.2697	694.7421	442.6731	269.1221	268.6433	477.0090	757.3807	1034.9218	1276.5040	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	476.3153	384.2080	312.7060	170.7549	64.7027	0.0000	0.0000	0.0000	0.0000	135.6289	300.3298	482.3964	(98)
Space heating												2327.0419	(98)
Space heating per m2												27.5259	(99)
												(98) / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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													2565.6470	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	476.3153	384.2080	312.7060	170.7549	64.7027	0.0000	0.0000	0.0000	0.0000	135.6289	300.3298	482.3964	(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)	525.1546	423.6030	344.7695	188.2634	71.3370	0.0000	0.0000	0.0000	0.0000	149.5357	331.1244	531.8594	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)	
Efficiency of water heater (217)m	89.7138	89.6522	89.4619	89.0534	88.2677	87.2000	87.2000	87.2000	87.2000	88.8200	89.4415	87.2000	(216)	
Fuel for water heating, kWh/month	200.2425	176.0606	183.9430	163.7710	160.5436	143.2162	135.6606	151.4705	152.0293	170.3735	181.2485	194.7391	(219)	
Water heating fuel used													(219)	
Annual totals kWh/year														
Space heating fuel - main system													2565.6470	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.75 * 989 * 1.00) =										-593.1804			-593.1804	(233)
Total delivered energy for all uses													4440.1085	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2565.6470	10.2300	262.4657	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2013.2982	10.2300	205.9604	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	379.3436	36.7200	139.2950	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-593.1804	36.7200	-217.8158	(252)
Total energy cost			520.4453	(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	2565.6470	0.2160	554.1798	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2013.2982	0.2160	434.8724	(264)
Space and water heating			989.0522	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-593.1804	0.5190	-307.8606	(269)
Total kg/year			916.9959	(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	2565.6470	1.2200	3130.0894	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2013.2982	1.2200	2456.2238	(264)
Space and water heating			5586.3132	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	379.3436	3.0700	1164.5850	(268)
Energy saving/generation technologies				
PV Unit	-593.1804	3.0700	-1821.0637	(269)
Primary energy kWh/year			5160.0845	(272)
Primary energy kWh/m2/year			61.0372	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 85	-193 kg (21.0%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£85	2.28 kg/m²	B 88	B 91
Total Savings	£85	2.28 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				B 91

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
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	£167	£185	-£18
Mains gas	£571	£468	£104
Space heating	£393	£393	£0
Water heating	£206	£121	£85
Lighting	£139	£139	£0
Generated (PV)	-£218	-£218	£0
Total cost of fuels	£520	£435	£86
Total cost of uses	£520	£435	£85
Delivered energy	53 kWh/m²	41 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	61 kWh/m²	48 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14791.6644 (34)
174.9665 (35)
8.2819 (36)
(33) + (36) = 53.5752 (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	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7400	94.4957	94.2562	93.1313	92.9208	91.9411	91.9411	91.7597	92.3185	92.9208	93.3466	93.7917 (39)
Average = Sum(39)m / 12 =												93.1303 (39)
HLP	1.1207	1.1178	1.1149	1.1016	1.0991	1.0875	1.0875	1.0854	1.0920	1.0991	1.1042	1.1094 (40)
HLP (average)												1.1016 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum (45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (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												1.2184 (H8)
Utilisation factor												0.5599 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.6054 (H14)
Volume ratio Veff/V												0.7928 (H15)
Solar storage volume factor												0.9536 (H16)
Solar input												-851.3931 (H17)
Solar input	-24.6887	-41.1983	-70.1655	-94.0356	-116.1731	-114.2166	-112.7072	-98.4729	-77.1240	-52.6666	-29.2844	-20.6602 (63)
												Solar input (sum of months) = Sum (63)m = -851.3931 (63)
Output from w/h	154.9565	116.6437	94.3934	51.8081	25.5351	10.6679	5.5888	33.6094	55.4456	98.6591	132.8270	154.1027 (64)
												Total per year (kWh/year) = Sum (64)m = 934.2373 (64)
Heat gains from water heating, kWh/month	57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.8200	10.6334		0.6300		0.7000		0.7700		25.4127 (74)
East				1.4400	19.6403		0.6300		0.7000		0.7700		8.6433 (76)
South				3.6200	46.7521		0.6300		0.7000		0.7700		51.7227 (78)
Solar gains	85.7787	150.1816	218.2726	295.1195	355.4168	364.4063	346.4699	299.3045	244.3236	169.2392	103.4361		72.9863 (83)
Total gains	664.9218	724.6762	770.3840	812.6222	837.5046	814.8802	778.5754	740.0290	705.0698	664.8102	637.6340		636.3825 (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)												
tau	43.3692	43.4813	43.5918	44.1183	44.2182	44.6894	44.6894	44.7778	44.5068	44.2182	44.0166	43.8077
alpha	3.8913	3.8988	3.9061	3.9412	3.9479	3.9793	3.9793	3.9852	3.9671	3.9479	3.9344	3.9205
util living area	0.9798	0.9702	0.9505	0.9040	0.8102	0.6536	0.5004	0.5425	0.7562	0.9154	0.9680	0.9828 (86)
MIT	19.6350	19.7989	20.0682	20.4220	20.7263	20.9175	20.9779	20.9695	20.8467	20.4725	19.9982	19.6024 (87)
Th 2	19.9840	19.9864	19.9887	19.9995	20.0015	20.0110	20.0110	20.0128	20.0074	20.0015	19.9974	19.9931 (88)
util rest of house	0.9753	0.9635	0.9391	0.8809	0.7638	0.5740	0.3963	0.4377	0.6857	0.8903	0.9597	0.9789 (89)
MIT 2	18.7558	18.9188	19.1839	19.5311	19.8074	19.9670	20.0035	20.0015	19.9160	19.5862	19.1256	18.7308 (90)
Living area fraction												fLA = Living area / (4) = 0.2130 (91)
MIT	18.9431	19.1062	19.3723	19.7209	20.0032	20.1695	20.2111	20.2078	20.1143	19.7750	19.3115	18.9165 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9431	19.1062	19.3723	19.7209	20.0032	20.1695	20.2111	20.2078	20.1143	19.7750	19.3115	18.9165 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9694	0.9563	0.9306	0.8734	0.7639	0.5876	0.4181	0.4593	0.6941	0.8835	0.9525	0.9735	(94)
Useful gains	644.5715	692.9869	716.9234	709.7205	639.7877	478.8203	325.5055	339.9055	489.4030	587.3459	607.3345	619.5277	(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	1387.2843	1342.4287	1213.2908	1007.7645	771.5375	512.0682	332.0078	349.3980	555.2282	852.5475	1139.9027	1380.2822	(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	552.5783	436.4249	369.2974	214.5917	98.0219	0.0000	0.0000	0.0000	0.0000	197.3100	383.4491	566.0013	(98)
Space heating												2817.6745	(98)
Space heating per m2											(98) / (4) =	33.3295	(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													3106.5872	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	552.5783	436.4249	369.2974	214.5917	98.0219	0.0000	0.0000	0.0000	0.0000	197.3100	383.4491	566.0013	(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)	609.2374	481.1741	407.1636	236.5951	108.0726	0.0000	0.0000	0.0000	0.0000	217.5413	422.7664	624.0368	(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	154.9565	116.6437	94.3934	51.8081	25.5351	10.6679	5.5888	33.6094	55.4456	98.6591	132.8270	154.1027	(64)	
Efficiency of water heater	89.9096	89.9387	89.9649	89.9975	89.9538	87.2000	87.2000	87.2000	87.2000	89.5025	89.7730	89.9276	(217)	
Fuel for water heating, kWh/month	172.3469	129.6926	104.9224	57.5661	28.3869	12.2338	6.4092	38.5429	63.5844	110.2305	147.9588	171.3631	(219)	
Water heating fuel used												1043.2377	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3106.5872	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.75 * 853 * 1.00) =										-511.8180		-511.8180	(233)	
Total delivered energy for all uses												4142.3505	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3106.5872	3.4800	108.1092 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1043.2377	3.4800	36.3047 (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	379.3436	13.1900	50.0354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-511.8180	13.1900	-67.5088 (252)
Total energy cost			263.4280 (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] =	0.8541 (257)
SAP value		88.0853
SAP rating (Section 12)		88 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3106.5872	0.2160	671.0228 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1043.2377	0.2160	225.3393 (264)
Space and water heating			896.3622 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-511.8180	0.5190	-265.6335 (269)
Total kg/year			892.4830 (272)
CO2 emissions per m2			10.5600 (273)
EI value			90.7679
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	0.5766 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7300	12.8500	62.8800	0.2400	15.0912	42.2200	2654.7936 (29a)
Tile Hung	17.9700	2.1800	15.7900	0.2400	3.7896	42.2200	666.6538 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2933		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			90.6900			9.0000	816.2100 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14791.6644 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							174.9665 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2819 (36)
Total fabric heat loss						(33) + (36) =	53.5752 (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	41.1648	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7400	93.7917	93.5667	92.9208	92.9208	92.3185	92.3185	92.1274	92.3185	93.3466	93.1313	93.7917 (39)
Average = Sum(39)m / 12 =												93.1077 (39)
HLP	1.1207	1.1094	1.1068	1.0991	1.0991	1.0920	1.0920	1.0897	1.0920	1.1042	1.1016	1.1094 (40)
HLP (average)												1.1013 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum (45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(62)
Aperture area of solar collector												
Zero-loss collector efficiency												3.0000 (H1)
Collector heat loss coefficient												0.7000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector effective heat loss coefficient												0.0050 (H3a)
Collector performance ratio												1.8063 (H3b)
Annual solar radiation per m2												2.5804 (H4)
Overshading factor												1234.4649 (H5)
Solar energy available												0.8000 (H6)
Adjustment factor for showers												2073.9010 (H7)
Solar-to-load ratio												1.0000 (H7a)
Utilisation factor												1.3933 (H8)
Collector performance factor												0.5121 (H9)
Dedicated solar storage volume												0.8793 (H10)
Effective solar volume												75.0000 (H11)
Daily hot water demand												75.0000 (H13)
Volume ratio Veff/V												94.6054 (H14)
Solar storage volume factor												0.7928 (H15)
Solar input												0.9536 (H16)
Solar input	-29.2250	-41.7196	-70.7076	-96.4849	-113.8733	-121.1827	-116.7087	-104.1196	-82.4045	-56.4222	-34.3598	-890.5523 (H17)
Output from w/h												
150.4202	116.1225	93.8513	49.3588	27.8348	3.7018	1.5873	27.9627	50.1650	94.9035	127.7515	151.4187	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				7.8200	13.8645	0.6300	0.7000	0.7700	33.1348 (74)				
East				1.4400	25.9136	0.6300	0.7000	0.7700	11.4041 (76)				
South				3.6200	58.2505	0.6300	0.7000	0.7700	64.4437 (78)				
Solar gains	108.9826	163.6556	238.3414	331.0612	382.8629	425.4888	394.6239	346.8877	283.9085	195.5317	130.3299	88.4799	(83)
Total gains	688.1257	738.1502	790.4527	848.5639	864.9506	875.9627	826.7294	787.6122	744.6547	691.1026	664.5278	651.8762	(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)												
tau	43.3692	43.8077	43.9130	44.2182	44.2182	44.5068	44.5068	44.5991	44.5068	44.0166	44.1183	43.8077
alpha	3.8913	3.9205	3.9275	3.9479	3.9479	3.9671	3.9671	3.9733	3.9671	3.9344	3.9412	3.9205
util living area	0.9720	0.9627	0.9368	0.8756	0.7550	0.5580	0.4058	0.4238	0.6674	0.8737	0.9509	0.9758 (86)
MIT	19.8133	19.9347	20.2032	20.5337	20.8120	20.9583	20.9910	20.9896	20.9159	20.6245	20.2020	19.7974 (87)
Th 2	19.9840	19.9931	19.9953	20.0015	20.0015	20.0074	20.0074	20.0092	20.0074	19.9974	19.9995	19.9931 (88)
util rest of house	0.9655	0.9543	0.9219	0.8462	0.6980	0.4709	0.3005	0.3146	0.5816	0.8358	0.9376	0.9700 (89)
MIT 2	18.9319	19.0575	19.3197	19.6353	19.8777	19.9884	20.0051	20.0066	19.9643	19.7212	19.3258	18.9239 (90)
Living area fraction												0.2130 (91)
MIT	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1197	19.2443	19.5079	19.8267	20.0767	20.1951	20.2151	20.2160	20.1670	19.9136	19.5125	19.1100 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9585	0.9464	0.9133	0.8404	0.7027	0.4881	0.3230	0.3379	0.5964	0.8321	0.9297	0.9636	(94)
Useful gains	659.5958	698.6090	721.9481	713.1100	607.7761	427.5582	266.9992	266.1658	444.1147	575.0839	617.7970	628.1217	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1299.8044	1270.3470	1142.2518	950.2697	694.7421	442.6731	269.1221	268.6433	477.0090	757.3807	1034.9218	1276.5040	(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	476.3153	384.2080	312.7060	170.7549	64.7027	0.0000	0.0000	0.0000	0.0000	135.6289	300.3298	482.3964	(98)
Space heating												2327.0419	(98)
Space heating per m2												(98) / (4) =	27.5259 (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													2565.6470 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	476.3153	384.2080	312.7060	170.7549	64.7027	0.0000	0.0000	0.0000	0.0000	135.6289	300.3298	482.3964	(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)	525.1546	423.6030	344.7695	188.2634	71.3370	0.0000	0.0000	0.0000	0.0000	149.5357	331.1244	531.8594	(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	150.4202	116.1225	93.8513	49.3588	27.8348	3.7018	1.5873	27.9627	50.1650	94.9035	127.7515	151.4187	(64)
Efficiency of water heater	89.8346	89.8629	89.8673	89.8909	89.6180	87.2000	87.2000	87.2000	87.2000	89.2257	89.6264	89.8385	(216)
(217)m	89.8346	89.8629	89.8673	89.8909	89.6180	87.2000	87.2000	87.2000	87.2000	89.2257	89.6264	89.8385	(217)
Fuel for water heating, kWh/month	167.4413	129.2219	104.4331	54.9096	31.0594	4.2452	1.8203	32.0673	57.5287	106.3634	142.5378	168.5453	(219)
Water heating fuel used												1000.1733	(219)
Annual totals kWh/year													
Space heating fuel - main system												2565.6470	(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)													379.3436 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 989 * 1.00) =										-593.1804		-593.1804	(233)
Total delivered energy for all uses												3476.9837	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2565.6470	10.2300	262.4657 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1000.1733	10.2300	102.3177 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	379.3436	36.7200	139.2950 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-593.1804	36.7200	-217.8158 (252)
Total energy cost			435.1626 (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	2565.6470	0.2160	554.1798 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1000.1733	0.2160	216.0374 (264)
Space and water heating			770.2172 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-593.1804	0.5190	-307.8606 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Total kg/year

724.1109 (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	2565.6470	1.2200	3130.0894 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1000.1733	1.2200	1220.2115 (264)
Space and water heating			4350.3008 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	379.3436	3.0700	1164.5850 (268)
Energy saving/generation technologies			
PV Unit	-593.1804	3.0700	-1821.0637 (269)
Primary energy kWh/year			4077.5721 (272)
Primary energy kWh/m2/year			48.2325 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 44	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.63	TER	18.36
Environmental	89 B	% DER<TER	20.34		
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57
General Requirements Compliance	Pass	% DFEE<TFEE	15.78		

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	Mineral wool batt						
	Main construction	350	0.0380	9.2105	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Mineral wool batt						
	Main construction	100	0.0380	2.6316	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² 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 0906 Plot 44	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.63	TER	18.36
Environmental	89 B	% DER<TER	20.34		
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57
General Requirements Compliance	Pass	% DFEE<TFEE	15.78		

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 0906 Plot 44	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.63	TER	18.36
Environmental	89 B	% DER<TER	20.34		
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57
General Requirements Compliance	Pass	% DFEE<TFEE	15.78		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Wall Tile Hung

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				0.1300			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	92.97		
	Main construction	100	0.8800	0.1136	7.03		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	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 6	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 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.349 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 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: 383 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 44	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.63	TER	18.36
Environmental	89 B	% DER<TER	20.34		
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57
General Requirements Compliance	Pass	% DFEE<TFEE	15.78		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 42.27 m², Perimeter = 18.36 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 Designed)

Property Reference	SAP 0906 Plot 44	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Property			

SAP Rating	87 B	DER	14.63	TER	18.36
Environmental	89 B	% DER<TER	20.34		
CO ₂ Emissions (t/year)	0.92	DFEE	44.27	TFEE	52.57
General Requirements Compliance	Pass	% DFEE<TFEE	15.78		

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 Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	18.74 m	42.27 m ²	2.39 m
	1st Storey:	18.74 m	42.27 m ²	2.61 m

7.0 Living Area	18.01	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	174.97	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	75.73	62.88
Tile Hung	Cavity Wall	Other	0.24	42.22	17.97	15.79

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	42.16

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
Ground Floor Stud	Plasterboard on timber frame		9.00	62.15
First Floor Stud	Plasterboard on timber frame		9.00	90.69

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Other	0.10	9.10	42.27	42.27

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.27

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	42.27

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.27

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
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 (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.15	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					1.44	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.44	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.82	
Front Tiled	Window	[2] Tile Hung	South	None	0.00					2.18	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	0.46	0.093	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.37	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.75	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.74	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	8.31	0.021	No	Knauf P5
Independently assessed	E4 Jamb	28.80	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	18.74	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.74	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	13.92	0.071	No	Knauf P16
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	14.99	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	5.00	0.036	No	Knauf P25 Halved
Independently assessed	E25 Staggered party wall between dwellings	5.00	0.055	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.45	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.45	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.45	0.035	No	Knauf P29 Halved

Y-value 0.046 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Tested ? m³/(h.m²) @ 50 Pa

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Description	Database	
Percentage of Heat	Mains Gas Combi	%
Database Ref. No.	100	
Fuel Type	17513	
Main Heating	Mains gas	
SAP Code	BGW	
In Winter	104	
In Summer	90.7	
Controls	87.2	
PCDF Controls	CBE Programmer, room thermostat and TRVs	
Delayed Start Stat	0	
Sap Code	No	
Flue Type	2106	
Fan Assisted Flue	Balanced	
Is MHS Pumped	Yes	
Heat Emitter	Pump in heated space	
Flow Temperature	Radiators	
Combi boiler type	Normal (> 45°C)	
	Standard Combi	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
0.75	East	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	£85	B 88	