



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 49

Contact: Tobias Whiting
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Report Issue Date: 08/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

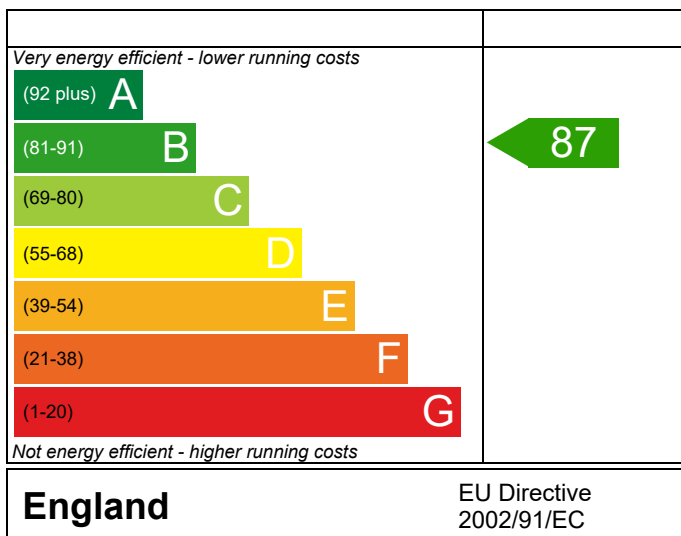
Plot 49

Dwelling type: House, Semi-Detached
Date of assessment: 08/02/2024
Produced by: Abacus Energy (UK) Ltd
Total floor area: 72.03 m²
DRRN: 3204-3825-8011

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

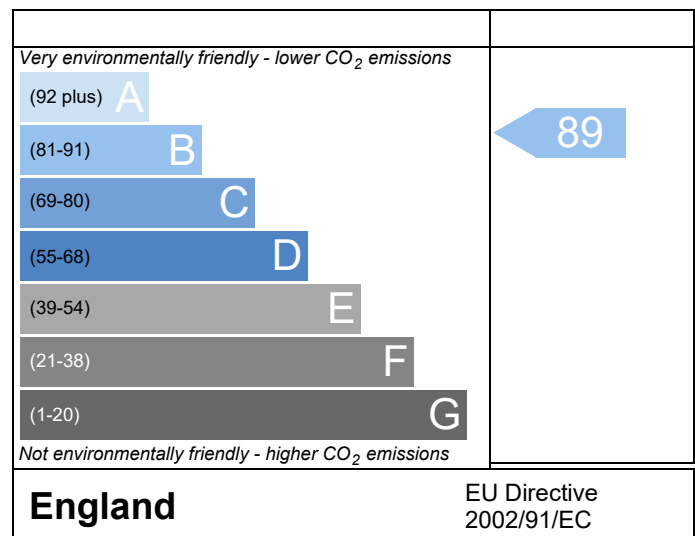
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 49			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C		
Property	Plot 49				
SAP Rating	87 B	DER	15.02	TER	19.63
Environmental	89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)	0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		
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)	19.63	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.02	kgCO ₂ /m ²	Pass
	-4.61 (-23.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.41	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.81	kWh/m ² /yr	
	-8.6 (-15.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.15 (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

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 830 VUW 306/6-3 (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

7.82 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

0.60

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£63	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£63	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 49				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C			
	Property					Plot 49
SAP Rating		87 B	DER	15.02	TER	19.63
Environmental		89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)		0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance		Pass	% DFEE<TFEE	15.53		
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	9.09	0.39	Catnic Thermally Broken
External wall	E3 Sill	Independently assessed	0.021	6.48	0.14	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	22.50	0.36	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	17.74	2.84	
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	1.01	0.32	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	2.24	0.72	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	14.79	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.40	0.50	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.72	0.38	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	14.20	0.55	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	4.20	-0.38	Knauf P24
External wall	E18 Party wall between dwellings	Independently assessed	0.036	10.00	0.36	Knauf P25 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.72	1.40	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.72	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.72	0.31	Knauf P29 Halved

Total: **7.89** W/mK:
Y-Value: **0.049** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 72 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.63 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.02 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.15 (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 830 VUW 306/6-3 (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:	7.82 m ² , No overhang
Windows facing South West:	3.14 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.12 W/m ² K
Door U-value	1.10 W/m ² K
Photovoltaic array	0.60 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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =		0.3542 (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	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (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) = 13875.8696 (34)
192.6401 (35)
7.8850 (36)
(33) + (36) = 48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	84.2170	83.9818	83.7513	82.6686	82.4660	81.5230	81.5230	81.3484	81.8863	82.4660	82.8758	83.3042 (39)
Average = Sum(39)m / 12 =												82.6676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1659	1.1627	1.1477	1.1449	1.1318	1.1318	1.1294	1.1368	1.1449	1.1506	1.1565 (40)
HLP (average)												1.1477 (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)
2.2944 (42)
88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172	(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	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	(61)
Total heat required for water heating calculated for each month												
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(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												
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)
Heat gains from water heating, kWh/month												
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
18.9789	16.8569	13.7089	10.3786	7.7581	6.5497	7.0772	9.1992	12.3471	15.6775	18.2980	19.5064	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)												
65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	346.5865	344.4753	331.7385	311.3184	290.7055	270.8179	257.9079	263.7456	274.2505	294.8730	318.5185	336.1443 (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					7.8200	11.2829	0.6300	0.7000	0.7700		26.9650 (75)	
Southwest					3.1400	36.7938	0.6300	0.7000	0.7700		35.3083 (79)	
Solar gains	62.2733	115.0312	181.1812	264.3690	332.5129	346.1184	327.0324	273.7463	209.6031	133.5485	76.2202	52.2375 (83)
Total gains	408.8598	459.5064	512.9198	575.6874	623.2184	616.9362	584.9403	537.4920	483.8536	428.4215	394.7386	388.3819 (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	45.7676	45.8957	46.0221	46.6248	46.7393	47.2800	47.2800	47.3815	47.0703	46.7393	46.5082	46.2690
alpha	4.0512	4.0597	4.0681	4.1083	4.1160	4.1520	4.1520	4.1588	4.1380	4.1160	4.1005	4.0846
util living area	0.9952	0.9917	0.9824	0.9534	0.8780	0.7332	0.5794	0.6407	0.8623	0.9704	0.9918	0.9961 (86)
MIT	19.4148	19.5773	19.8716	20.2806	20.6496	20.8890	20.9683	20.9523	20.7639	20.2954	19.7889	19.3895 (87)
Th 2	19.9447	19.9474	19.9499	19.9621	19.9643	19.9750	19.9750	19.9769	19.9709	19.9643	19.9597	19.9549 (88)
util rest of house	0.9940	0.9895	0.9774	0.9389	0.8388	0.6502	0.4593	0.5212	0.8028	0.9586	0.9892	0.9951 (89)
MIT 2	18.4997	18.6633	18.9571	19.3661	19.7111	19.9157	19.9646	19.9596	19.8234	19.3878	18.8843	18.4823 (90)
Living area fraction												
MIT	18.7235	18.8869	19.1808	19.5898	19.9407	20.1538	20.2101	20.2024	20.0535	19.6098	19.1056	18.7042 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7235	18.8869	19.1808	19.5898	19.9407	20.1538	20.2101	20.2024	20.0535	19.6098	19.1056	18.7042 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9864	0.9725	0.9325	0.8377	0.6661	0.4883	0.5494	0.8084	0.9533	0.9863	0.9934	(94)
Useful gains	405.5535	453.2583	498.8373	536.8376	522.0776	410.9196	285.6123	295.3162	391.1422	408.4143	389.3143	385.8180	(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													
	1214.7053	1174.6448	1062.0325	883.7135	679.5784	452.7639	294.3069	309.3186	487.5070	743.0036	994.9755	1208.2601	(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													
	602.0089	484.7718	419.0172	249.7506	117.1806	0.0000	0.0000	0.0000	0.0000	248.9345	436.0761	611.8969	(98)
Space heating												3169.6367	(98)
Space heating per m2											(98) / (4) =	44.0044	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3514.0096 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.0089	484.7718	419.0172	249.7506	117.1806	0.0000	0.0000	0.0000	0.0000	248.9345	436.0761	611.8969	(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)	667.4157	537.4410	464.5424	276.8854	129.9120	0.0000	0.0000	0.0000	0.0000	275.9806	483.4546	678.3779	(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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)
Efficiency of water heater (217)m	87.0723	86.8681	86.3988	85.2618	82.8225	76.2000	76.2000	76.2000	76.2000	85.1290	86.5395	76.2000	(216)
Fuel for water heating, kWh/month	168.0247	147.2415	152.7038	134.8517	133.1505	124.8341	115.6771	132.7948	134.4351	140.2949	150.7076	162.5067	(219)
Water heating fuel used												1697.2225	(219)
Annual totals kWh/year													
Space heating fuel - main system												3514.0096	(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)												335.1734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096		-494.0096	(233)
Total delivered energy for all uses												5127.3958	(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	3514.0096	0.2160	759.0261 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1697.2225	0.2160	366.6001 (264)
Space and water heating			1125.6261 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.1734	0.5190	173.9550 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total CO2, kg/year			1082.1151 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0200 (273)

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

DER		15.0200	ZC1
Total Floor Area	TFA	72.0300	
Assumed number of occupants	N	2.2944	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6172	ZC2
CO2 emissions from cooking, equation (L16)		2.4166	ZC3
Total CO2 emissions		34.0538	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.0538	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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 180.0084 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1667 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.4167 (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) =	0.3542 (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	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			10.9600	1.3258	14.5303			(27)					
Ground Floor			35.8300	0.1300	4.6579			(28a)					
Exposed above Door			0.6000	0.1300	0.0780			(28b)					
Brick and Block	86.7600	13.0800	73.6800	0.1800	13.2624			(29a)					
Pitched Roof	36.2000		36.2000	0.1300	4.7060			(30)					
Total net area of external elements Aum(A, m2)			159.3900					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.3546			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0531	(36)					
Total fabric heat loss						(33) + (36) =	49.4077	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.7575	Feb 35.5224	Mar 35.2919	Apr 34.2092	May 34.0066	Jun 33.0636	Jul 33.0636	Aug 32.8890	Sep 33.4268	Oct 34.0066	Nov 34.4164	Dec 34.8448	(38)
Heat transfer coeff	85.1652	84.9301	84.6996	83.6169	83.4143	82.4713	82.4713	82.2967	82.8345	83.4143	83.8241	84.2525	(39)
Average = Sum(39)m / 12 =												83.6159	(39)
HLP	Jan 1.1824	Feb 1.1791	Mar 1.1759	Apr 1.1609	May 1.1580	Jun 1.1450	Jul 1.1450	Aug 1.1425	Sep 1.1500	Oct 1.1580	Nov 1.1637	Dec 1.1697	(40)
HLP (average)												1.1608	(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												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
Daily hot water use	Jan 97.5607	Feb 94.0131	Mar 90.4654	Apr 86.9177	May 83.3701	Jun 79.8224	Jul 79.8224	Aug 83.3701	Sep 86.9177	Oct 90.4654	Nov 94.0131	Dec 97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)
Energy content (annual)										Total = Sum(45)m =		1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.7159	43.2718	46.1002	42.8635	42.4845	39.3645	40.6766	42.4845	42.8635	46.1002	46.3626	49.7159 (61)
Total heat required for water heating calculated for each month	194.3956	169.8096	176.6759	156.7026	151.7158	133.6228	128.0208	142.7132	144.2893	164.3021	175.3893	189.8305 (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	194.3956	169.8096	176.6759	156.7026	151.7158	133.6228	128.0208	142.7132	144.2893	164.3021	175.3893	189.8305 (64)
Heat gains from water heating, kWh/month	60.5350	52.8918	54.9415	48.5674	46.9405	41.1820	39.2111	43.9472	44.4400	50.8272	54.4920	59.0171 (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	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9789	16.8569	13.7089	10.3786	7.7581	6.5497	7.0772	9.1992	12.3471	15.6775	18.2980	19.5064 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719 (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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Water heating gains (Table 5)	81.3642	78.7080	73.8461	67.4547	63.0921	57.1972	52.7031	59.0688	61.7222	68.3161	75.6834	79.3240 (72)
Total internal gains	362.7467	360.0644	346.7727	325.8065	304.6293	284.1856	271.3067	277.6984	288.7816	309.9504	334.1322	352.3217 (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												7.8200	11.2829	0.6300	0.7000	0.7700	26.9650 (75)
Southwest												3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)
Solar gains	62.2733	115.0312	181.1812	264.3690	332.5129	346.1184	327.0324	273.7463	209.6031	133.5485	76.2202	52.2375 (83)					
Total gains	425.0200	475.0956	527.9539	590.1755	637.1422	630.3040	598.3391	551.4448	498.3848	443.4989	410.3524	404.5592 (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	58.7339	58.8965	59.0568	59.8215	59.9667	60.6524	60.6524	60.7811	60.3865	59.9667	59.6736	59.3701
alpha	4.9156	4.9264	4.9371	4.9881	4.9978	5.0435	5.0435	5.0521	5.0258	4.9978	4.9782	4.9580
util living area	0.9981	0.9964	0.9911	0.9705	0.9036	0.7528	0.5863	0.6506	0.8856	0.9826	0.9964	0.9986 (86)
MIT	19.7064	19.8405	20.0853	20.4288	20.7396	20.9304	20.9843	20.9742	20.8302	20.4379	20.0164	19.6859 (87)
Th 2	19.9341	19.9368	19.9393	19.9514	19.9537	19.9643	19.9643	19.9662	19.9602	19.9537	19.9491	19.9443 (88)
util rest of house	0.9975	0.9952	0.9878	0.9586	0.8638	0.6621	0.4585	0.5217	0.8229	0.9735	0.9949	0.9981 (89)
MIT 2	18.2112	18.4090	18.7670	19.2684	19.6904	19.9164	19.9583	19.9552	19.8164	19.2892	18.6751	18.1885 (90)
Living area fraction	18.5770	18.7592	19.0895	19.5523	19.9470	20.1644	20.2093	20.2044	20.0644	19.5702	19.0032	0.2446 (91)
MIT	18.5770	18.7592	19.0895	19.5523	19.9470	20.1644	20.2093	20.2044	20.0644	19.5702	19.0032	18.5548 (92)
Temperature adjustment	18.5770	18.7592	19.0895	19.5523	19.9470	20.1644	20.2093	20.2044	20.0644	19.5702	19.0032	0.0000
adjusted MIT	18.5770	18.7592	19.0895	19.5523	19.9470	20.1644	20.2093	20.2044	20.0644	19.5702	19.0032	18.5548 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	423.4403	471.8356	519.5349	562.2445	550.1829	429.3892	293.1759	305.0789	413.8524	429.6690	407.4401	403.3769 (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	1215.9008	1177.0590	1066.3218	890.7098	687.9191	458.9049	297.6634	313.0919	494.0565	748.2398	997.7762	1209.4296 (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	589.5906	473.9101	406.8094	236.4950	102.4757	0.0000	0.0000	0.0000	0.0000	237.0167	425.0420	599.7032 (98)
Space heating												3071.0428 (98)
Space heating per m2												42.6356 (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												3288.0544 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	589.5906	473.9101	406.8094	236.4950	102.4757	0.0000	0.0000	0.0000	0.0000	237.0167	425.0420	599.7032 (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)	631.2533	507.3984	435.5562	253.2067	109.7170	0.0000	0.0000	0.0000	0.0000	253.7652	455.0771	642.0805 (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	194.3956	169.8096	176.6759	156.7026	151.7158	133.6228	128.0208	142.7132	144.2893	164.3021	175.3893	189.8305 (64)
Efficiency of water heater (217)m	87.6659	87.4969	87.0834	86.0848	84.0874	80.3000	80.3000	80.3000	80.3000	85.9729	87.1964	80.3000 (216)
Fuel for water heating, kWh/month	221.7460	194.0750	202.8812	182.0328	180.4262	166.4045	159.4282	177.7250	179.6878	191.1093	201.1429	216.3399 (219)
Water heating fuel used												2272.9988 (219)
Annual totals kWh/year												
Space heating fuel - main system												3288.0544 (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)												335.1734 (232)
Total delivered energy for all uses												5971.2265 (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	3288.0544	0.2160	710.2198 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2272.9988	0.2160	490.9677 (264)
Space and water heating			1201.1875 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.1734	0.5190	173.9550 (268)
Total CO2, kg/m2/year			1414.0675 (272)
Emissions per m2 for space and water heating			16.6762 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4150 (272b)
Emissions per m2 for pumps and fans			0.5404 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6762 * 1.00) + 2.4150 + 0.5404, rounded to 2 d.p.			19.6300 (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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =	0.3542 (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	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			9.0000	322.4700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13553.3996 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.1633 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8850 (36)
Total fabric heat loss						(33) + (36) =	48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	84.2170	83.9818	83.7513	82.6686	82.4660	81.5230	81.5230	81.3484	81.8863	82.4660	82.8758	83.3042 (39)
Average = Sum(39)m / 12 =												82.6676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1659	1.1627	1.1477	1.1449	1.1318	1.1318	1.1294	1.1368	1.1449	1.1506	1.1565 (40)
HLP (average)												1.1477 (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												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (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	30.7444	26.8893	27.7473	24.1908	23.2117	20.0299	18.5606	21.2986	21.5530	25.1179	27.4182	29.7744 (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	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9789	16.8569	13.7089	10.3786	7.7581	6.5497	7.0772	9.1992	12.3471	15.6775	18.2980	19.5064	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	(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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	41.3232	40.0138	37.2948	33.5983	31.1985	27.8193	24.9471	28.6272	29.9347	33.7606	38.0808	40.0193	(72)
Total internal gains	319.7056	318.3703	307.2214	288.9501	269.7357	251.8077	240.5507	244.2568	253.9942	272.3949	293.5296	310.0170	(73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains	
				m2	Table 6a	Table 6b		Table 6c		factor		W	
					W/m2	or		or		Table 6d			
Northeast				7.8200	11.2829	0.6300		0.7000		0.7700		26.9650 (75)	
Southwest				3.1400	36.7938	0.6300		0.7000		0.7700		35.3083 (79)	
Solar gains	62.2733	115.0312	181.1812	264.3690	332.5129	346.1184	327.0324	273.7463	209.6031	133.5485	76.2202	52.2375	(83)
Total gains	381.9789	433.4014	488.4027	553.3191	602.2486	597.9261	567.5831	518.0032	463.5973	405.9434	369.7498	362.2545	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.7040	44.8291	44.9525	45.5413	45.6531	46.1812	46.1812	46.2804	45.9764	45.6531	45.4274	45.1938	
alpha	3.9803	3.9886	3.9968	4.0361	4.0435	4.0787	4.0787	4.0854	4.0651	4.0435	4.0285	4.0129	
util living area	0.9959	0.9927	0.9841	0.9569	0.8853	0.7449	0.5923	0.6567	0.8731	0.9738	0.9930	0.9967	(86)
MIT	19.3443	19.5112	19.8142	20.2365	20.6207	20.8758	20.9634	20.9446	20.7395	20.2498	19.7282	19.3194	(87)
Th 2	19.9447	19.9474	19.9499	19.9621	19.9643	19.9750	19.9750	19.9769	19.9709	19.9643	19.9597	19.9549	(88)
util rest of house	0.9948	0.9908	0.9796	0.9435	0.8480	0.6634	0.4714	0.5371	0.8169	0.9634	0.9908	0.9959	(89)
MIT 2	18.4318	18.6000	18.9027	19.3257	19.6871	19.9074	19.9626	19.9561	19.8050	19.3458	18.8263	18.4147	(90)
Living area fraction	18.6550	18.8229	19.1257	19.5485	19.9155	20.1443	20.2074	20.1979	20.0336	19.5670	19.0469	18.6360	(92)
Temperature adjustment	18.6550	18.8229	19.1257	19.5485	19.9155	20.1443	20.2074	20.1979	20.0336	19.5670	19.0469	18.6360	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9930	0.9879	0.9749	0.9369	0.8459	0.6782	0.5004	0.5650	0.8209	0.9581	0.9881	0.9943	(94)
Ext temp.	379.3063	428.1573	476.1539	518.4021	509.4484	405.5343	284.0327	292.6827	380.5867	388.9164	365.3376	360.1973	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1208.9337	1169.2705	1057.4160	880.2975	677.4998	451.9867	294.0877	308.9555	485.8787	739.4697	990.1099	1202.5831	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	617.2428	498.0281	432.4590	260.5647	125.0302	0.0000	0.0000	0.0000	0.0000	260.8117	449.8360	626.7350	(98)
												3270.7075	(98)
												45.4076	(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	766.3165	603.2704	618.2479	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8124	0.8786	0.8453	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	622.5716	530.0445	522.6008	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	784.5361	747.3724	690.9468	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	116.6144	161.6920	125.2494	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												403.5558 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.1536	40.4230	31.3124	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												100.8890 (107)
Space cooling per m2												1.4007 (108)
Energy for space heating												45.4076 (99)
Energy for space cooling												1.4007 (108)
Total												46.8082 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.8 (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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 180.0084 (5)
Dwelling volume			

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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =	0.3542 (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	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			10.9600	1.3258	14.5303		(27)
Ground Floor			35.8300	0.1300	4.6579		(28a)
Exposed above Door			0.6000	0.1300	0.0780		(28b)
Brick and Block	86.7600	13.0800	73.6800	0.1800	13.2624		(29a)
Pitched Roof	36.2000		36.2000	0.1300	4.7060		(30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3546		(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)							10.0531 (36)
Total fabric heat loss						(33) + (36) =	49.4077 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	85.1652	84.9301	84.6996	83.6169	83.4143	82.4713	82.4713	82.2967	82.8345	83.4143	83.8241	84.2525 (39)
Average = Sum(39)m / 12 =												83.6159 (39)
HLP	1.1824	1.1791	1.1759	1.1609	1.1580	1.1450	1.1450	1.1425	1.1500	1.1580	1.1637	1.1697 (40)
HLP (average)												1.1608 (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												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy content (annual)	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1395.4639 (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	30.7444	26.8893	27.7473	24.1908	23.2117	20.0299	18.5606	21.2986	21.5530	25.1179	27.4182	29.7744 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.9789	16.8569	13.7089	10.3786	7.7581	6.5497	7.0772	9.1992	12.3471	15.6775	18.2980	19.5064 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756 (68)
Pumps, fans	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Total internal gains	41.3232	40.0138	37.2948	33.5983	31.1985	27.8193	24.9471	28.6272	29.9347	33.7606	38.0808	40.0193 (72)
	319.7056	318.3703	307.2214	288.9501	269.7357	251.8077	240.5507	244.2568	253.9942	272.3949	293.5296	310.0170 (73)

6. Solar gains												

[Jan]												
			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
Northeast			7.8200		11.2829		0.6300		0.7000		0.7700	26.9650 (75)
Southwest			3.1400		36.7938		0.6300		0.7000		0.7700	35.3083 (79)

Solar gains	62.2733	115.0312	181.1812	264.3690	332.5129	346.1184	327.0324	273.7463	209.6031	133.5485	76.2202	52.2375 (83)
Total gains	381.9789	433.4014	488.4027	553.3191	602.2486	597.9261	567.5831	518.0032	463.5973	405.9434	369.7498	362.2545 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	58.7339	58.8965	59.0568	59.8215	59.9667	60.6524	60.6524	60.7811	60.3865	59.9667	59.6736	59.3701
util living area	4.9156	4.9264	4.9371	4.9881	4.9978	5.0435	5.0435	5.0521	5.0258	4.9978	4.9782	4.9580
	0.9989	0.9976	0.9936	0.9771	0.9192	0.7785	0.6134	0.6834	0.9080	0.9879	0.9977	0.9991 (86)
MIT	19.6510	19.7873	20.0360	20.3869	20.7107	20.9187	20.9808	20.9679	20.8036	20.3927	19.9644	19.6313 (87)
Th 2	19.9341	19.9368	19.9393	19.9514	19.9537	19.9643	19.9643	19.9662	19.9602	19.9537	19.9491	19.9443 (88)
util rest of house	0.9985	0.9968	0.9912	0.9674	0.8837	0.6896	0.4820	0.5522	0.8526	0.9813	0.9968	0.9988 (89)
MIT 2	18.7026	18.8407	19.0904	19.4455	19.7503	19.9251	19.9592	19.9565	19.8427	19.4565	19.0276	18.6910 (90)
Living area fraction									fLA = Living area / (4) =			0.2446 (91)
MIT	18.9346	19.0723	19.3217	19.6758	19.9852	20.1681	20.2091	20.2039	20.0777	19.6855	19.2568	18.9211 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9346	19.0723	19.3217	19.6758	19.9852	20.1681	20.2091	20.2039	20.0777	19.6855	19.2568	18.9211 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9979	0.9958	0.9893	0.9642	0.8850	0.7090	0.5146	0.5846	0.8603	0.9790	0.9959	0.9984 (94)
Ext temp.	381.1867	431.5875	483.1578	533.4936	532.9838	423.9090	292.0769	302.8394	398.8123	397.4186	368.2315	361.6801 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1246.3606	1203.6532	1085.9899	901.0383	691.1056	459.2103	297.6486	313.0504	495.1625	757.8632	1019.0326	1240.2854 (97)
Space heating kWh	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 per m2	643.6894	518.8281	448.5070	264.6322	117.6426	0.0000	0.0000	0.0000	0.0000	268.1708	468.5767	653.6823 (98)
												3383.7292 (98)
										(98) / (4) =		46.9767 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	775.2301	610.2875	625.4546	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8395	0.9065	0.8734	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	650.7836	553.2366	546.2647	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	784.5361	747.3724	690.9468	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	96.3017	144.4370	107.6435	0.0000	0.0000	0.0000	0.0000 (104)
												348.3822 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.0754	36.1093	26.9109	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												87.0956 (107)
Space cooling per m2												1.2092 (108)
Energy for space heating												46.9767 (99)
Energy for space cooling												1.2092 (108)
Total												48.1858 (109)
Target Fabric Energy Efficiency (TFEE)												55.4 (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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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)	=	0.3542 (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	0.4516	0.4161	0.4073	0.3807	0.3807	0.3542	0.3542	0.3453	0.3542	0.3984	0.3896	0.4161 (22b)
Effective ac	0.6020	0.5866	0.5829	0.5725	0.5725	0.5627	0.5627	0.5596	0.5627	0.5794	0.5759	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13875.8696 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.6401 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8850 (36)
Total fabric heat loss (33) + (36) = 48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	34.8448	34.6283	34.0066	34.0066	33.4268	33.4268	33.2429	33.4268	34.4164	34.2092	34.8448 (38)
Heat transfer coeff	84.2170	83.3042	83.0877	82.4660	82.4660	81.8863	81.8863	81.7023	81.8863	82.8758	82.6686	83.3042 (39)
Average = Sum(39)m / 12 =												82.6459 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1565	1.1535	1.1449	1.1449	1.1368	1.1368	1.1343	1.1368	1.1506	1.1477	1.1565 (40)
HLP (average)												1.1474 (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 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (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	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	1.5720 (61)
Total heat required for water heating calculated for each month	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (64)
RHI water heating demand												Total per year (kWh/year) = Sum(64)m = 1409.8373 (64)
Heat gains from water heating, kWh/month	48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (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	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4473	42.1422	34.2724	25.9464	19.3952	16.3743	17.6930	22.9980	30.8679	39.1938	45.7450	48.7660	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	514.0740	509.8121	489.7519	458.7979	427.2632	398.9923	382.4840	390.4723	408.3006	439.4570	474.0243	500.0334	(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					7.8200	15.0428	0.6300	0.7000			0.7700			35.9508 (75)
Southwest					3.1400	46.3896	0.6300	0.7000			0.7700			44.5166 (79)
Solar gains	80.4674	127.7309	201.5337	300.7995	361.6330	407.1738	375.6204	321.1589	247.7773	157.2803	97.7417	64.3570 (83)		
Total gains	594.5414	637.5429	691.2856	759.5974	788.8962	806.1661	758.1043	711.6313	656.0779	596.7373	571.7660	564.3904 (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	45.7676	46.2690	46.3896	46.7393	46.7393	47.0703	47.0703	47.1762	47.0703	46.5082	46.6248	46.2690
alpha	4.0512	4.0846	4.0926	4.1160	4.1160	4.1380	4.1380	4.1451	4.1380	4.1005	4.1083	4.0846
util living area	0.9775	0.9696	0.9446	0.8798	0.7490	0.5437	0.3942	0.4177	0.6754	0.8885	0.9597	0.9806 (86)
MIT	19.8381	19.9560	20.2277	20.5665	20.8377	20.9676	20.9934	20.9919	20.9230	20.6301	20.2146	19.8266 (87)
Th 2	19.9447	19.9549	19.9574	19.9643	19.9643	19.9709	19.9709	19.9729	19.9709	19.9597	19.9621	19.9549 (88)
util rest of house	0.9717	0.9619	0.9302	0.8489	0.6880	0.4537	0.2873	0.3053	0.5847	0.8507	0.9475	0.9754 (89)
MIT 2	18.9183	19.0416	19.3071	19.6297	19.8614	19.9572	19.9694	19.9711	19.9334	19.6913	19.3023	18.9154 (90)
Living area fraction									fLA = Living area / (4) =			0.2446 (91)
MIT	19.1433	19.2653	19.5323	19.8588	20.1002	20.2044	20.2199	20.2208	20.1755	19.9209	19.5254	19.1383 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1433	19.2653	19.5323	19.8588	20.1002	20.2044	20.2199	20.2208	20.1755	19.9209	19.5254	19.1383 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9661	0.9555	0.9232	0.8453	0.6967	0.4748	0.3136	0.3329	0.6040	0.8491	0.9411	0.9703	(94)
Ext temp.	574.3883	609.1795	638.1643	642.0830	549.5942	382.7998	237.7150	236.9204	396.2934	506.6825	538.1096	547.6094	(95)
Heat loss rate W	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)
Month fracti	1157.4220	1130.0481	1016.3501	846.0052	618.5130	393.4127	239.0999	238.6384	423.8009	673.0291	919.7235	1136.1265	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
RHI space heating demand	433.7770	350.0238	281.3702	146.8240	51.2756	0.0000	0.0000	0.0000	0.0000	123.7619	274.7620	437.8567	(98)
												2099.6513	(98)
												2100	(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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =	0.3542 (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	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13875.8696 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.6401 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8850 (36)
Total fabric heat loss (33) + (36) = 48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	84.2170	83.9818	83.7513	82.6686	82.4660	81.5230	81.5230	81.3484	81.8863	82.4660	82.8758	83.3042 (39)
Average = Sum(39)m / 12 =												82.6676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1659	1.1627	1.1477	1.1449	1.1318	1.1318	1.1294	1.1368	1.1449	1.1506	1.1565 (40)
HLP (average)												1.1477 (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 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (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	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	1.5720 (61)
Total heat required for water heating calculated for each month	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (64)
Heat gains from water heating, kWh/month	48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (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	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4473	42.1422	34.2724	25.9464	19.3952	16.3743	17.6930	22.9980	30.8679	39.1938	45.7450	48.7660	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	514.0740	509.8121	489.7519	458.7979	427.2632	398.9923	382.4840	390.4723	408.3006	439.4570	474.0243	500.0334	(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					7.8200	11.2829	0.6300	0.7000			0.7700			26.9650 (75)
Southwest					3.1400	36.7938	0.6300	0.7000			0.7700			35.3083 (79)
Solar gains	62.2733	115.0312	181.1812	264.3690	332.5129	346.1184	327.0324	273.7463	209.6031	133.5485	76.2202			52.2375 (83)
Total gains	576.3473	624.8432	670.9331	723.1669	759.7761	745.1107	709.5164	664.2187	617.9037	573.0055	550.2445			552.2710 (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	45.7676	45.8957	46.0221	46.6248	46.7393	47.2800	47.2800	47.3815	47.0703	46.7393	46.5082	46.2690
alpha	4.0512	4.0597	4.0681	4.1083	4.1160	4.1520	4.1520	4.1588	4.1380	4.1160	4.1005	4.0846
util living area	0.9839	0.9761	0.9579	0.9097	0.8083	0.6434	0.4904	0.5395	0.7678	0.9277	0.9742	0.9863 (86)
MIT	19.6688	19.8220	20.0920	20.4543	20.7563	20.9322	20.9828	20.9746	20.8553	20.4801	20.0191	19.6405 (87)
Th 2	19.9447	19.9474	19.9499	19.9621	19.9643	19.9750	19.9750	19.9769	19.9709	19.9643	19.9597	19.9549 (88)
util rest of house	0.9799	0.9702	0.9470	0.8858	0.7585	0.5595	0.3831	0.4300	0.6937	0.9035	0.9667	0.9829 (89)
MIT 2	18.7509	18.9038	19.1700	19.5256	19.7966	19.9409	19.9696	19.9683	19.8876	19.5585	19.1096	18.7309 (90)
Living area fraction	18.9754	19.1284	19.3956	19.7528	20.0314	20.1834	20.2175	20.2145	20.1243	19.7839	19.3321	18.9534 (91)
MIT	18.9754	19.1284	19.3956	19.7528	20.0314	20.1834	20.2175	20.2145	20.1243	19.7839	19.3321	18.9534 (92)
Temperature adjustment	18.9754	19.1284	19.3956	19.7528	20.0314	20.1834	20.2175	20.2145	20.1243	19.7839	19.3321	18.9534 (93)
adjusted MIT	18.9754	19.1284	19.3956	19.7528	20.0314	20.1834	20.2175	20.2145	20.1243	19.7839	19.3321	18.9534 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9752	0.9643	0.9400	0.8802	0.7621	0.5775	0.4092	0.4565	0.7059	0.8984	0.9609	0.9787	(94)
Ext temp.	562.0554	602.5631	630.6876	636.5294	579.0249	430.3289	290.3572	303.1846	436.1703	514.7843	528.7570	540.4813	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1235.9197	1194.9310	1080.0194	897.1853	687.0540	455.1754	294.9075	310.3041	493.3082	757.3608	1013.7425	1229.0224	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	501.3550	398.0712	334.3029	187.6722	80.3736	0.0000	0.0000	0.0000	0.0000	180.4769	349.1896	512.2745	(98)
Space heating per m2												2543.7161	(98)
												(98) / (4) =	35.3147 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2820.0843	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	501.3550	398.0712	334.3029	187.6722	80.3736	0.0000	0.0000	0.0000	0.0000	180.4769	349.1896	512.2745	(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)	555.8260	441.3207	370.6240	208.0624	89.1060	0.0000	0.0000	0.0000	0.0000	200.0853	387.1282	567.9319	(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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)
Efficiency of water heater (217)m	86.6056	86.3424	85.7422	84.3150	81.5350	76.2000	76.2000	76.2000	76.2000	84.0504	85.9079	76.2000	(216)
Fuel for water heating, kWh/month	168.9302	148.1381	153.8730	136.3660	135.2530	124.8341	115.6771	132.7948	134.4351	142.0952	151.8156	163.3333	(219)
Water heating fuel used												1707.5455	(219)
Annual totals kWh/year													
Space heating fuel - main system												2820.0843	(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)												335.1734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096		-494.0096	(233)
Total delivered energy for all uses												4443.7936	(238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2820.0843	3.4800	98.1389 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1707.5455	3.4800	59.4226 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	335.1734	13.1900	44.2094 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.0096	13.1900	-65.1599 (252)
Total energy cost			266.5035 (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] =	0.9564 (257)
SAP value	86.6577	
SAP rating (Section 12)	87	(258)
SAP band	B	

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2820.0843	0.2160	609.1382 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1707.5455	0.2160	368.8298 (264)
Space and water heating			977.9680 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.1734	0.5190	173.9550 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total kg/year			934.4570 (272)
CO2 emissions per m2			12.9700 (273)
EI value			89.3004
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, 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	$3.48 / 0.8217 = 4.235$, stars = 4
Water heating environmental impact	$0.216 / 0.8217 = 0.2629$, 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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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)	=	0.3542 (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	0.4516	0.4161	0.4073	0.3807	0.3807	0.3542	0.3542	0.3453	0.3542	0.3984	0.3896	0.4161 (22b)
Effective ac	0.6020	0.5866	0.5829	0.5725	0.5725	0.5627	0.5627	0.5596	0.5627	0.5794	0.5759	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13875.8696 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.6401 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8850 (36)
Total fabric heat loss (33) + (36) = 48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	34.8448	34.6283	34.0066	34.0066	33.4268	33.4268	33.2429	33.4268	34.4164	34.2092	34.8448 (38)
Heat transfer coeff	84.2170	83.3042	83.0877	82.4660	82.4660	81.8863	81.8863	81.7023	81.8863	82.8758	82.6686	83.3042 (39)
Average = Sum(39)m / 12 =												82.6459 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1565	1.1535	1.1449	1.1449	1.1368	1.1368	1.1343	1.1368	1.1506	1.1477	1.1565 (40)
HLP (average)												1.1474 (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 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172	(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	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	(61)
Total heat required for water heating calculated for each month												
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(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)
Output from w/h												
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)
Heat gains from water heating, kWh/month												
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811	(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	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4473	42.1422	34.2724	25.9464	19.3952	16.3743	17.6930	22.9980	30.8679	39.1938	45.7450	48.7660	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	514.0740	509.8121	489.7519	458.7979	427.2632	398.9923	382.4840	390.4723	408.3006	439.4570	474.0243	500.0334	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access		Gains	
						Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
Northeast				7.8200	15.0428	0.6300		0.7000		0.7700		35.9508 (75)	
Southwest				3.1400	46.3896	0.6300		0.7000		0.7700		44.5166 (79)	

Solar gains	80.4674	127.7309	201.5337	300.7995	361.6330	407.1738	375.6204	321.1589	247.7773	157.2803	97.7417	64.3570 (83)	
Total gains	594.5414	637.5429	691.2856	759.5974	788.8962	806.1661	758.1043	711.6313	656.0779	596.7373	571.7660	564.3904 (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	45.7676	46.2690	46.3896	46.7393	46.7393	47.0703	47.0703	47.1762	47.0703	46.5082	46.6248	46.2690
alpha	4.0512	4.0846	4.0926	4.1160	4.1160	4.1380	4.1380	4.1451	4.1380	4.1005	4.1083	4.0846
util living area	0.9775	0.9696	0.9446	0.8798	0.7490	0.5437	0.3942	0.4177	0.6754	0.8885	0.9597	0.9806 (86)
MIT	19.8381	19.9560	20.2277	20.5665	20.8377	20.9676	20.9934	20.9919	20.9230	20.6301	20.2146	19.8266 (87)
Th 2	19.9447	19.9549	19.9574	19.9643	19.9643	19.9709	19.9709	19.9729	19.9709	19.9597	19.9621	19.9549 (88)
util rest of house	0.9717	0.9619	0.9302	0.8489	0.6880	0.4537	0.2873	0.3053	0.5847	0.8507	0.9475	0.9754 (89)
MIT 2	18.9183	19.0416	19.3071	19.6297	19.8614	19.9572	19.9694	19.9711	19.9334	19.6913	19.3023	18.9154 (90)
Living area fraction									fLA = Living area / (4) =			0.2446 (91)
MIT	19.1433	19.2653	19.5323	19.8588	20.1002	20.2044	20.2199	20.2208	20.1755	19.9209	19.5254	19.1383 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1433	19.2653	19.5323	19.8588	20.1002	20.2044	20.2199	20.2208	20.1755	19.9209	19.5254	19.1383 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9661	0.9555	0.9232	0.8453	0.6967	0.4748	0.3136	0.3329	0.6040	0.8491	0.9411	0.9703	(94)	
Useful gains	574.3883	609.1795	638.1643	642.0830	549.5942	382.7998	237.7150	236.9204	396.2934	506.6825	538.1096	547.6094	(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	1157.4220	1130.0481	1016.3501	846.0052	618.5130	393.4127	239.0999	238.6384	423.8009	673.0291	919.7235	1136.1265	(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	433.7770	350.0238	281.3702	146.8240	51.2756	0.0000	0.0000	0.0000	0.0000	123.7619	274.7620	437.8567	(98)	
Space heating												2099.6513	(98)	
Space heating per m2												(98) / (4) =	29.1497	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2327.7730	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	433.7770	350.0238	281.3702	146.8240	51.2756	0.0000	0.0000	0.0000	0.0000	123.7619	274.7620	437.8567	(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)	480.9058	388.0529	311.9404	162.7761	56.8466	0.0000	0.0000	0.0000	0.0000	137.2083	304.6142	485.4287	(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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)
Efficiency of water heater (217)m	86.2054	85.9727	85.2029	83.4653	80.1483	76.2000	76.2000	76.2000	76.2000	82.7350	85.1635	86.3226	(216)
Fuel for water heating, kWh/month	169.7144	148.7750	154.8470	137.7542	137.5932	124.8341	115.6771	132.7948	134.4351	144.3545	153.1426	164.1362	(219)
Water heating fuel used												1718.0581	(219)
Annual totals kWh/year													
Space heating fuel - main system												2327.7730	(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)												335.1734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1182 * 1.00) =										-567.2191		-567.2191	(233)
Total delivered energy for all uses												3888.7854	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2327.7730	7.6100	177.1435 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1718.0581	7.6100	130.7442 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	335.1734	31.0800	104.1719 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-567.2191	31.0800	-176.2917 (252)
Total energy cost			364.0779 (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	2327.7730	0.2160	502.7990 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1718.0581	0.2160	371.1006 (264)
Space and water heating			873.8995 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.1734	0.5190	173.9550 (268)
Energy saving/generation technologies			
PV Unit	-567.2191	0.5190	-294.3867 (269)
Total kg/year			792.3928 (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	2327.7730	1.2200	2839.8831 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1718.0581	1.2200	2096.0309 (264)
Space and water heating			4935.9140 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	335.1734	3.0700	1028.9822 (268)
Energy saving/generation technologies			
PV Unit	-567.2191	3.0700	-1741.3628 (269)
Primary energy kWh/year			4453.7835 (272)
Primary energy kWh/m2/year			61.8323 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 63	-196 kg (24.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£63 2.72 kg/m²	B 88	B 91
Total Savings	£63 2.72 kg/m²		

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

Fuel prices for cost data on this page from database revision number 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	£127	£143	-£16
Mains gas	£413	£335	£78
Space heating	£305	£305	£0
Water heating	£131	£68	£63
Lighting	£104	£104	£0
Generated (PV)	-£176	-£176	£0
Total cost of fuels	£364	£302	£62
Total cost of uses	£364	£301	£63
Delivered energy	54 kWh/m²	40 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	62 kWh/m²	47 kWh/m²	15 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	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =	0.3542 (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	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13875.8696 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							192.6401 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8850 (36)
Total fabric heat loss						(33) + (36) =	48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	84.2170	83.9818	83.7513	82.6686	82.4660	81.5230	81.5230	81.3484	81.8863	82.4660	82.8758	83.3042 (39)
Average = Sum(39)m / 12 =												82.6676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1659	1.1627	1.1477	1.1449	1.1318	1.1318	1.1294	1.1368	1.1449	1.1506	1.1565 (40)
HLP (average)												1.1477 (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												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (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	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	1.5720 (61)
Total heat required for water heating calculated for each month												
	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (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												1.2996 (H8)
Utilisation factor												0.5367 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.6916 (H14)
Volume ratio Veff/V												0.8456 (H15)
Solar storage volume factor												0.9665 (H16)
Solar input												-827.2121 (H17)
Solar input	-23.9875	-40.0282	-68.1727	-91.3648	-112.8736	-110.9727	-109.5061	-95.6761	-74.9335	-51.1708	-28.4526	-20.0734 (63)
												Solar input (sum of months) = Sum(63)m = -827.2121 (63)
Output from w/h												
	122.3155	87.8777	63.7615	23.6121	0.0000	0.0000	0.0000	5.5136	27.5060	68.2609	101.9690	121.6132 (64)
												Total per year (kWh/year) = Sum(64)m = 622.4295 (64)
Heat gains from water heating, kWh/month												
	48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (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	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4473	42.1422	34.2724	25.9464	19.3952	16.3743	17.6930	22.9980	30.8679	39.1938	45.7450	48.7660	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	514.0740	509.8121	489.7519	458.7979	427.2632	398.9923	382.4840	390.4723	408.3006	439.4570	474.0243	500.0334	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF			Access factor Table 6d			Gains W
Northeast					7.8200	11.2829	0.6300		0.7000			0.7700			26.9650 (75)
Southwest					3.1400	36.7938	0.6300		0.7000			0.7700			35.3083 (79)
Solar gains	62.2733	115.0312	181.1812	264.3690	332.5129	346.1184	327.0324	273.7463	209.6031	133.5485	76.2202			52.2375 (83)	
Total gains	576.3473	624.8432	670.9331	723.1669	759.7761	745.1107	709.5164	664.2187	617.9037	573.0055	550.2445			552.2710 (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	45.7676	45.8957	46.0221	46.6248	46.7393	47.2800	47.2800	47.3815	47.0703	46.7393	46.5082	46.2690
alpha	4.0512	4.0597	4.0681	4.1083	4.1160	4.1520	4.1520	4.1588	4.1380	4.1160	4.1005	4.0846
util living area	0.9839	0.9761	0.9579	0.9097	0.8083	0.6434	0.4904	0.5395	0.7678	0.9277	0.9742	0.9863 (86)
MIT	19.6688	19.8220	20.0920	20.4543	20.7563	20.9322	20.9828	20.9746	20.8553	20.4801	20.0191	19.6405 (87)
Th 2	19.9447	19.9474	19.9499	19.9621	19.9643	19.9750	19.9750	19.9769	19.9709	19.9643	19.9597	19.9549 (88)
util rest of house	0.9799	0.9702	0.9470	0.8858	0.7585	0.5595	0.3831	0.4300	0.6937	0.9035	0.9667	0.9829 (89)
MIT 2	18.7509	18.9038	19.1700	19.5256	19.7966	19.9409	19.9696	19.9683	19.8876	19.5585	19.1096	18.7309 (90)
Living area fraction	fLA = Living area / (4) =											0.2446 (91)
MIT	18.9754	19.1284	19.3956	19.7528	20.0314	20.1834	20.2175	20.2145	20.1243	19.7839	19.3321	18.9534 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9754	19.1284	19.3956	19.7528	20.0314	20.1834	20.2175	20.2145	20.1243	19.7839	19.3321	18.9534 (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	0.9752	0.9643	0.9400	0.8802	0.7621	0.5775	0.4092	0.4565	0.7059	0.8984	0.9609	0.9787	(94)
Useful gains	562.0554	602.5631	630.6876	636.5294	579.0249	430.3289	290.3572	303.1846	436.1703	514.7843	528.7570	540.4813	(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	1235.9197	1194.9310	1080.0194	897.1853	687.0540	455.1754	294.9075	310.3041	493.3082	757.3608	1013.7425	1229.0224	(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	501.3550	398.0712	334.3029	187.6722	80.3736	0.0000	0.0000	0.0000	0.0000	180.4769	349.1896	512.2745	(98)
Space heating												2543.7161	(98)
Space heating per m2												35.3147	(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													2820.0843	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	501.3550	398.0712	334.3029	187.6722	80.3736	0.0000	0.0000	0.0000	0.0000	180.4769	349.1896	512.2745	(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)	555.8260	441.3207	370.6240	208.0624	89.1060	0.0000	0.0000	0.0000	0.0000	200.0853	387.1282	567.9319	(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	122.3155	87.8777	63.7615	23.6121	0.0000	0.0000	0.0000	5.5136	27.5060	68.2609	101.9690	121.6132	(64)	
Efficiency of water heater	87.0629	87.2995	87.6214	88.3852	90.2000	76.2000	76.2000	76.2000	76.2000	85.8704	86.6038	87.1288	(216)	
(217)m	87.0629	87.2995	87.6214	88.3852	90.2000	76.2000	76.2000	76.2000	76.2000	85.8704	86.6038	87.1288	(217)	
Fuel for water heating, kWh/month	140.4910	100.6623	72.7693	26.7150	0.0000	0.0000	0.0000	7.2357	36.0972	79.4929	117.7420	139.5786	(219)	
Water heating fuel used														
Annual totals kWh/year													720.7840	(219)
Space heating fuel - main system													2820.0843	(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)													335.1734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096			-494.0096	(233)
Total delivered energy for all uses													3507.0320	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2820.0843	3.4800	98.1389	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	720.7840	3.4800	25.0833	(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	335.1734	13.1900	44.2094	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.0096	13.1900	-65.1599	(252)
Total energy cost			238.7592	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.8569	(257)
SAP value			88.0467	
SAP rating (Section 12)			88	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2820.0843	0.2160	609.1382 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	720.7840	0.2160	155.6893 (264)
Space and water heating			764.8275 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	335.1734	0.5190	173.9550 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total kg/year			747.2665 (272)
CO2 emissions per m2			10.3700 (273)
EI value			91.4438
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =		0.3542 (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	0.4516	0.4161	0.4073	0.3807	0.3807	0.3542	0.3542	0.3453	0.3542	0.3984	0.3896	0.4161 (22b)
Effective ac	0.6020	0.5866	0.5829	0.5725	0.5725	0.5627	0.5627	0.5596	0.5627	0.5794	0.5759	0.5866 (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)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	86.7600	13.0800	73.6800	0.2400	17.6832	42.2200	3110.7696 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5744		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13875.8696 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.6401 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8850 (36)
Total fabric heat loss (33) + (36) = 48.4594 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	34.8448	34.6283	34.0066	34.0066	33.4268	33.4268	33.2429	33.4268	34.4164	34.2092	34.8448 (38)
Heat transfer coeff	84.2170	83.3042	83.0877	82.4660	82.4660	81.8863	81.8863	81.7023	81.8863	82.8758	82.6686	83.3042 (39)
Average = Sum(39)m / 12 =												82.6459 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1565	1.1535	1.1449	1.1449	1.1368	1.1368	1.1343	1.1368	1.1506	1.1477	1.1565 (40)
HLP (average)												1.1474 (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 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (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 = 1395.4639 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (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	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950 (61)
Total heat required for water heating calculated for each month											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-28.3259	-40.4361	-68.5324	-93.5167	-110.3701	-117.4546	-113.1183	-100.9164	-79.8694	-54.6864	-33.3028
Solar input (sum of months) = Sum(63)m =											
-863.1552											
Output from w/h											
117.9770	87.4698	63.4018	21.4603	0.0000	0.0000	0.0000	0.2733	22.5702	64.7453	97.1189	119.0605 (64)
Total per year (kWh/year) = Sum(64)m =											
594.0770											
Heat gains from water heating, kWh/month											
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (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	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4473	42.1422	34.2724	25.9464	19.3952	16.3743	17.6930	22.9980	30.8679	39.1938	45.7450	48.7660 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607 (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)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467 (72)
Total internal gains	514.0740	509.8121	489.7519	458.7979	427.2632	398.9923	382.4840	390.4723	408.3006	439.4570	474.0243	500.0334 (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			7.8200	15.0428	0.6300			0.7000	0.7700	35.9508 (75)		
Southwest			3.1400	46.3896	0.6300			0.7000	0.7700	44.5166 (79)		
Solar gains	80.4674	127.7309	201.5337	300.7995	361.6330	407.1738	375.6204	321.1589	247.7773	157.2803	97.7417	64.3570 (83)
Total gains	594.5414	637.5429	691.2856	759.5974	788.8962	806.1661	758.1043	711.6313	656.0779	596.7373	571.7660	564.3904 (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	45.7676	46.2690	46.3896	46.7393	46.7393	47.0703	47.0703	47.1762	47.0703	46.5082	46.6248	46.2690
alpha	4.0512	4.0846	4.0926	4.1160	4.1160	4.1380	4.1380	4.1451	4.1380	4.1005	4.1083	4.0846
util living area	0.9775	0.9696	0.9446	0.8798	0.7490	0.5437	0.3942	0.4177	0.6754	0.8885	0.9597	0.9806 (86)
MIT	19.8381	19.9560	20.2277	20.5665	20.8377	20.9676	20.9934	20.9919	20.9230	20.6301	20.2146	19.8266 (87)
Th 2	19.9447	19.9549	19.9574	19.9643	19.9643	19.9709	19.9709	19.9729	19.9709	19.9597	19.9621	19.9549 (88)
util rest of house	0.9717	0.9619	0.9302	0.8489	0.6880	0.4537	0.2873	0.3053	0.5847	0.8507	0.9475	0.9754 (89)
MIT 2	18.9183	19.0416	19.3071	19.6297	19.8614	19.9572	19.9694	19.9711	19.9334	19.6913	19.3023	18.9154 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1433	19.2653	19.5323	19.8588	20.1002	20.2044	20.2199	20.2208	20.1755	19.9209	19.5254	19.1383 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1433	19.2653	19.5323	19.8588	20.1002	20.2044	20.2199	20.2208	20.1755	19.9209	19.5254	19.1383 (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	0.9661	0.9555	0.9232	0.8453	0.6967	0.4748	0.3136	0.3329	0.6040	0.8491	0.9411	0.9703	(94)
Useful gains	574.3883	609.1795	638.1643	642.0830	549.5942	382.7998	237.7150	236.9204	396.2934	506.6825	538.1096	547.6094	(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	1157.4220	1130.0481	1016.3501	846.0052	618.5130	393.4127	239.0999	238.6384	423.8009	673.0291	919.7235	1136.1265	(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	433.7770	350.0238	281.3702	146.8240	51.2756	0.0000	0.0000	0.0000	0.0000	123.7619	274.7620	437.8567	(98)
Space heating												2099.6513	(98)
Space heating per m2												29.1497	(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													2327.7730	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	433.7770	350.0238	281.3702	146.8240	51.2756	0.0000	0.0000	0.0000	0.0000	123.7619	274.7620	437.8567	(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)	480.9058	388.0529	311.9404	162.7761	56.8466	0.0000	0.0000	0.0000	0.0000	137.2083	304.6142	485.4287	(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	117.9770	87.4698	63.4018	21.4603	0.0000	0.0000	0.0000	0.2733	22.5702	64.7453	97.1189	119.0605	(64)	
Efficiency of water heater	86.7905	87.0041	87.2521	88.1350	90.2000	76.2000	76.2000	76.2000	76.2000	84.8459	86.0702	86.7910	(217)	
Fuel for water heating, kWh/month	135.9332	100.5353	72.6651	24.3493	0.0000	0.0000	0.0000	0.3586	29.6196	76.3092	112.8368	137.1807	(219)	
Water heating fuel used												689.7879	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2327.7730	(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)													335.1734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1182 * 1.00) =										-567.2191			-567.2191	(233)
Total delivered energy for all uses													2910.5152	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2327.7730	7.6100	177.1435	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	689.7879	7.6100	52.4929	(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	335.1734	31.0800	104.1719	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-567.2191	31.0800	-176.2917	(252)
Total energy cost			301.3666	(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	2327.7730	0.2160	502.7990	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	689.7879	0.2160	148.9942	(264)
Space and water heating			651.7932	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	335.1734	0.5190	173.9550	(268)
Energy saving/generation technologies				
PV Unit	-567.2191	0.5190	-294.3867	(269)
Total kg/year			596.2364	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2327.7730	1.2200	2839.8831 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	689.7879	1.2200	841.5412 (264)
Space and water heating			3681.4244 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	335.1734	3.0700	1028.9822 (268)
Energy saving/generation technologies			
PV Unit	-567.2191	3.0700	-1741.3628 (269)
Primary energy kWh/year			3352.7938 (272)
Primary energy kWh/m2/year			46.5472 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 49	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 49		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.02	TER	19.63
Environmental	89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)	0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

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 49	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 49		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.02	TER	19.63
Environmental	89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)	0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

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

Wall 000001

Wall Type: Standard Wall

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

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

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m ² K	Kappa: 42.22 kJ/m ² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 49	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 49		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.02	TER	19.63
Environmental	89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)	0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

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

Floor 000003

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 49	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 49		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.02	TER	19.63
Environmental	89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)	0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

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

Floor 000004 - New exposed above Garage

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Promat Masterboard				
	Main construction	12	0.2200	0.0545	100.00
Layer 2	Celotex GA4000				
	Main construction	50	0.0220	2.2727	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Polythene, 500 gauge				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 4	Mineral wool batt				
	Main construction	290	0.0380	7.6316	98.75
	Main construction	290	50.0000	0.0058	1.25
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 9.987 m ² K/W	Lower limit = 3.144 m ² K/W	Average = 6.566 m ² K/W
	Total correction = 0.0012 m ² K/W	U-value (unrounded) = 0.15 W/m ² K	

Unheated space: None

Total thickness: 375 mm

U-value: 0.15 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 49			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C		
Property	Plot 49				
SAP Rating	87 B	DER	15.02	TER	19.63
Environmental	89 B	% DER<TER	23.49		
CO ₂ Emissions (t/year)	0.79	DFEE	46.81	TFEE	55.41
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		
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:	17.63 m	35.83 m ²	2.68 m
	1st Storey:	17.03 m	36.20 m ²	2.32 m

7.0 Living Area	17.62	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	192.64	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	86.76	73.68

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	43.50

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Stud	Plasterboard on timber frame		9.00	59.67
First Floor Stud	Plasterboard on timber frame		9.00	65.23

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	36.20	36.20

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	35.83

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	35.83
Exposed above Door	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.15	20.00	0.60

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.83

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					7.82	

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)	9.09	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	6.48	0.021	No	Knauf P5
Independently assessed	E4 Jamb	22.50	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	17.74	0.160	No	
Table K1 - Default	E20 Exposed floor (normal)	1.01	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	2.24	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	14.79	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.40	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.72	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	14.20	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.20	-0.091	No	Knauf P24
Independently assessed	E18 Party wall between dwellings	10.00	0.036	No	Knauf P25 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.72	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.72	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.72	0.035	No	Knauf P29 Halved

Y-value 0.049 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

m³/(h.m²) @ 50 Pa

Property Tested ?

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
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	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17959	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.2	
In Summer	76.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.60	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	£63	B 88	