



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 51

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 08/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

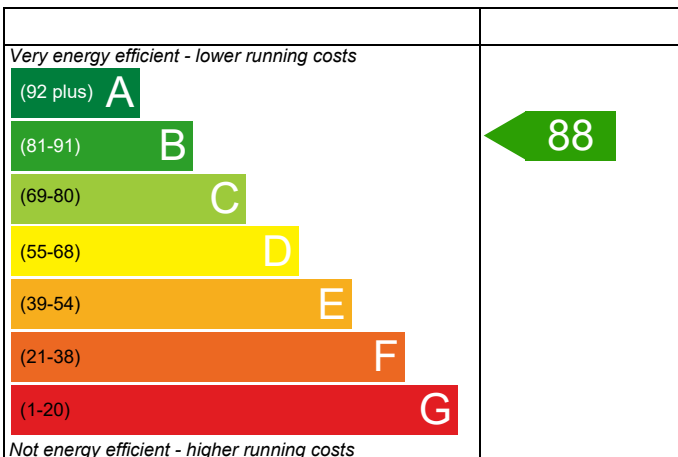
Plot 51

Dwelling type: House, Semi-Detached
Date of assessment: 08/02/2024
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.42 m²
DRRN: 4204-3127-8025

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

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

Energy Efficiency Rating

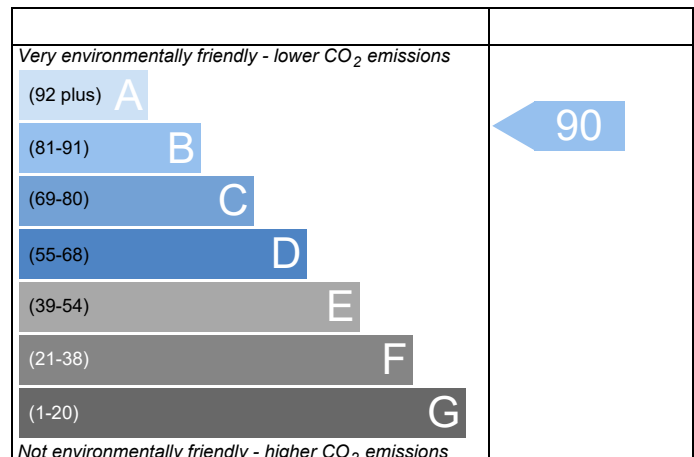


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

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 0931 Plot 51				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G			
Property	Plot 51					
SAP Rating	88 B	DER	13.43	TER	18.33	
Environmental	90 B	% DER<TER	26.71			
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07	
General Requirements Compliance	Pass	% DFEE<TFEE	16.33			
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)	18.33	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.43	kgCO ₂ /m ²	Pass
	-4.90 (-26.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.07	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.57	kWh/m ² /yr	
	-8.5 (-16.3%)	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)	0.26 (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	1.18 (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

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)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% 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 East

7.00 m², No overhang

Windows facing South East

1.44 m², No overhang

Windows facing South West

3.14 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

0.80 kW

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.

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	£65	B 89	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£65	B 89	A 92	

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.

THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 51	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Property	Plot 51		

SAP Rating	88 B	DER	13.43	TER	18.33
Environmental	90 B	% DER<TER	26.71		
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07
General Requirements Compliance	Pass	% DFEE<TFEE	16.33		

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

Client	Foreman Homes, FORE
--------	---------------------

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	9.77	0.42	Catnic Thermally Broken
External wall	E3 Sill	Independently assessed	0.021	7.16	0.15	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.60	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	27.15	4.34	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.37	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.66	0.58	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.80	0.39	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.60	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	9.40	0.34	Knauf P25 Halved
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.80	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.80	0.31	Knauf P29 Halved

Total: **7.33** W/mK:
Y-Value: **0.041** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 51				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G			
Property	Plot 51					
SAP Rating	88 B	DER	13.43	TER	18.33	
Environmental	90 B	% DER<TER	26.71			
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07	
General Requirements Compliance	Pass	% DFEE<TFEE	16.33			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
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

Semi-Detached House, total floor area 84 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) 18.33 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.43 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (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	1.18 (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
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% 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 East: 7.00 m², No overhang
Windows facing South East: 1.44 m², No overhang
Windows facing South West: 3.14 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 0.80 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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (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) =		0.3736 (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	0.4763	0.4670	0.4577	0.4110	0.4016	0.3549	0.3549	0.3456	0.3736	0.4016	0.4203	0.4390 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3347 (36)
Total fabric heat loss						(33) + (36) =	51.6548 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	42.4178	42.1170	40.7045	40.4402	39.2099	39.2099	38.9820	39.6838	40.4402	40.9748	41.5338 (38)
Heat transfer coeff	94.3794	94.0726	93.7719	92.3593	92.0950	90.8647	90.8647	90.6368	91.3386	92.0950	92.6296	93.1886 (39)
Average = Sum(39)m / 12 =												92.3580 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1180	1.1143	1.1108	1.0940	1.0909	1.0763	1.0763	1.0736	1.0820	1.0909	1.0972	1.1039 (40)
HLP (average)												1.0940 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(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	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(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												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Total per year (kWh/year) = Sum(64)m =												1494.0575 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(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	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	383.6570	381.3899	367.2180	344.4569	321.3519	299.2078	284.9336	291.1797	302.9872	325.9642	352.2845	372.0057	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.0000	11.2829	0.6300	0.7000	0.7700	24.1375 (75)			
Southeast				1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)			
Southwest				3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)			
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	459.2951	518.2471	575.7679	638.5555	683.3478	672.9172	639.2653	592.6660	540.8173	482.9625	444.3416	435.7914 (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	43.8570	44.0001	44.1412	44.8163	44.9449	45.5535	45.5535	45.6680	45.3171	44.9449	44.6855	44.4175
alpha	3.9238	3.9333	3.9427	3.9878	3.9963	4.0369	4.0369	4.0445	4.0211	3.9963	3.9790	3.9612
util living area	0.9944	0.9903	0.9802	0.9510	0.8788	0.7391	0.5865	0.6429	0.8570	0.9668	0.9905	0.9954 (86)
MIT	19.3652	19.5364	19.8366	20.2505	20.6238	20.8759	20.9633	20.9470	20.7543	20.2785	19.7562	19.3416 (87)
Th 2	19.9862	19.9891	19.9920	20.0057	20.0083	20.0202	20.0202	20.0224	20.0156	20.0083	20.0031	19.9977 (88)
util rest of house	0.9930	0.9879	0.9750	0.9371	0.8423	0.6617	0.4722	0.5301	0.8005	0.9547	0.9877	0.9943 (89)
MIT 2	18.4902	18.6627	18.9625	19.3780	19.7297	19.9505	20.0070	20.0015	19.8574	19.4124	18.8930	18.4754 (90)
Living area fraction	18.6832	18.8554	19.1553	19.5705	19.9269	20.1546	20.2180	20.2101	fLA = Living area / (4) = 20.0552	19.6035	19.0834	0.2206 (91)
MIT	18.6832	18.8554	19.1553	19.5705	19.9269	20.1546	20.2180	20.2101	20.0552	19.6035	19.0834	18.6665 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6832	18.8554	19.1553	19.5705	19.9269	20.1546	20.2180	20.2101	20.0552	19.6035	19.0834	18.6665 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9905	0.9842	0.9694	0.9295	0.8389	0.6733	0.4966	0.5534	0.8031	0.9484	0.9841	0.9923	(94)
Useful gains	454.9488	510.0595	558.1546	593.5540	573.2433	453.0848	317.4515	327.9774	434.3528	458.0314	437.2929	432.4142	(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	1357.4794	1312.8185	1186.7097	985.5156	757.6541	504.7154	328.7453	345.3325	543.9408	829.1739	1110.0205	1348.1120	(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	671.4827	539.4541	467.6451	282.2124	137.2017	0.0000	0.0000	0.0000	0.0000	276.1301	484.3638	681.2792	(98)
Space heating												3539.7689	(98)
Space heating per m2												41.9305	(99)
										(98) / (4) =			

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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3924.3558 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	671.4827	539.4541	467.6451	282.2124	137.2017	0.0000	0.0000	0.0000	0.0000	276.1301	484.3638	681.2792	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	744.4376	598.0644	518.4535	312.8740	152.1083	0.0000	0.0000	0.0000	0.0000	306.1309	536.9887	755.2984	(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	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Efficiency of water heater (217)m	87.2458	87.0434	86.5997	85.5399	83.2789	76.4000	76.4000	76.4000	76.4000	85.3543	86.7231	87.3524	(216)
Fuel for water heating, kWh/month	177.5678	155.6865	161.4522	142.4776	140.3985	132.0393	122.3538	140.4266	142.1278	148.2849	159.3350	171.7550	(219)
Water heating fuel used												1793.9050	(219)
Annual totals kWh/year													
Space heating fuel - main system													3924.3558 (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)													387.5584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1029 * 1.00) =										-658.6795			-658.6795 (233)
Total delivered energy for all uses													5522.1397 (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	3924.3558	0.2160	847.6609	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1793.9050	0.2160	387.4835	(264)
Space and water heating			1235.1443	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.5584	0.5190	201.1428	(268)
Energy saving/generation technologies				
PV Unit	-658.6795	0.5190	-341.8547	(269)
Total CO2, kg/year			1133.3575	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4300	(273)

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

DER			13.4300	ZC1
Total Floor Area		TFA	84.4200	
Assumed number of occupants		N	2.5414	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.0344	ZC2
CO2 emissions from cooking, equation (L16)			2.1321	ZC3
Total CO2 emissions			31.5966	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			31.5966	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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3921 (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) =	0.3333 (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	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523		(27)
Ground Floor			42.2100	0.1300	5.4873		(28a)
Brick and Block	91.8500	13.7000	78.1500	0.1800	14.0670		(29a)
Step Party Wall	2.6400		2.6400	0.1800	0.4752		(29a)
Pitched Roof	42.2100		42.2100	0.1300	5.4873		(30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.9891		(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)							10.1021 (36)
Total fabric heat loss						(33) + (36) =	53.0912 (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	41.1129	40.8686	40.6292	39.5048	39.2944	38.3151	38.3151	38.1337	38.6923	39.2944	39.7200	40.1649 (38)
Heat transfer coeff	94.2040	93.9598	93.7204	92.5960	92.3856	91.4062	91.4062	91.2249	91.7835	92.3856	92.8112	93.2561 (39)
Average = Sum(39)m / 12 =												92.5950 (39)
HLP	1.1159	1.1130	1.1102	1.0968	1.0944	1.0828	1.0828	1.0806	1.0872	1.0944	1.0994	1.1047 (40)
HLP (average)												1.0968 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy content (annual)	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074 (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	0.0000	(57)
Combi loss	50.9589	46.0274	49.1495	45.6988	45.2947	41.9683	43.3672	45.2947	45.6988	49.1495	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	205.2087	180.9353	188.3624	167.0679	161.7512	142.4615	136.4889	152.1532	153.8335	175.1701	186.8764	200.3416	(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	205.2087	180.9353	188.3624	167.0679	161.7512	142.4615	136.4889	Solar input (sum of months) = Sum (63)m =					0.0000 (63)	
Heat gains from water heating, kWh/month	64.0278	56.3637	58.5757	51.7799	50.0455	43.9061	41.8048	46.8541	47.3795	54.1892	58.0679	62.4095	(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	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	86.0589	83.8746	78.7307	71.9166	67.2654	60.9806	56.1892	62.9760	65.8049	72.8350	80.6499	83.8837	(72)
Total internal gains	400.5550	398.2874	383.5303	360.1488	336.4154	313.6465	299.3861	306.2561	318.6983	342.2957	369.1929	388.9108	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.0000	11.2829	0.6300	0.7000	0.7700	24.1375 (75)			
Southeast				1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)			
Southwest				3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)			
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	476.1931	535.1446	592.0802	654.2474	698.4113	687.3559	653.7178	607.7424	556.5284	499.2940	461.2500	452.6965 (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	62.2319	62.3937	62.5531	63.3127	63.4569	64.1368	64.1368	64.2643	63.8732	63.4569	63.1659	62.8645	
alpha	5.1488	5.1596	5.1702	5.2208	5.2305	5.2758	5.2758	5.2843	5.2582	5.2305	5.2111	5.1910	
util living area	0.9985	0.9970	0.9923	0.9740	0.9127	0.7660	0.5961	0.6570	0.8892	0.9841	0.9970	0.9989	(86)
MIT	19.7712	19.9032	20.1355	20.4572	20.7508	20.9342	20.9859	20.9771	20.8442	20.4724	20.0678	19.7498	(87)
Th 2	19.9879	19.9902	19.9925	20.0034	20.0054	20.0149	20.0149	20.0167	20.0113	20.0054	20.0013	19.9970	(88)
util rest of house	0.9980	0.9959	0.9894	0.9635	0.8762	0.6792	0.4724	0.5328	0.8293	0.9758	0.9957	0.9985	(89)
MIT 2	18.3440	18.5386	18.8785	19.3489	19.7498	19.9686	20.0094	20.0066	19.8778	19.3771	18.7875	18.3193	(90)
Living area fraction	18.6588	18.8396	19.1558	19.5934	19.9705	20.1816	20.2248	20.2207	20.0909	19.6187	19.0699	18.6348	(92)
MIT	18.6588	18.8396	19.1558	19.5934	19.9705	20.1816	20.2248	20.2207	20.0909	19.6187	19.0699	18.6348	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.6588	18.8396	19.1558	19.5934	19.9705	20.1816	20.2248	20.2207	20.0909	19.6187	19.0699	18.6348	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	474.7624	532.0078	583.8007	626.6418	610.9098	477.9341	326.7346	340.4196	464.7618	484.9631	458.4737	451.6457	(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	1352.6553	1309.7579	1186.1044	990.1630	764.0789	510.1918	331.3304	348.5402	549.8679	833.1953	1110.9368	1346.1346	(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	653.1523	522.6481	448.1140	261.7352	113.9578	0.0000	0.0000	0.0000	0.0000	259.0848	469.7735	665.4997	(98)
Space heating												3393.9654	(98)
Space heating per m2												40.2033	(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													3633.7959 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	653.1523	522.6481	448.1140	261.7352	113.9578	0.0000	0.0000	0.0000	0.0000	259.0848	469.7735	665.4997	(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)	699.3066	559.5804	479.7794	280.2304	122.0105	0.0000	0.0000	0.0000	0.0000	277.3927	502.9694	712.5264	(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	205.2087	180.9353	188.3624	167.0679	161.7512	142.4615	136.4889	152.1532	153.8335	175.1701	186.8764	200.3416	(64)
Efficiency of water heater (217)m	87.7610	87.5676	87.1558	86.1769	84.1877	80.3000	80.3000	80.3000	80.3000	86.0349	87.2759	87.8435	(216)
Fuel for water heating, kWh/month	233.8267	206.6236	216.1216	193.8663	192.1316	177.4115	169.9738	189.4809	191.5735	203.6036	214.1214	228.0665	(219)
Water heating fuel used												2416.8009	(219)
Annual totals kWh/year													
Space heating fuel - main system												3633.7959	(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)												387.5584	(232)
Total delivered energy for all uses												6513.1552	(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	3633.7959	0.2160	784.8999 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2416.8009	0.2160	522.0290 (264)
Space and water heating			1306.9289 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Total CO2, kg/m2/year			1546.9967 (272)
Emissions per m2 for space and water heating			15.4813 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3826 (272b)
Emissions per m2 for pumps and fans			0.4611 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4813 * 1.00) + 2.3826 + 0.4611, rounded to 2 d.p.			18.3300 (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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3921 (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) =		0.3333 (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	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			9.0000	379.8900 (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) = 14521.2324 (34)
172.0118 (35)
7.3347 (36)
(33) + (36) = 51.6548 (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	41.1129	40.8686	40.6292	39.5048	39.2944	38.3151	38.3151	38.1337	38.6923	39.2944	39.7200	40.1649 (38)
Heat transfer coeff	92.7677	92.5234	92.2840	91.1596	90.9492	89.9699	89.9699	89.7885	90.3471	90.9492	91.3748	91.8198 (39)
Average = Sum(39)m / 12 =												91.1586 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0989	1.0960	1.0932	1.0798	1.0773	1.0657	1.0657	1.0636	1.0702	1.0773	1.0824	1.0877 (40)
HLP (average)												1.0798 (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)
2.5414 (42)
94.5582 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 = 1487.7689 (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	32.7781	28.6679	29.5827	25.7909	24.7470	21.3548	19.7884	22.7074	22.9786	26.7794	29.2318	31.7438 (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	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	44.0566	42.6606	39.7617	35.8207	33.2621	29.6594	26.5973	30.5207	31.9148	35.9938	40.5997	42.6664	(72)
Total internal gains	355.5527	354.0734	341.5613	321.0530	299.4121	279.3253	266.7941	270.8009	281.8082	302.4545	326.1427	344.6935	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W			
Northeast				7.0000	11.2829	0.6300		0.7000		0.7700		24.1375 (75)			
Southeast				1.4400	36.7938	0.6300		0.7000		0.7700		16.1923 (77)			
Southwest				3.1400	36.7938	0.6300		0.7000		0.7700		35.3083 (79)			
Solar gains				75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains				431.1908	490.9306	550.1112	615.1516	661.4080	653.0347	621.1258	572.2872	519.6383	459.4528	418.1998	408.4792 (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	43.4815	43.5963	43.7094	44.2485	44.3509	44.8336	44.8336	44.9242	44.6464	44.3509	44.1443	43.9304	
alpha	3.8988	3.9064	3.9140	3.9499	3.9567	3.9889	3.9889	3.9949	3.9764	3.9567	3.9430	3.9287	
util living area	0.9951	0.9912	0.9816	0.9534	0.8830	0.7464	0.5945	0.6538	0.8646	0.9696	0.9916	0.9960	(86)
MIT	19.3252	19.4993	19.8050	20.2240	20.6065	20.8668	20.9599	20.9414	20.7378	20.2479	19.7158	19.2973	(87)
Th 2	20.0017	20.0041	20.0064	20.0173	20.0194	20.0289	20.0289	20.0307	20.0252	20.0194	20.0152	20.0109	(88)
util rest of house	0.9939	0.9890	0.9768	0.9403	0.8481	0.6706	0.4809	0.5421	0.8108	0.9587	0.9891	0.9951	(89)
MIT 2	18.4647	18.6397	18.9448	19.3638	19.7252	19.9528	20.0141	20.0069	19.8535	19.3938	18.8646	18.4438	(90)
Living area fraction	18.6545	18.8293	19.1345	19.5536	19.9196	20.1544	20.2227	20.2130	20.0486	19.5822	19.0524	18.6320	(91)
MIT	18.6545	18.8293	19.1345	19.5536	19.9196	20.1544	20.2227	20.2130	20.0486	19.5822	19.0524	18.6320	(92)
Temperature adjustment	18.6545	18.8293	19.1345	19.5536	19.9196	20.1544	20.2227	20.2130	20.0486	19.5822	19.0524	18.6320	(93)
adjusted MIT	18.6545	18.8293	19.1345	19.5536	19.9196	20.1544	20.2227	20.2130	20.0486	19.5822	19.0524	18.6320	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	427.5834	483.8645	534.3591	573.6863	558.2061	444.9635	313.6112	323.2316	422.0911	437.5670	412.2880	405.6963	(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	1331.6312	1288.7860	1165.9673	971.1746	747.5683	499.7248	325.9345	342.3655	537.4373	816.9232	1092.1462	1325.1460	(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	672.6116	540.9072	469.9165	286.1915	140.8855	0.0000	0.0000	0.0000	0.0000	282.2410	489.4979	684.0706	(98)
Space heating													3566.3218 (98)
Space heating per m2													(98) / (4) = 42.2450 (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	845.7168	665.7771	682.3927	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	0.8058	0.8732	0.8425	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	681.4718	581.3656	574.9486	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.1206	819.8908	764.6432	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	127.9071	177.4627	141.1327	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												446.5025 (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	31.9768	44.3657	35.2832	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												111.6256 (107)
Space cooling per m2												1.3223 (108)
Energy for space heating												42.2450 (99)
Energy for space cooling												1.3223 (108)
Total												43.5673 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.6 (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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3921 (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) =	0.3333 (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	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523		(27)
Ground Floor			42.2100	0.1300	5.4873		(28a)
Brick and Block	91.8500	13.7000	78.1500	0.1800	14.0670		(29a)
Step Party Wall	2.6400		2.6400	0.1800	0.4752		(29a)
Pitched Roof	42.2100		42.2100	0.1300	5.4873		(30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.9891		(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)							10.1021 (36)
Total fabric heat loss						(33) + (36) =	53.0912 (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	41.1129	40.8686	40.6292	39.5048	39.2944	38.3151	38.3151	38.1337	38.6923	39.2944	39.7200	40.1649 (38)
Heat transfer coeff	94.2040	93.9598	93.7204	92.5960	92.3856	91.4062	91.4062	91.2249	91.7835	92.3856	92.8112	93.2561 (39)
Average = Sum(39)m / 12 =												92.5950 (39)
HLP	1.1159	1.1130	1.1102	1.0968	1.0944	1.0828	1.0828	1.0806	1.0872	1.0944	1.0994	1.1047 (40)
HLP (average)												1.0968 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy content (annual)	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)
Distribution loss (46)m = 0.15 x (45)m												1487.7689 (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	32.7781	28.6679	29.5827	25.7909	24.7470	21.3548	19.7884	22.7074	22.9786	26.7794	29.2318	31.7438 (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	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	44.0566	42.6606	39.7617	35.8207	33.2621	29.6594	26.5973	30.5207	31.9148	35.9938	40.5997	42.6664	(72)
Total internal gains	355.5527	354.0734	341.5613	321.0530	299.4121	279.3253	266.7941	270.8009	281.8082	302.4545	326.1427	344.6935	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				7.0000	11.2829	0.6300		0.7000		0.7700		24.1375 (75)
Southeast				1.4400	36.7938	0.6300		0.7000		0.7700		16.1923 (77)
Southwest				3.1400	36.7938	0.6300		0.7000		0.7700		35.3083 (79)
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	431.1908	490.9306	550.1112	615.1516	661.4080	653.0347	621.1258	572.2872	519.6383	459.4528	418.1998	408.4792 (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	62.2319	62.3937	62.5531	63.3127	63.4569	64.1368	64.1368	64.2643	63.8732	63.4569	63.1659	62.8645	
alpha	5.1488	5.1596	5.1702	5.2208	5.2305	5.2758	5.2758	5.2843	5.2582	5.2305	5.2111	5.1910	
util living area	0.9991	0.9980	0.9944	0.9798	0.9271	0.7911	0.6229	0.6890	0.9107	0.9889	0.9981	0.9993	(86)
MIT	19.7211	19.8544	20.0902	20.4185	20.7236	20.9230	20.9828	20.9715	20.8198	20.4308	20.0201	19.7005	(87)
Th 2	19.9879	19.9902	19.9925	20.0034	20.0054	20.0149	20.0149	20.0167	20.0113	20.0054	20.0013	19.9970	(88)
util rest of house	0.9988	0.9972	0.9923	0.9713	0.8948	0.7064	0.4958	0.5628	0.8578	0.9829	0.9973	0.9991	(89)
MIT 2	18.8156	18.9505	19.1872	19.5197	19.8083	19.9770	20.0102	20.0079	19.9023	19.5364	19.1252	18.8023	(90)
Living area fraction									fLA = Living area / (4) =			0.2206	(91)
MIT	19.0153	19.1499	19.3864	19.7179	20.0101	20.1857	20.2247	20.2204	20.1047	19.7337	19.3226	19.0004	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0153	19.1499	19.3864	19.7179	20.0101	20.1857	20.2247	20.2204	20.1047	19.7337	19.3226	19.0004	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.4632	489.1712	544.9332	595.5924	591.9804	471.9108	325.5991	338.1417	448.8961	450.5443	416.7404	407.9615	(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	(95)
Heat loss rate W	1386.2424	1338.9154	1207.7164	1001.6948	767.7378	510.5634	331.3240	348.5145	551.1313	843.8192	1134.3896	1380.2267	(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	711.0997	571.0281	493.1107	292.3938	130.7635	0.0000	0.0000	0.0000	0.0000	292.5965	516.7074	723.3654	(98)
Space heating												3731.0650	(98)
Space heating per m2												44.1965	(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	859.2186	676.4061	693.3090	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8406	0.9095	0.8790	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	722.2672	615.2058	609.4333	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.1206	819.8908	764.6432	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	98.5344	152.2856	115.4762	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												366.2962 (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	24.6336	38.0714	28.8690	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												91.5740 (107)
Space cooling per m2												1.0847 (108)
Energy for space heating												44.1965 (99)
Energy for space cooling												1.0847 (108)
Total												45.2812 (109)
Target Fabric Energy Efficiency (TFEE)												52.1 (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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (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) =		0.3736 (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	0.4763	0.4390	0.4296	0.4016	0.4016	0.3736	0.3736	0.3643	0.3736	0.4203	0.4110	0.4390 (22b)
Effective ac	0.6134	0.5964	0.5923	0.5806	0.5806	0.5698	0.5698	0.5663	0.5698	0.5883	0.5844	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.3347 (36)
Total fabric heat loss (33) + (36) = 51.6548 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	41.5338	41.2513	40.4402	40.4402	39.6838	39.6838	39.4438	39.6838	40.9748	40.7045	41.5338 (38)
Heat transfer coeff	94.3794	93.1886	92.9061	92.0950	92.0950	91.3386	91.3386	91.0986	91.3386	92.6296	92.3593	93.1886 (39)
Average = Sum(39)m / 12 =												92.3297 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1180	1.1039	1.1005	1.0909	1.0909	1.0820	1.0820	1.0791	1.0820	1.0972	1.0940	1.1039 (40)
HLP (average)												1.0937 (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 2.5414 (42)
Average daily hot water use (litres/day) 94.5582 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(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	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	0.6494 (61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(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												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(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	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898 (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)												
	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559 (71)
Water heating gains (Table 5)												
	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786 (72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	7.0000				15.0428		0.6300		0.7000		0.7700		32.1810 (75)	
Southeast	1.4400				46.3896		0.6300		0.7000		0.7700		20.4153 (77)	
Southwest	3.1400				46.3896		0.6300		0.7000		0.7700		44.5166 (79)	
Solar gains	97.1129	150.8290	230.1329	332.3562	391.6722	437.7366	405.0716	351.5410	278.9908	183.4485	117.2537	78.1129	(83)	
Total gains	668.6947	717.6307	774.3608	841.7832	865.5429	879.9365	828.9479	784.1764	731.8357	671.3101	643.8869	633.9941	(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	43.8570	44.4175	44.5525	44.9449	44.9449	45.3171	45.3171	45.4365	45.3171	44.6855	44.8163	44.4175
alpha	3.9238	3.9612	3.9702	3.9963	3.9963	4.0211	4.0211	4.0291	4.0211	3.9790	3.9878	3.9612
util living area	0.9748	0.9661	0.9405	0.8773	0.7526	0.5519	0.4011	0.4216	0.6721	0.8818	0.9555	0.9781 (86)
MIT	19.8018	19.9267	20.2015	20.5424	20.8204	20.9619	20.9919	20.9904	20.9173	20.6181	20.1944	19.7922 (87)
Th 2	19.9862	19.9977	20.0004	20.0083	20.0083	20.0156	20.0156	20.0179	20.0156	20.0031	20.0057	19.9977 (88)
util rest of house	0.9689	0.9583	0.9264	0.8482	0.6955	0.4658	0.2976	0.3137	0.5866	0.8454	0.9432	0.9729 (89)
MIT 2	18.9219	19.0530	19.3220	19.6488	19.8903	19.9984	20.0136	20.0155	19.9732	19.7208	19.3234	18.9218 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138 (91)
Temperature adjustment	0.0000											
adjusted MIT	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9623	0.9509	0.9181	0.8427	0.7010	0.4836	0.3205	0.3375	0.6021	0.8418	0.9357	0.9669	(94)
Useful gains	643.5149	682.4309	710.9502	709.3994	606.7129	425.5140	265.6380	264.6664	440.6314	565.1087	602.4884	613.0003	(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	1294.5077	1262.3073	1134.9385	943.5930	690.2915	439.4210	267.5650	266.9690	473.2632	752.0346	1026.6170	1268.6481	(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	484.3387	389.6769	315.4473	168.6194	62.1825	0.0000	0.0000	0.0000	0.0000	139.0729	305.3726	487.8019	(98)
Space heating												2352.5121	(98)
RHI space heating demand												2353	(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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (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)	=	0.3736 (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	0.4763	0.4670	0.4577	0.4110	0.4016	0.3549	0.3549	0.3456	0.3736	0.4016	0.4203	0.4390 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3347 (36)
Total fabric heat loss						(33) + (36) =	51.6548 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	42.4178	42.1170	40.7045	40.4402	39.2099	39.2099	38.9820	39.6838	40.4402	40.9748	41.5338 (38)
Heat transfer coeff	94.3794	94.0726	93.7719	92.3593	92.0950	90.8647	90.8647	90.6368	91.3386	92.0950	92.6296	93.1886 (39)
Average = Sum(39)m / 12 =												92.3580 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1180	1.1143	1.1108	1.0940	1.0909	1.0763	1.0763	1.0736	1.0820	1.0909	1.0972	1.1039 (40)
HLP (average)												1.0940 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(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	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(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												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Total per year (kWh/year) = Sum(64)m =												1494.0575 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(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	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
Northeast				7.0000	11.2829		0.6300	0.7000		0.7700	24.1375 (75)	
Southeast				1.4400	36.7938		0.6300	0.7000		0.7700	16.1923 (77)	
Southwest				3.1400	36.7938		0.6300	0.7000		0.7700	35.3083 (79)	
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	647.2199	703.6589	752.7777	803.5256	835.8666	815.9093	778.2080	734.1217	690.6750	644.8599	618.6903	619.6669 (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	43.8570	44.0001	44.1412	44.8163	44.9449	45.5535	45.5535	45.6680	45.3171	44.9449	44.6855	44.4175
alpha	3.9238	3.9333	3.9427	3.9878	3.9963	4.0369	4.0369	4.0445	4.0211	3.9963	3.9790	3.9612
util living area	0.9818	0.9731	0.9542	0.9066	0.8095	0.6490	0.4962	0.5415	0.7626	0.9220	0.9711	0.9845 (86)
MIT	19.6263	19.7871	20.0617	20.4285	20.7356	20.9233	20.9798	20.9714	20.8475	20.4661	19.9921	19.5999 (87)
Th 2	19.9862	19.9891	19.9920	20.0057	20.0083	20.0202	20.0202	20.0224	20.0156	20.0083	20.0031	19.9977 (88)
util rest of house	0.9777	0.9671	0.9434	0.8838	0.7630	0.5698	0.3934	0.4375	0.6927	0.8982	0.9635	0.9809 (89)
MIT 2	18.7483	18.9090	19.1801	19.5422	19.8211	19.9795	20.0134	20.0119	19.9245	19.5860	19.1238	18.7312 (90)
Living area fraction									fLA = Living area / (4) =			0.2206 (91)
MIT	18.9420	19.1027	19.3745	19.7377	20.0228	20.1876	20.2265	20.2235	20.1281	19.7801	19.3153	18.9228 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9420	19.1027	19.3745	19.7377	20.0228	20.1876	20.2265	20.2235	20.1281	19.7801	19.3153	18.9228 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9722	0.9603	0.9353	0.8766	0.7638	0.5841	0.4157	0.4598	0.7016	0.8916	0.9568	0.9760 (94)
Useful gains	629.2489	675.7347	704.0451	704.3967	638.4285	476.6098	323.5268	337.5613	484.5491	574.9600	591.9854	604.7958 (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	1381.8989	1336.0828	1207.2689	1000.9610	766.4869	507.7190	329.5231	346.5520	550.5942	845.4436	1131.5031	1371.9966 (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	559.9716	443.7539	374.3985	213.5263	95.2754	0.0000	0.0000	0.0000	0.0000	201.2398	388.4527	570.7974 (98)
Space heating												2847.4156 (98)
Space heating per m2												33.7292 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3156.7801 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	559.9716	443.7539	374.3985	213.5263	95.2754	0.0000	0.0000	0.0000	0.0000	201.2398	388.4527	570.7974	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	620.8111	491.9666	415.0760	236.7253	105.6268	0.0000	0.0000	0.0000	0.0000	223.1040	430.6571	632.8131	(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	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Efficiency of water heater (217)m	86.8023	86.5430	85.9774	84.6444	82.0352	76.4000	76.4000	76.4000	76.4000	84.3195	86.1185	86.9317	(216)
Fuel for water heating, kWh/month	178.4750	156.5866	162.6208	143.9851	142.5270	132.0393	122.3538	140.4266	142.1278	150.1048	160.4535	172.5861	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3156.7801 (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)													387.5584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1029 * 1.00) =										-658.6795			-658.6795 (233)
Total delivered energy for all uses													4764.9453 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3156.7801	3.4800	109.8559 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1804.2864	3.4800	62.7892 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.5584	13.1900	51.1190 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-658.6795	13.1900	-86.8798 (252)
Total energy cost			266.7767 (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] =	0.8658 (257)
SAP value		87.9227
SAP rating (Section 12)		88 (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	3156.7801	0.2160	681.8645 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1804.2864	0.2160	389.7259 (264)
Space and water heating			1071.5903 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Energy saving/generation technologies			
PV Unit	-658.6795	0.5190	-341.8547 (269)
Total kg/year			969.8035 (272)
CO2 emissions per m2			11.4900 (273)
EI value			89.9588
EI rating			90 (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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8241 = 4.223$, stars = 4
Water heating environmental impact	$0.216 / 0.8241 = 0.2621$, 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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (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) =		0.3736 (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	0.4763	0.4390	0.4296	0.4016	0.4016	0.3736	0.3736	0.3643	0.3736	0.4203	0.4110	0.4390 (22b)
Effective ac	0.6134	0.5964	0.5923	0.5806	0.5806	0.5698	0.5698	0.5663	0.5698	0.5883	0.5844	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3347 (36)
Total fabric heat loss						(33) + (36) =	51.6548 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	41.5338	41.2513	40.4402	40.4402	39.6838	39.6838	39.4438	39.6838	40.9748	40.7045	41.5338 (38)
Heat transfer coeff	94.3794	93.1886	92.9061	92.0950	92.0950	91.3386	91.3386	91.0986	91.3386	92.6296	92.3593	93.1886 (39)
Average = Sum(39)m / 12 =												92.3297 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1180	1.1039	1.1005	1.0909	1.0909	1.0820	1.0820	1.0791	1.0820	1.0972	1.0940	1.1039 (40)
HLP (average)												1.0937 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(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	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(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												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Total per year (kWh/year) = Sum (64)m =												1494.0575 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(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	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			7.0000		15.0428		0.6300		0.7000		0.7700		32.1810 (75)
Southeast			1.4400		46.3896		0.6300		0.7000		0.7700		20.4153 (77)
Southwest			3.1400		46.3896		0.6300		0.7000		0.7700		44.5166 (79)
Solar gains	97.1129	150.8290	230.1329	332.3562	391.6722	437.7366	405.0716	351.5410	278.9908	183.4485	117.2537	78.1129	(83)
Total gains	668.6947	717.6307	774.3608	841.7832	865.5429	879.9365	828.9479	784.1764	731.8357	671.3101	643.8869	633.9941	(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	43.8570	44.4175	44.5525	44.9449	44.9449	45.3171	45.3171	45.4365	45.3171	44.6855	44.8163	44.4175
alpha	3.9238	3.9612	3.9702	3.9963	3.9963	4.0211	4.0211	4.0291	4.0211	3.9790	3.9878	3.9612
util living area	0.9748	0.9661	0.9405	0.8773	0.7526	0.5519	0.4011	0.4216	0.6721	0.8818	0.9555	0.9781 (86)
MIT	19.8018	19.9267	20.2015	20.5424	20.8204	20.9619	20.9919	20.9904	20.9173	20.6181	20.1944	19.7922 (87)
Th 2	19.9862	19.9977	20.0004	20.0083	20.0083	20.0156	20.0156	20.0179	20.0156	20.0031	20.0057	19.9977 (88)
util rest of house	0.9689	0.9583	0.9264	0.8482	0.6955	0.4658	0.2976	0.3137	0.5866	0.8454	0.9432	0.9729 (89)
MIT 2	18.9219	19.0530	19.3220	19.6488	19.8903	19.9984	20.0136	20.0155	19.9732	19.7208	19.3234	18.9218 (90)
Living area fraction	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138 (91)
MIT	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9623	0.9509	0.9181	0.8427	0.7010	0.4836	0.3205	0.3375	0.6021	0.8418	0.9357	0.9669	(94)	
Useful gains	643.5149	682.4309	710.9502	709.3994	606.7129	425.5140	265.6380	264.6664	440.6314	565.1087	602.4884	613.0003	(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	1294.5077	1262.3073	1134.9385	943.5930	690.2915	439.4210	267.5650	266.9690	473.2632	752.0346	1026.6170	1268.6481	(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	484.3387	389.6769	315.4473	168.6194	62.1825	0.0000	0.0000	0.0000	0.0000	139.0729	305.3726	487.8019	(98)	
Space heating												2352.5121	(98)	
Space heating per m2												(98) / (4) =	27.8668	(99)

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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2608.1066 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.3387	389.6769	315.4473	168.6194	62.1825	0.0000	0.0000	0.0000	0.0000	139.0729	305.3726	487.8019	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	536.9608	432.0143	349.7199	186.9395	68.9385	0.0000	0.0000	0.0000	0.0000	154.1828	338.5505	540.8003	(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	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Efficiency of water heater (217)m	86.4172	86.1832	85.4593	83.8460	80.6858	76.4000	76.4000	76.4000	76.4000	83.0523	85.3947	76.4000	(216)
Fuel for water heating, kWh/month	179.2704	157.2403	163.6066	145.3560	144.9107	132.0393	122.3538	140.4266	142.1278	152.3950	161.8135	173.3998	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2608.1066 (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)													387.5584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1182 * 1.00) =									-756.2922				-756.2922 (233)
Total delivered energy for all uses													4129.3125 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2608.1066	7.6100	198.4769 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1814.9398	7.6100	138.1169 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	387.5584	31.0800	120.4531 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-756.2922	31.0800	-235.0556 (252)
Total energy cost			350.3014 (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	2608.1066	0.2160	563.3510 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1814.9398	0.2160	392.0270 (264)
Space and water heating			955.3780 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Energy saving/generation technologies			
PV Unit	-756.2922	0.5190	-392.5157 (269)
Total kg/year			802.9302 (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	2608.1066	1.2200	3181.8900 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1814.9398	1.2200	2214.2265 (264)
Space and water heating			5396.1165 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	387.5584	3.0700	1189.8042 (268)
Energy saving/generation technologies			
PV Unit	-756.2922	3.0700	-2321.8170 (269)
Primary energy kWh/year			4494.3537 (272)
Primary energy kWh/m2/year			53.2380 (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 88
Current environmental impact rating: B 90

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 65	-204 kg (25.4%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£65	2.42 kg/m²	B 89	A 92
Total Savings	£65	2.42 kg/m²		
Potential energy efficiency rating:			B 89	
Potential environmental impact rating:				A 92

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
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	£144	£159	-£16
Mains gas	£442	£361	£81
Space heating	£327	£327	£0
Water heating	£138	£73	£65
Lighting	£120	£120	£0
Generated (PV)	-£235	-£235	£0
Total cost of fuels	£351	£285	£65
Total cost of uses	£350	£285	£65
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	14 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	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (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)	=	0.3736 (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	0.4763	0.4670	0.4577	0.4110	0.4016	0.3549	0.3549	0.3456	0.3736	0.4016	0.4203	0.4390 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3347 (36)
Total fabric heat loss						(33) + (36) =	51.6548 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	42.4178	42.1170	40.7045	40.4402	39.2099	39.2099	38.9820	39.6838	40.4402	40.9748	41.5338 (38)
Heat transfer coeff	94.3794	94.0726	93.7719	92.3593	92.0950	90.8647	90.8647	90.6368	91.3386	92.0950	92.6296	93.1886 (39)
Average = Sum(39)m / 12 =												92.3580 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1180	1.1143	1.1108	1.0940	1.0909	1.0763	1.0763	1.0736	1.0820	1.0909	1.0972	1.1039 (40)
HLP (average)												1.0940 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074 (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	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	0.6494 (61)
Total heat required for water heating calculated for each month	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321 (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												1.2190 (H8)
Utilisation factor												0.5597 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.5582 (H14)
Volume ratio Veff/V												0.7932 (H15)
Solar storage volume factor												0.9537 (H16)
Solar input	-24.6833	-41.1894	-70.1503	-94.0152	-116.1479	-114.1918	-112.6828	-98.4515	-77.1073	-52.6552	-29.2780	-851.2084 (H17)
Solar input (sum of months) = Sum (63)m =												-851.2084 (63)
Output from w/h	130.2370	94.3254	69.6668	27.8600	0.7745	0.0000	0.0000	8.8344	31.4784	73.9124	108.9022	129.3764 (64)
Total per year (kWh/year) = Sum (64)m =												675.3675 (64)
Heat gains from water heating, kWh/month	51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321 (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	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			7.0000	11.2829	0.6300	0.7000	0.7700	24.1375 (75)				
Southeast			1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)				
Southwest			3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)				
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	647.2199	703.6589	752.7777	803.5256	835.8666	815.9093	778.2080	734.1217	690.6750	644.8599	618.6903	619.6669 (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	43.8570	44.0001	44.1412	44.8163	44.9449	45.5535	45.5535	45.6680	45.3171	44.9449	44.6855	44.4175
alpha	3.9238	3.9333	3.9427	3.9878	3.9963	4.0369	4.0369	4.0445	4.0211	3.9963	3.9790	3.9612
util living area	0.9818	0.9731	0.9542	0.9066	0.8095	0.6490	0.4962	0.5415	0.7626	0.9220	0.9711	0.9845 (86)
MIT	19.6263	19.7871	20.0617	20.4285	20.7356	20.9233	20.9798	20.9714	20.8475	20.4661	19.9921	19.5999 (87)
Th 2	19.9862	19.9891	19.9920	20.0057	20.0083	20.0202	20.0202	20.0224	20.0156	20.0083	20.0031	19.9977 (88)
util rest of house	0.9777	0.9671	0.9434	0.8838	0.7630	0.5698	0.3934	0.4375	0.6927	0.8982	0.9635	0.9809 (89)
MIT 2	18.7483	18.9090	19.1801	19.5422	19.8211	19.9795	20.0134	20.0119	19.9245	19.5860	19.1238	18.7312 (90)
Living area fraction									fLA = Living area / (4) =			0.2206 (91)
MIT	18.9420	19.1027	19.3745	19.7377	20.0228	20.1876	20.2265	20.2235	20.1281	19.7801	19.3153	18.9228 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9420	19.1027	19.3745	19.7377	20.0228	20.1876	20.2265	20.2235	20.1281	19.7801	19.3153	18.9228 (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	0.9722	0.9603	0.9353	0.8766	0.7638	0.5841	0.4157	0.4598	0.7016	0.8916	0.9568	0.9760	(94)
Useful gains	629.2489	675.7347	704.0451	704.3967	638.4285	476.6098	323.5268	337.5613	484.5491	574.9600	591.9854	604.7958	(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	1381.8989	1336.0828	1207.2689	1000.9610	766.4869	507.7190	329.5231	346.5520	550.5942	845.4436	1131.5031	1371.9966	(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	559.9716	443.7539	374.3985	213.5263	95.2754	0.0000	0.0000	0.0000	0.0000	201.2398	388.4527	570.7974	(98)
Space heating												2847.4156	(98)
Space heating per m2											(98) / (4) =	33.7292	(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 %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3156.7801	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	559.9716	443.7539	374.3985	213.5263	95.2754	0.0000	0.0000	0.0000	0.0000	201.2398	388.4527	570.7974	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	620.8111	491.9666	415.0760	236.7253	105.6268	0.0000	0.0000	0.0000	0.0000	223.1040	430.6571	632.8131	(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	130.2370	94.3254	69.6668	27.8600	0.7745	0.0000	0.0000	8.8344	31.4784	73.9124	108.9022	129.3764	(64)	
Efficiency of water heater	87.2270	87.4316	87.7144	88.3580	90.0688	76.4000	76.4000	76.4000	76.4000	86.0259	86.7682	87.2867	(217)	
Fuel for water heating, kWh/month	149.3081	107.8848	79.4246	31.5309	0.8599	0.0000	0.0000	11.5634	41.2021	85.9187	125.5093	148.2200	(219)	
Water heating fuel used												781.4217	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3156.7801	(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)													387.5584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.80 * 1029 * 1.00) =													-658.6795	(233)
Total delivered energy for all uses													3792.0807	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3156.7801	3.4800	109.8559 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	781.4217	3.4800	27.1935 (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	387.5584	13.1900	51.1190 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-658.6795	13.1900	-86.8798 (252)
Total energy cost			237.7760 (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] =	0.7716 (257)
SAP value		89.2356
SAP rating (Section 12)		89 (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	3156.7801	0.2160	681.8645	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	781.4217	0.2160	168.7871	(264)
Space and water heating			850.6516	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	387.5584	0.5190	201.1428	(268)
Energy saving/generation technologies				
PV Unit	-658.6795	0.5190	-341.8547	(269)
Total kg/year			774.8147	(272)
CO2 emissions per m2			9.1800	(273)
EI value			91.9777	
EI rating			92	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2100 (1b)	x 2.3900 (2b)	= 100.8819 (1b) - (3b)
First floor	42.2100 (1c)	x 2.6100 (2c)	= 110.1681 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.0500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (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) =		0.3736 (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	0.4763	0.4390	0.4296	0.4016	0.4016	0.3736	0.3736	0.3643	0.3736	0.4203	0.4110	0.4390 (22b)
Effective ac	0.6134	0.5964	0.5923	0.5806	0.5806	0.5698	0.5698	0.5663	0.5698	0.5883	0.5844	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3347 (36)
Total fabric heat loss						(33) + (36) =	51.6548 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	41.5338	41.2513	40.4402	40.4402	39.6838	39.6838	39.4438	39.6838	40.9748	40.7045	41.5338 (38)
Heat transfer coeff	94.3794	93.1886	92.9061	92.0950	92.0950	91.3386	91.3386	91.0986	91.3386	92.6296	92.3593	93.1886 (39)
Average = Sum(39)m / 12 =												92.3297 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1180	1.1039	1.1005	1.0909	1.0909	1.0820	1.0820	1.0791	1.0820	1.0972	1.0940	1.1039 (40)
HLP (average)												1.0937 (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												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (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 =	1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(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	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	0.6494	(61)
Total heat required for water heating calculated for each month	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(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												1234.4649	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2073.9010	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3940	(H8)
Utilisation factor												0.5120	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												94.5582	(H14)
Volume ratio Veff/V												0.7932	(H15)
Solar storage volume factor												0.9537	(H16)
Solar input												-890.3420	(H17)
Solar input	-29.2181	-41.7097	-70.6909	-96.4621	-113.8464	-121.1541	-116.6812	-104.0950	-82.3851	-56.4089	-34.3517	-23.3387	(63)
												Solar input (sum of months) = Sum (63)m =	-890.3420 (63)
Output from w/h	125.7023	93.8050	69.1261	25.4131	3.0760	0.0000	0.0000	3.1909	26.2006	70.1587	103.8285	126.6934	(64)
												Total per year (kWh/year) = Sum (64)m =	647.1945 (64)
Heat gains from water heating, kWh/month	51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(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	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(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)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			7.0000	15.0428	0.6300	0.7000	0.7700	32.1810 (75)				
Southeast			1.4400	46.3896	0.6300	0.7000	0.7700	20.4153 (77)				
Southwest			3.1400	46.3896	0.6300	0.7000	0.7700	44.5166 (79)				
Solar gains	97.1129	150.8290	230.1329	332.3562	391.6722	437.7366	405.0716	351.5410	278.9908	183.4485	117.2537	78.1129 (83)
Total gains	668.6947	717.6307	774.3608	841.7832	865.5429	879.9365	828.9479	784.1764	731.8357	671.3101	643.8869	633.9941 (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	43.8570	44.4175	44.5525	44.9449	44.9449	45.3171	45.3171	45.4365	45.3171	44.6855	44.8163	44.4175	
alpha	3.9238	3.9612	3.9702	3.9963	3.9963	4.0211	4.0211	4.0291	4.0211	3.9790	3.9878	3.9612	
util living area	0.9748	0.9661	0.9405	0.8773	0.7526	0.5519	0.4011	0.4216	0.6721	0.8818	0.9555	0.9781	(86)
MIT	19.8018	19.9267	20.2015	20.5424	20.8204	20.9619	20.9919	20.9904	20.9173	20.6181	20.1944	19.7922	(87)
Th 2	19.9862	19.9977	20.0004	20.0083	20.0083	20.0156	20.0156	20.0179	20.0156	20.0031	20.0057	19.9977	(88)
util rest of house	0.9689	0.9583	0.9264	0.8482	0.6955	0.4658	0.2976	0.3137	0.5866	0.8454	0.9432	0.9729	(89)
MIT 2	18.9219	19.0530	19.3220	19.6488	19.8903	19.9984	20.0136	20.0155	19.9732	19.7208	19.3234	18.9218	(90)
Living area fraction												0.2206	(91)
MIT	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1160	19.2457	19.5160	19.8459	20.0954	20.2109	20.2294	20.2306	20.1814	19.9187	19.5155	19.1138	(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	0.9623	0.9509	0.9181	0.8427	0.7010	0.4836	0.3205	0.3375	0.6021	0.8418	0.9357	0.9669	(94)
Useful gains	643.5149	682.4309	710.9502	709.3994	606.7129	425.5140	265.6380	264.6664	440.6314	565.1087	602.4884	613.0003	(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	1294.5077	1262.3073	1134.9385	943.5930	690.2915	439.4210	267.5650	266.9690	473.2632	752.0346	1026.6170	1268.6481	(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	484.3387	389.6769	315.4473	168.6194	62.1825	0.0000	0.0000	0.0000	0.0000	139.0729	305.3726	487.8019	(98)
Space heating												2352.5121	(98)
Space heating per m2												(98) / (4) =	27.8668 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2608.1066 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.3387	389.6769	315.4473	168.6194	62.1825	0.0000	0.0000	0.0000	0.0000	139.0729	305.3726	487.8019	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	536.9608	432.0143	349.7199	186.9395	68.9385	0.0000	0.0000	0.0000	0.0000	154.1828	338.5505	540.8003	(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	125.7023	93.8050	69.1261	25.4131	3.0760	0.0000	0.0000	3.1909	26.2006	70.1587	103.8285	126.6934	(64)
Efficiency of water heater	86.9633	87.1459	87.3635	88.1154	89.4385	76.4000	76.4000	76.4000	76.4000	85.0488	86.2472	86.9615	(216)
(217)m	144.5464	107.6413	79.1247	28.8407	3.4392	0.0000	0.0000	4.1766	34.2940	82.4923	120.3848	145.6891	(219)
Fuel for water heating, kWh/month												750.6290	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												2608.1066	(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)													387.5584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1182 * 1.00) =									-756.2922			-756.2922	(233)
Total delivered energy for all uses												3115.0018	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2608.1066	7.6100	198.4769	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	750.6290	7.6100	57.1229	(247)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Pump for solar water heating	50.0000	31.0800	15.5400	(249)
Energy for lighting	387.5584	31.0800	120.4531	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-756.2922	31.0800	-235.0556	(252)
Total energy cost			284.8473	(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	2608.1066	0.2160	563.3510	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	750.6290	0.2160	162.1359	(264)
Space and water heating			725.4869	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	387.5584	0.5190	201.1428	(268)
Energy saving/generation technologies				
PV Unit	-756.2922	0.5190	-392.5157	(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

598.9890 (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	2608.1066	1.2200	3181.8900 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	750.6290	1.2200	915.7674 (264)
Space and water heating			4097.6574 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	387.5584	3.0700	1189.8042 (268)
Energy saving/generation technologies			
PV Unit	-756.2922	3.0700	-2321.8170 (269)
Primary energy kWh/year			3349.3946 (272)
Primary energy kWh/m2/year			39.6754 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 51	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 51		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.43	TER	18.33
Environmental	90 B	% DER<TER	26.71		
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07
General Requirements Compliance	Pass	% DFEE<TFEE	16.33		

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 0931 Plot 51	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 51		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.43	TER	18.33
Environmental	90 B	% DER<TER	26.71		
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07
General Requirements Compliance	Pass	% DFEE<TFEE	16.33		

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 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 0931 Plot 51	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 51		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.43	TER	18.33
Environmental	90 B	% DER<TER	26.71		
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07
General Requirements Compliance	Pass	% DFEE<TFEE	16.33		

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 000007

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	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Supafil Party Wall						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	680	1000
	Main construction	100	0.8803	0.1136	5.96	680	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 = 3.898 m ² K/W	Lower limit = 3.765 m ² K/W	Average = 3.831 m ² K/W
	Total correction = 0.0003 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: None

Total thickness: 328 mm

U-value: 0.26 W/m² K

Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 51	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 51		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.43	TER	18.33
Environmental	90 B	% DER<TER	26.71		
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07
General Requirements Compliance	Pass	% DFEE<TFEE	16.33		

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

Floor Type: Suspended Floor

Area = 43.48 m², Perimeter = 19.02 m, Wall thickness = 275.00 mm, Soil: Unknown

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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				0.1700			
Layer 1	EPS 200 Lower portion						
	Main construction	55	0.0340	1.6176	80.65		
	Main construction	55	2.0000	0.0275	19.35		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	EPS Upper portion						
	Main construction	100	0.0340	2.9412	87.10		
	Main construction	100	2.0000	0.0500	12.90		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Grey EPS 100 Topsheet						
	Main construction	155	0.0300	5.1667	100.00	15	1450
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance:	Upper limit = 9.271 m ² K/W	Lower limit = 6.052 m ² K/W	Average = 7.661 m ² K/W
	Total correction = 0.0046 m ² K/W	U-value (unrounded) = 0.12 W/m ² K	

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 51			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G		
Property	Plot 51				
SAP Rating	88 B	DER	13.43	TER	18.33
Environmental	90 B	% DER<TER	26.71		
CO ₂ Emissions (t/year)	0.80	DFEE	43.57	TFEE	52.07
General Requirements Compliance	Pass	% DFEE<TFEE	16.33		
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 West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
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:	27.15 m	42.21 m ²	2.39 m
	1st Storey:	18.37 m	42.21 m ²	2.61 m

7.0 Living Area	18.62	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	176.51	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	91.85	78.15
Step Party Wall	Cavity Wall	Other	0.26	58.06	2.64	2.64

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	38.70

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
Ground Floor Stud	Plasterboard on timber frame		9.00	67.11
First Floor Stud	Plasterboard on timber frame		9.00	98.31

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	42.21	42.21

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	42.21

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	90.00	42.21

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.21

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 West							2.12	
Windows	Window	[1] Brick and Block	South West	None	0.00					3.14	
Rear Elevation	Window	[1] Brick and Block	North East	None	0.00					7.00	
Side Elevation	Window	[1] Brick and Block	South East	None	0.00					1.44	

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)	9.77	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	7.16	0.021	No	Knauf P5
Independently assessed	E4 Jamb	24.60	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	27.15	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.37	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.66	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.80	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.60	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	9.40	0.036	No	Knauf P25 Halved
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.80	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.80	0.035	No	Knauf P29 Halved

Y-value 0.041 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	Database	
Percentage of Heat	Gas Combi	%
Database Ref. No.	100	
Fuel Type	17960	
Main Heating	Mains gas	
SAP Code	BGW	
In Winter	104	
In Summer	90.2	
Controls	76.4	
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)	
Combi keep hot type	Standard Combi	
	None	

25.0 Main Heating 2

None

Community Heating	None
-------------------	------

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
0.80	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£65	B 89	