



## SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 36

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

Report Issue Date: 08/02/2024

EXCELLENCE  
IN ENERGY  
ASSESSMENT

# PREDICTED ENERGY ASSESSMENT

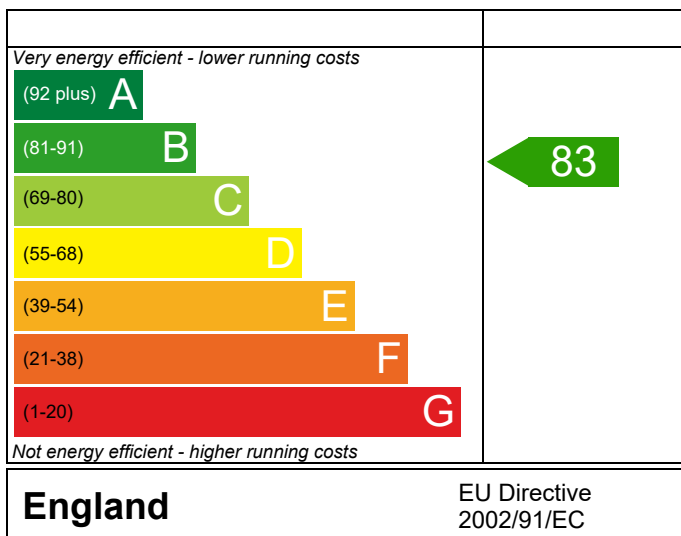
Plot 36

Dwelling type: Flat, Detached  
Date of assessment: 08/02/2024  
Produced by: Abacus Energy (UK) Ltd  
Total floor area: 61.36 m<sup>2</sup>  
DRRN: 9062-0298-4053

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.

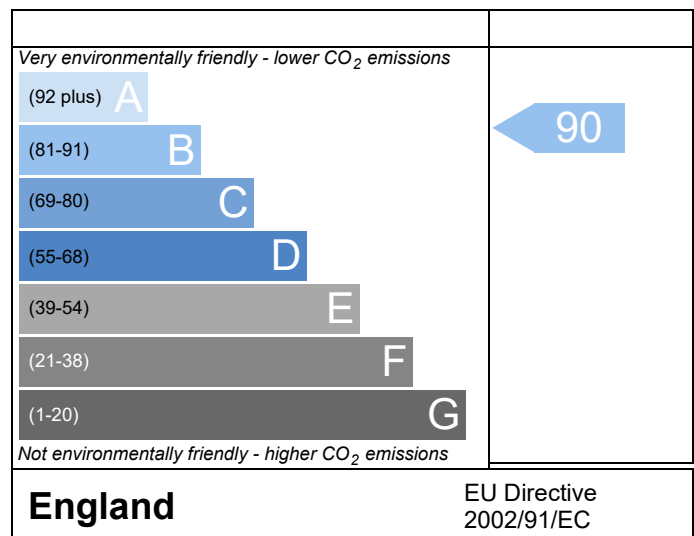
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.

## 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 (CO<sub>2</sub>) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) 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 36			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1		
Property	Plot 36				
SAP Rating	83 B	DER	15.07	TER	19.77
Environmental	90 B	% DER<TER	23.76		
CO <sub>2</sub> Emissions (t/year)	0.73	DFEE	43.05	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	16.97		
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)	19.77	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	15.07	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-4.70 (-23.8%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.84	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.05	kWh/m <sup>2</sup> /yr	
	-8.8 (-17.0%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.11 (max. 0.20)	0.17 (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 <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa	
Maximum	10.0	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 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 835 VUW 356/6-3 (H-GB)  
Combi boiler  
Efficiency: 89.3% SEDBUK2009  
Minimum: 88.0%

Pass

Secondary heating system

None

### 5 Cylinder insulation

Hot water storage

No cylinder

### 6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

### 8 Mechanical ventilation

Not applicable

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (Southern England)

Medium

Pass

Based on:

Overshading

Average

Windows facing South East

4.52 m<sup>2</sup>, No overhang

Windows facing North West

3.93 m<sup>2</sup>, 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

W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Maximum

10.0 m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Pass

### 10 Key features

Party wall U-value

0.00 W/m<sup>2</sup>K

Roof U-value

0.10 W/m<sup>2</sup>K

Door U-value

1.10 W/m<sup>2</sup>K

Photovoltaic array

418.00 kWh/Year

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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			0	0	Not applicable
Photovoltaic			0	0	Not applicable
Wind turbine			0	0	Not applicable
<b>Totals</b>	<b>£0</b>	<b>£0</b>	<b>B 83</b>	<b>B 90</b>	

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# THERMAL BRIDGING

## Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 36	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1
Property	Plot 36		
SAP Rating	83 B	DER	15.07
Environmental	90 B	TER	19.77
CO <sub>2</sub> Emissions (t/year)	0.73	% DER<TER	23.76
General Requirements Compliance	Pass	DFEE	43.05
		TFEE	51.84
		% DFEE<TFEE	16.97
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	1.01	0.04	Catnic Thermally Broken
External wall	E3 Sill	Independently assessed	0.021	8.05	0.17	Knauf P5
External wall	E4 Jamb	Independently assessed	0.014	10.44	0.15	Knauf P6
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	63.06	4.41	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	7.20	0.29	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	10.98	0.48	Knauf P21
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.010	3.08	0.03	Knauf P20
External wall	E16 Corner (normal)	Independently assessed	0.039	7.40	0.29	Knauf P23
External roof	R1 Head of roof window	Table K1 - Default	0.080	8.05	0.64	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	6.36	0.51	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	10.17	0.61	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	9.24	0.55	

Total: **8.18** W/mK:  
Y-Value: **0.061** W/m²K:

# FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	16.97		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 61 m<sup>2</sup>

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) 19.77 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 15.07 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)43.0 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

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

#### 4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from database  
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)  
Combi boiler  
Efficiency: 89.3% SEDBUK2009  
Minimum: 88.0% OK

Secondary heating system: None

#### 5 Cylinder insulation

Hot water storage No cylinder

#### 6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

Not applicable

#### 9 Summertime temperature

Overheating risk (Southern England): Medium OK  
Based on:  
Overshading: Average  
Windows facing South East: 4.52 m<sup>2</sup>, No overhang  
Windows facing North West: 3.93 m<sup>2</sup>, No overhang  
Air change rate: 4.00 ach  
Blinds/curtains: None

#### 10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K  
Roof U-value 0.10 W/m<sup>2</sup>K  
Door U-value 1.10 W/m<sup>2</sup>K  
Photovoltaic array 418.00 kWh/Year

# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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					2 * 10 = 20.0000 (7a)
Number of passive vents					1 * 10 = 10.0000 (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) = 0.2126 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4626 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4279 (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	0.5455	0.5349	0.5242	0.4707	0.4600	0.4065	0.4065	0.3958	0.4279	0.4600	0.4814	0.5028 (22b)
Effective ac	0.6488	0.6430	0.6374	0.6108	0.6058	0.5826	0.5826	0.5783	0.5915	0.6058	0.6159	0.6264 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			8.4500	1.1450	9.6756		(27)
Brick and Block	44.4900		44.4900	0.2200	9.7878	42.2200	1878.3678 (29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.2300	3.0219	113.5000	1491.3900 (29a)
Dormers	12.7400	8.4500	4.2900	0.2300	0.9867	9.0000	38.6100 (29a)
Pitched Roof	54.4600		54.4600	0.1000	5.4460	9.1000	495.5860 (30)
Sloping Ceiling	7.8300		7.8300	0.1700	1.3311	9.1000	71.2530 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5811		(33)
Party Floor 1			61.3600			70.0000	4295.2000 (32d)
Ground Floor Stud			115.6400			9.0000	1040.7600 (32c)

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 9311.1668 (34)  
151.7465 (35)  
8.1808 (36)  
(33) + (36) = 40.7618 (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	30.2166	29.9475	29.6837	28.4447	28.2128	27.1337	27.1337	26.9339	27.5494	28.2128	28.6818	29.1721 (38)
Heat transfer coeff	70.9784	70.7093	70.4455	69.2065	68.9747	67.8955	67.8955	67.6957	68.3112	68.9747	69.4436	69.9339 (39)
Average = Sum(39)m / 12 =												69.2054 (39)
HLP	1.1568	1.1524	1.1481	1.1279	1.1241	1.1065	1.1065	1.1033	1.1133	1.1241	1.1317	1.1397 (40)
HLP (average)												1.1279 (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												2.0198 (42)
Average daily hot water use (litres/day)												82.1706 (43)
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1063	17.5851	18.1463	15.8204	15.1800	13.0992	12.1383	13.9289	14.0953	16.4267	17.9310	19.4719 (46)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.5452	0.4595	0.4563	0.3822	0.3518	0.2906	0.2693	0.3228	0.3405	0.4130	0.4685	0.5280	(61)
Total heat required for water heating calculated for each month	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)
Heat gains from water heating, kWh/month	44.7054	39.0953	40.3383	35.1640	33.7370	29.1092	26.9740	30.9565	31.3297	36.5157	39.8642	43.2948	(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	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.9286	15.0358	12.2279	9.2573	6.9200	5.8421	6.3126	8.2054	11.0133	13.9839	16.3212	17.3991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.3634	178.1935	173.5817	163.7637	151.3703	139.7223	131.9406	130.1105	134.7223	144.5403	156.9337	168.5818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	(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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	(71)
Water heating gains (Table 5)	60.0878	58.1775	54.2182	48.8389	45.3454	40.4295	36.2553	41.6082	43.5134	49.0803	55.3670	58.1919	(72)
Total internal gains	309.6770	307.7040	296.3250	278.1572	259.9329	242.2911	230.8058	236.2213	245.5462	263.9017	284.9191	300.4699	(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
Southeast					4.5200	36.7938	0.6300	0.7000			0.7700	50.8259 (77)
Northwest					3.9300	11.2829	0.6300	0.7000			0.7700	13.5515 (81)
Solar gains	64.3774	114.1598	168.1545	228.3919	274.1099	280.1736	266.7689	231.4312	188.8212	129.3946	77.9290	54.5632 (83)
Total gains	374.0544	421.8638	464.4796	506.5492	534.0428	522.4647	497.5747	467.6525	434.3674	393.2962	362.8481	355.0331 (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	36.4398	36.5784	36.7154	37.3727	37.4983	38.0943	38.0943	38.2068	37.8625	37.4983	37.2451	36.9840	
alpha	3.4293	3.4386	3.4477	3.4915	3.4999	3.5396	3.5396	3.5471	3.5242	3.4999	3.4830	3.4656	
util living area	0.9868	0.9790	0.9629	0.9237	0.8430	0.7031	0.5566	0.6035	0.8096	0.9409	0.9791	0.9889	(86)
MIT	19.1909	19.3903	19.7243	20.1747	20.5724	20.8490	20.9511	20.9344	20.7317	20.2236	19.6389	19.1658	(87)
Th 2	19.9548	19.9583	19.9618	19.9781	19.9812	19.9955	19.9955	19.9982	19.9900	19.9812	19.9750	19.9685	(88)
util rest of house	0.9840	0.9746	0.9545	0.9055	0.8032	0.6267	0.4465	0.4948	0.7482	0.9232	0.9739	0.9866	(89)
MIT 2	18.3077	18.5079	18.8400	19.2902	19.6631	19.9081	19.9767	19.9708	19.8166	19.3463	18.7685	18.2931	(90)
Living area fraction	18.6034	18.8032	19.1360	19.5863	19.9675	20.2231	20.3029	20.2934	20.1229	19.6399	19.0599	18.5852	(92)
Temperature adjustment	18.6034	18.8032	19.1360	19.5863	19.9675	20.2231	20.3029	20.2934	20.1229	19.6399	19.0599	18.5852	(93)
adjusted MIT	18.6034	18.8032	19.1360	19.5863	19.9675	20.2231	20.3029	20.2934	20.1229	19.6399	19.0599	18.5852	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	366.2644	408.4175	439.5123	454.4512	428.5979	337.1794	239.7843	247.3209	328.9783	360.1887	351.1410	348.7557	(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	1015.2290	983.0879	890.1489	739.5608	570.2474	381.7811	251.4087	263.5643	411.4319	623.5271	830.5377	1006.0163	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	482.8297	386.1785	335.2736	205.2789	105.3872	0.0000	0.0000	0.0000	0.0000	195.9237	345.1657	489.0019	(98)
Space heating												2545.0392	(98)
Space heating per m <sup>2</sup>												41.4772	(99)

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2821.5512	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	482.8297	386.1785	335.2736	205.2789	105.3872	0.0000	0.0000	0.0000	0.0000	195.9237	345.1657	489.0019	(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)	535.2879	428.1358	371.7002	227.5820	116.8373	0.0000	0.0000	0.0000	0.0000	217.2103	382.6670	542.1307	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)	
Efficiency of water heater (217)m	86.7830	86.5484	86.0665	84.9779	82.8557	76.4000	76.4000	76.4000	76.4000	84.7013	86.1839	86.8968	(216)	
Fuel for water heating, kWh/month	155.0851	135.9860	141.0903	124.5634	122.5648	114.6841	106.2717	121.9663	123.4411	129.7788	139.2472	149.9950	(219)	
Water heating fuel used												1564.6737	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2821.5512	(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)													298.9637	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
Total delivered energy for all uses													4760.1886	(238)

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

	Energy kWh/year	Emission factor kg CO <sub>2</sub> /kWh	Emissions kg CO <sub>2</sub> /year	
Space heating - main system 1	2821.5512	0.2160	609.4551	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1564.6737	0.2160	337.9695	(264)
Space and water heating			947.4246	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	298.9637	0.5190	155.1622	(268)
Energy saving/generation technologies				
PV Unit	-418.0000	0.5190	-216.9420	(269)
Total CO <sub>2</sub> , kg/year			924.5698	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0700	(273)

#### 16 CO<sub>2</sub> EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			15.0700	ZC1
Total Floor Area		TFA	61.3600	
Assumed number of occupants		N	2.0198	
CO <sub>2</sub> emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO <sub>2</sub> emissions from appliances, equation (L14)			17.0321	ZC2
CO <sub>2</sub> emissions from cooking, equation (L16)			2.7294	ZC3
Total CO <sub>2</sub> emissions			34.8315	ZC4
Residual CO <sub>2</sub> emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000	ZC6
Resulting CO <sub>2</sub> emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO <sub>2</sub> emissions			34.8315	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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1417 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3917 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3623 (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	0.4620	0.4529	0.4439	0.3986	0.3895	0.3442	0.3442	0.3352	0.3623	0.3895	0.4076	0.4257 (22b)
Effective ac	0.6067	0.6026	0.5985	0.5794	0.5759	0.5592	0.5592	0.5562	0.5656	0.5759	0.5831	0.5906 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.4500	1.3258	11.2027		(27)
Brick and Block	44.4900		44.4900	0.1800	8.0082		(29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.1800	2.3652		(29a)
Dormers	12.7400	8.4500	4.2900	0.1800	0.7722		(29a)
Pitched Roof	54.4600		54.4600	0.1300	7.0798		(30)
Sloping Ceiling	7.8300		7.8300	0.1300	1.0179		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5660		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5658 (36)
Total fabric heat loss						(33) + (36) =	42.1318 (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	28.2560	28.0630	27.8738	26.9853	26.8191	26.0452	26.0452	25.9019	26.3433	26.8191	27.1554	27.5069 (38)
Heat transfer coeff	70.3877	70.1947	70.0056	69.1171	68.9508	68.1770	68.1770	68.0337	68.4751	68.9508	69.2871	69.6387 (39)
Average = Sum(39)m / 12 =												69.1163 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1471	1.1440	1.1409	1.1264	1.1237	1.1111	1.1111	1.1088	1.1160	1.1237	1.1292	1.1349 (40)
HLP (average)												1.1264 (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	2.0198 (42)
Average daily hot water use (litres/day)	82.1706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1063	17.5851	18.1463	15.8204	15.1800	13.0992	12.1383	13.9289	14.0953	16.4267	17.9310	19.4719 (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	46.0606	40.0902	42.7107	39.7120	39.3608	36.4702	37.6859	39.3608	39.7120	42.7107	42.9538	46.0606 (61)
Total heat required for water heating calculated for each month	180.1028	157.3245	163.6859	145.1812	140.5610	123.7983	118.6082	132.2203	133.6805	152.2219	162.4939	175.8733 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.1028	157.3245	163.6859	145.1812	140.5610	123.7983	118.6082	132.2203	133.6805	152.2219	162.4939	175.8733 (64)
Heat gains from water heating, kWh/month	56.0842	49.0029	50.9019	44.9965	43.4893	38.1541	36.3281	40.7160	41.1725	47.0902	50.4855	54.6779 (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	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.9286	15.0358	12.2279	9.2573	6.9200	5.8421	6.3126	8.2054	11.0133	13.9839	16.3212	17.3991 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.3634	178.1935	173.5817	163.7637	151.3703	139.7223	131.9406	130.1105	134.7223	144.5403	156.9337	168.5818 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991 (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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926 (71)
Water heating gains (Table 5)	75.3820	72.9210	68.4166	62.4951	58.4533	52.9918	48.8281	54.7258	57.1841	63.2932	70.1188	73.4918 (72)
Total internal gains	324.9712	322.4476	310.5234	291.8134	273.0408	254.8535	243.3786	249.3389	259.2169	278.1146	299.6709	315.7698 (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				
Southeast			4.5200	36.7938	0.6300	0.7000	0.7700	50.8259 (77)				
Northwest			3.9300	11.2829	0.6300	0.7000	0.7700	13.5515 (81)				
Solar gains	64.3774	114.1598	168.1545	228.3919	274.1099	280.1736	266.7689	231.4312	188.8212	129.3946	77.9290	54.5632 (83)
Total gains	389.3486	436.6073	478.6780	520.2054	547.1507	535.0271	510.1475	480.7701	448.0381	407.5092	377.6000	370.3331 (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	60.5377	60.7042	60.8682	61.6506	61.7993	62.5007	62.5007	62.6324	62.2287	61.7993	61.4993	61.1888
alpha	5.0358	5.0469	5.0579	5.1100	5.1200	5.1667	5.1667	5.1755	5.1486	5.1200	5.1000	5.0793
util living area	0.9974	0.9949	0.9881	0.9647	0.8952	0.7422	0.5718	0.6244	0.8588	0.9753	0.9949	0.9980 (86)
MIT	19.7946	19.9340	20.1689	20.4858	20.7671	20.9395	20.9873	20.9804	20.8649	20.5084	20.0975	19.7717 (87)
Th 2	19.9625	19.9651	19.9676	19.9793	19.9815	19.9918	19.9918	19.9937	19.9878	19.9815	19.9771	19.9724 (88)
util rest of house	0.9966	0.9932	0.9838	0.9509	0.8539	0.6527	0.4491	0.5009	0.7902	0.9631	0.9928	0.9973 (89)
MIT 2	18.3601	18.5650	18.9079	19.3690	19.7477	19.9503	19.9870	19.9854	19.8770	19.4085	18.8129	18.3336 (90)
Living area fraction	18.8403	19.0233	19.3300	19.7428	20.0890	20.2815	20.3218	20.3184	20.2077	19.7767	19.2429	0.3347 (91)
MIT	18.8403	19.0233	19.3300	19.7428	20.0890	20.2815	20.3218	20.3184	20.2077	19.7767	19.2429	18.8150 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8403	19.0233	19.3300	19.7428	20.0890	20.2815	20.3218	20.3184	20.2077	19.7767	19.2429	18.8150 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9952	0.9910	0.9802	0.9470	0.8589	0.6804	0.4905	0.5425	0.8072	0.9599	0.9907	0.9962 (94)
Ext temp.	387.4865	432.6848	469.2001	492.6087	469.9673	364.0116	250.2384	260.8205	361.6663	391.1552	374.0752	368.9431 (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	1023.4585	991.3793	898.1736	749.4242	578.4254	387.3453	253.7413	266.5851	418.2247	632.7393	841.3468	1017.7701 (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	473.1632	375.4427	319.1563	184.9071	80.6929	0.0000	0.0000	0.0000	0.0000	179.7386	336.4356	482.7272 (98)
Space heating per m2												2432.2635 (98)
										(98) / (4) =		39.6392 (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													2604.1365 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.1632	375.4427	319.1563	184.9071	80.6929	0.0000	0.0000	0.0000	0.0000	179.7386	336.4356	482.7272	(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)	506.5987	401.9729	341.7091	197.9734	86.3949	0.0000	0.0000	0.0000	0.0000	192.4396	360.2094	516.8386	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	180.1028	157.3245	163.6859	145.1812	140.5610	123.7983	118.6082	132.2203	133.6805	152.2219	162.4939	175.8733	(64)
Efficiency of water heater (217)m	87.3703	87.1626	86.7030	85.6612	83.7110	80.3000	80.3000	80.3000	80.3000	85.4704	86.8426	80.3000	(216)
Fuel for water heating, kWh/month	206.1374	180.4954	188.7892	169.4830	167.9122	154.1697	147.7063	164.6579	166.4764	178.0990	187.1132	201.0847	(219)
Water heating fuel used												2112.1244	(219)
Annual totals kWh/year													
Space heating fuel - main system												2604.1365	(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)												298.9637	(232)
Total delivered energy for all uses												5090.2247	(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	2604.1365	0.2160	562.4935 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2112.1244	0.2160	456.2189 (264)
Space and water heating			1018.7124 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	298.9637	0.5190	155.1622 (268)
Total CO2, kg/m2/year			1212.7995 (272)
Emissions per m2 for space and water heating			16.6022 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5287 (272b)
Emissions per m2 for pumps and fans			0.6344 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6022 * 1.00) + 2.5287 + 0.6344, rounded to 2 d.p.			19.7700 (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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (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					2 * 10 = 20.0000 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3917 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3623 (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	0.4620	0.4529	0.4439	0.3986	0.3895	0.3442	0.3442	0.3352	0.3623	0.3895	0.4076	0.4257 (22b)
Effective ac	0.6067	0.6026	0.5985	0.5794	0.5759	0.5592	0.5592	0.5562	0.5656	0.5759	0.5831	0.5906 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			8.4500	1.1450	9.6756		(27)
Brick and Block	44.4900		44.4900	0.2200	9.7878	42.2200	1878.3678 (29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.2300	3.0219	113.5000	1491.3900 (29a)
Dormers	12.7400	8.4500	4.2900	0.2300	0.9867	9.0000	38.6100 (29a)
Pitched Roof	54.4600		54.4600	0.1000	5.4460	9.1000	495.5860 (30)
Sloping Ceiling	7.8300		7.8300	0.1700	1.3311	9.1000	71.2530 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5811		(33)
Party Floor 1			61.3600			70.0000	4295.2000 (32d)
Ground Floor Stud			115.6400			9.0000	1040.7600 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9311.1668 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K		151.7465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.1808 (36)
Total fabric heat loss	(33) + (36) =	40.7618 (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	28.2560	28.0630	27.8738	26.9853	26.8191	26.0452	26.0452	25.9019	26.3433	26.8191	27.1554	27.5069 (38)
Heat transfer coeff	69.0178	68.8248	68.6356	67.7471	67.5809	66.8070	66.8070	66.6637	67.1051	67.5809	67.9172	68.2688 (39)
Average = Sum(39)m / 12 =												67.7463 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1248	1.1217	1.1186	1.1041	1.1014	1.0888	1.0888	1.0864	1.0936	1.1014	1.1069	1.1126 (40)
HLP (average)												1.1041 (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												2.0198 (42)
Average daily hot water use (litres/day)												82.1706 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (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)

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## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	28.4840	24.9123	25.7072	22.4122	21.5050	18.5572	17.1960	19.7326	19.9683	23.2711	25.4023	27.5852	(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	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.9286	15.0358	12.2279	9.2573	6.9200	5.8421	6.3126	8.2054	11.0133	13.9839	16.3212	17.3991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.3634	178.1935	173.5817	163.7637	151.3703	139.7223	131.9406	130.1105	134.7223	144.5403	156.9337	168.5818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	(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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	(71)
Water heating gains (Table 5)	38.2849	37.0718	34.5527	31.1280	28.9046	25.7739	23.1129	26.5224	27.7338	31.2784	35.2809	37.0769	(72)
Total internal gains	284.8741	283.5983	273.6596	257.4463	240.4921	224.6355	214.6634	218.1355	226.7666	243.0998	261.8331	276.3550	(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	
Southeast				4.5200	36.7938		0.6300		0.7000	0.7700	50.8259	
Northwest				3.9300	11.2829		0.6300		0.7000	0.7700	13.5515	
<hr/>												
Solar gains	64.3774	114.1598	168.1545	228.3919	274.1099	280.1736	266.7689	231.4312	188.8212	129.3946	77.9290	54.5632
Total gains	349.2515	397.7581	441.8141	485.8383	514.6020	504.8091	481.4323	449.5667	415.5878	372.4943	339.7621	330.9182
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#### 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	37.4749	37.5800	37.6836	38.1778	38.2717	38.7150	38.7150	38.7982	38.5430	38.2717	38.0822	37.8861		
alpha	3.4983	3.5053	3.5122	3.5452	3.5514	3.5810	3.5810	3.5865	3.5695	3.5514	3.5388	3.5257		
util living area	0.9893	0.9822	0.9671	0.9297	0.8509	0.7128	0.5652	0.6156	0.8213	0.9478	0.9826	0.9911	(86)	
MIT	19.1959	19.3950	19.7283	20.1727	20.5712	20.8471	20.9507	20.9325	20.7257	20.2132	19.6295	19.1634	(87)	
Th 2	19.9806	19.9832	19.9857	19.9975	19.9997	20.0100	20.0100	20.0119	20.0060	19.9997	19.9952	19.9906	(88)	
util rest of house	0.9870	0.9783	0.9596	0.9128	0.8126	0.6375	0.4555	0.5075	0.7623	0.9319	0.9782	0.9892	(89)	
MIT 2	18.3320	18.5313	18.8626	19.3044	19.6786	19.9206	19.9908	19.9834	19.8268	19.3516	18.7746	18.3071	(90)	
Living area fraction														
MIT	18.6212	18.8204	19.1524	19.5951	19.9774	20.2308	20.3121	20.3011	20.1277	19.6400	19.0608	18.5937	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6212	18.8204	19.1524	19.5951	19.9774	20.2308	20.3121	20.3011	20.1277	19.6400	19.0608	18.5937	(93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	343.2631	386.8752	420.5896	439.4959	417.6685	330.9982	236.2544	243.3085	320.1956	344.4617	330.5442	326.1536	(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	988.4144	958.0717	868.4033	724.5590	559.3958	376.1744	247.9964	260.0622	404.4870	610.9329	812.3438	982.6434	(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	479.9926	383.8440	333.1734	205.2455	105.4451	0.0000	0.0000	0.0000	0.0000	198.2545	346.8957	488.4284	(98)
Space heating												2541.2792	(98)
Space heating per m2												41.4159	(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	627.9863	494.3722	506.6445	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8040	0.8686	0.8435	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	504.9237	429.3935	427.3424	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	665.9306	637.1636	601.2696	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)

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## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	115.9250	154.5809	129.4019	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												399.9078 (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	28.9812	38.6452	32.3505	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												99.9769 (107)
Space cooling per m2												1.6294 (108)
Energy for space heating												41.4159 (99)
Energy for space cooling												1.6294 (108)
Total												43.0452 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.0 (109)

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# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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				2 * 10 =	20.0000 (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) =				Air changes per hour
Pressure test					20.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3917 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3623 (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	0.4620	0.4529	0.4439	0.3986	0.3895	0.3442	0.3442	0.3352	0.3623	0.3895	0.4076	0.4257 (22b)
Effective ac	0.6067	0.6026	0.5985	0.5794	0.5759	0.5592	0.5592	0.5562	0.5656	0.5759	0.5831	0.5906 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.4500	1.3258	11.2027		(27)
Brick and Block	44.4900		44.4900	0.1800	8.0082		(29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.1800	2.3652		(29a)
Dormers	12.7400	8.4500	4.2900	0.1800	0.7722		(29a)
Pitched Roof	54.4600		54.4600	0.1300	7.0798		(30)
Sloping Ceiling	7.8300		7.8300	0.1300	1.0179		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5660		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5658 (36)
Total fabric heat loss						(33) + (36) =	42.1318 (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	28.2560	28.0630	27.8738	26.9853	26.8191	26.0452	26.0452	25.9019	26.3433	26.8191	27.1554	27.5069 (38)
Heat transfer coeff	70.3877	70.1947	70.0056	69.1171	68.9508	68.1770	68.1770	68.0337	68.4751	68.9508	69.2871	69.6387 (39)
Average = Sum(39)m / 12 =												69.1163 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1471	1.1440	1.1409	1.1264	1.1237	1.1111	1.1111	1.1088	1.1160	1.1237	1.1292	1.1349 (40)
HLP (average)												1.1264 (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	2.0198 (42)
Average daily hot water use (litres/day)	82.1706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (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)

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### 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	28.4840	24.9123	25.7072	22.4122	21.5050	18.5572	17.1960	19.7326	19.9683	23.2711	25.4023	27.5852 (65)
-----												
5. Internal gains (see Table 5 and 5a)												
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Metabolic gains (Table 5), Watts												
(66)m	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907	100.9907 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.9286	15.0358	12.2279	9.2573	6.9200	5.8421	6.3126	8.2054	11.0133	13.9839	16.3212	17.3991 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.3634	178.1935	173.5817	163.7637	151.3703	139.7223	131.9406	130.1105	134.7223	144.5403	156.9337	168.5818 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991	33.0991 (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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926 (71)
Water heating gains (Table 5)	38.2849	37.0718	34.5527	31.1280	28.9046	25.7739	23.1129	26.5224	27.7338	31.2784	35.2809	37.0769 (72)
Total internal gains	284.8741	283.5983	273.6596	257.4463	240.4921	224.6355	214.6634	218.1355	226.7666	243.0998	261.8331	276.3550 (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	
Southeast			4.5200		36.7938		0.6300		0.7000		0.7700	50.8259 (77)
Northwest			3.9300		11.2829		0.6300		0.7000		0.7700	13.5515 (81)
-----												
Solar gains	64.3774	114.1598	168.1545	228.3919	274.1099	280.1736	266.7689	231.4312	188.8212	129.3946	77.9290	54.5632 (83)
Total gains	349.2515	397.7581	441.8141	485.8383	514.6020	504.8091	481.4323	449.5667	415.5878	372.4943	339.7621	330.9182 (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	60.5377	60.7042	60.8682	61.6506	61.7993	62.5007	62.5007	62.6324	62.2287	61.7993	61.4993	61.1888
alpha	5.0358	5.0469	5.0579	5.1100	5.1200	5.1667	5.1667	5.1755	5.1486	5.1200	5.1000	5.0793
util living area	0.9984	0.9967	0.9915	0.9729	0.9135	0.7713	0.6015	0.6598	0.8860	0.9829	0.9968	0.9988 (86)
MIT	19.7339	19.8758	20.1154	20.4410	20.7367	20.9276	20.9840	20.9748	20.8394	20.4602	20.0407	19.7117 (87)
Th 2	19.9625	19.9651	19.9676	19.9793	19.9815	19.9918	19.9918	19.9937	19.9878	19.9815	19.9771	19.9724 (88)
util rest of house	0.9979	0.9955	0.9884	0.9619	0.8768	0.6834	0.4746	0.5330	0.8244	0.9740	0.9955	0.9984 (89)
MIT 2	18.8080	18.9515	19.1916	19.5206	19.7973	19.9569	19.9875	19.9862	19.8946	19.5446	19.1259	18.7937 (90)
Living area fraction									fLA = Living area / (4) =			0.3347 (91)
MIT	19.1179	19.2609	19.5009	19.8287	20.1118	20.2819	20.3211	20.3171	20.2108	19.8511	19.4321	19.1010 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1179	19.2609	19.5009	19.8287	20.1118	20.2819	20.3211	20.3171	20.2108	19.8511	19.4321	19.1010 (93)
-----												
8. Space heating requirement												
-----												
Utilisation	0.9973	0.9944	0.9865	0.9599	0.8823	0.7109	0.5177	0.5760	0.8402	0.9725	0.9945	0.9979 (94)
Useful gains	348.3099	395.5452	435.8620	466.3462	454.0230	358.8590	249.2255	258.9497	349.1815	362.2470	337.9000	330.2385 (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	1043.0003	1008.0574	910.1320	755.3579	579.9980	387.3714	253.6937	266.4950	418.4404	637.8734	854.4574	1037.6877 (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	516.8497	411.6082	352.8569	208.0884	93.7254	0.0000	0.0000	0.0000	0.0000	205.0660	371.9213	526.3421 (98)
Space heating												2686.4580 (98)
Space heating per m2										(98) / (4) =		43.7819 (99)
-----												
8c. Space cooling requirement												
-----												
Calculated for June, July and August. See Table 10b												
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	640.8636	504.5097	517.0559	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8535	0.9183	0.8942	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	546.9608	463.2976	462.3420	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	665.9306	637.1636	601.2696	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	85.6582	129.3563	103.3622	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												318.3766 (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	21.4145	32.3391	25.8405	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												79.5942 (107)
Space cooling per m2												1.2972 (108)
Energy for space heating												43.7819 (99)
Energy for space cooling												1.2972 (108)
Total												45.0791 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (109)

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# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					1 * 10 = 10.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.2126 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4626 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4279 (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	0.5455	0.5028	0.4921	0.4600	0.4600	0.4279	0.4279	0.4172	0.4279	0.4814	0.4707	0.5028 (22b)
Effective ac	0.6488	0.6264	0.6211	0.6058	0.6058	0.5915	0.5915	0.5870	0.5915	0.6159	0.6108	0.6264 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			8.4500	1.1450	9.6756		(27)
Brick and Block	44.4900		44.4900	0.2200	9.7878	42.2200	1878.3678 (29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.2300	3.0219	113.5000	1491.3900 (29a)
Dormers	12.7400	8.4500	4.2900	0.2300	0.9867	9.0000	38.6100 (29a)
Pitched Roof	54.4600		54.4600	0.1000	5.4460	9.1000	495.5860 (30)
Sloping Ceiling	7.8300		7.8300	0.1700	1.3311	9.1000	71.2530 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5811		(33)
Party Floor 1			61.3600			70.0000	4295.2000 (32d)
Ground Floor Stud			115.6400			9.0000	1040.7600 (32c)

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 9311.1668 (34)  
151.7465 (35)  
8.1808 (36)  
(33) + (36) = 40.7618 (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	30.2166	29.1721	28.9243	28.2128	28.2128	27.5494	27.5494	27.3389	27.5494	28.6818	28.4447	29.1721 (38)
Heat transfer coeff	70.9784	69.9339	69.6861	68.9747	68.9747	68.3112	68.3112	68.1007	68.3112	69.4436	69.2065	69.9339 (39)
Average = Sum(39)m / 12 =												69.1805 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1568	1.1397	1.1357	1.1241	1.1241	1.1133	1.1133	1.1099	1.1133	1.1317	1.1279	1.1397 (40)
HLP (average)												1.1275 (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												2.0198 (42)
Average daily hot water use (litres/day)												82.1706 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1063	17.5851	18.1463	15.8204	15.1800	13.0992	12.1383	13.9289	14.0953	16.4267	17.9310	19.4719 (46)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.5452	0.4595	0.4563	0.3822	0.3518	0.2906	0.2693	0.3228	0.3405	0.4130	0.4685	0.5280	(61)
Total heat required for water heating calculated for each month	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)
RHI water heating demand	44.7054	39.0953	40.3383	35.1640	33.7370	29.1092	26.9740	30.9565	31.3297	36.5157	39.8642	43.2948	(65)
Heat gains from water heating, kWh/month													
	44.7054	39.0953	40.3383	35.1640	33.7370	29.1092	26.9740	30.9565	31.3297	36.5157	39.8642	43.2948	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.3214	37.5895	30.5698	23.1433	17.2999	14.6053	15.7816	20.5135	27.5331	34.9596	40.8031	43.4977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	263.2289	265.9604	259.0772	244.4235	225.9259	208.5407	196.9263	194.1948	201.0781	215.7318	234.2294	251.6146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	(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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	(71)
Water heating gains (Table 5)	60.0878	58.1775	54.2182	48.8389	45.3454	40.4295	36.2553	41.6082	43.5134	49.0803	55.3670	58.1919	(72)
Total internal gains	458.1732	454.2624	436.4002	408.9407	381.1062	356.1105	341.4982	348.8514	364.6596	392.3067	422.9344	445.8391	(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			
Southeast				4.5200	46.3896	0.6300	0.7000	0.7700	64.0812			
Northwest				3.9300	15.0428	0.6300	0.7000	0.7700	18.0673			
Solar gains	82.1486	124.8718	183.9777	256.0906	294.7468	326.4449	303.2375	267.9191	219.6282	149.9794	98.6084	66.4383
Total gains	540.3218	579.1342	620.3779	665.0314	675.8530	682.5554	644.7357	616.7706	584.2878	542.2862	521.5428	512.2774

#### 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	36.4398	36.9840	37.1155	37.4983	37.4983	37.8625	37.8625	37.9796	37.8625	37.2451	37.3727	36.9840		
Feb	3.4293	3.4656	3.4744	3.4999	3.4999	3.5242	3.5242	3.5320	3.5242	3.4830	3.4915	3.4656		
util living area	0.9544	0.9416	0.9084	0.8379	0.7145	0.5259	0.3831	0.3981	0.6264	0.8359	0.9258	0.9593	(86)	
MIT	19.6887	19.8318	20.1281	20.4878	20.7843	20.9472	20.9871	20.9856	20.9016	20.5859	20.1309	19.6807	(87)	
Th 2	19.9548	19.9685	19.9718	19.9812	19.9812	19.9900	19.9900	19.9928	19.9900	19.9750	19.9781	19.9685	(88)	
util rest of house	0.9452	0.9302	0.8901	0.8056	0.6576	0.4429	0.2826	0.2944	0.5435	0.7944	0.9088	0.9510	(89)	
MIT 2	18.7970	18.9462	19.2344	19.5781	19.8366	19.9647	19.9865	19.9888	19.9378	19.6695	19.2471	18.8003	(90)	
Living area fraction	0.9452	0.9302	0.8901	0.8056	0.6576	0.4429	0.2826	0.2944	0.5435	0.7944	0.9088	0.9510	(91)	
MIT	19.0955	19.2426	19.5336	19.8826	20.1538	20.2936	20.3214	20.3225	20.2604	19.9763	19.5429	19.0950	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0955	19.2426	19.5336	19.8826	20.1538	20.2936	20.3214	20.3225	20.2604	19.9763	19.5429	19.0950	(93)	

#### 8. Space heating requirement

Utilisation	0.9360	0.9205	0.8811	0.8021	0.6679	0.4687	0.3162	0.3291	0.5670	0.7944	0.9001	0.9423	(94)	
Useful gains	505.7266	533.0996	546.5974	533.4226	451.4217	319.9368	203.8480	202.9689	331.2904	430.8124	469.4638	482.6970	(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	972.0838	947.0902	852.5098	709.2407	521.0228	334.2877	206.3967	205.8318	359.3441	567.7885	771.1628	950.7538	(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	346.9698	278.2017	227.5988	126.5891	51.7832	0.0000	0.0000	0.0000	0.0000	101.9102	217.2233	348.2342	(98)	
Space heating												1698.5102	(98)	
RHI space heating demand												1699	(98)	

# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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					2 * 10 = 20.0000 (7a)
Number of passive vents					1 * 10 = 10.0000 (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) = 0.2126 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4626 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4279 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5455	0.5349	0.5242	0.4707	0.4600	0.4065	0.4065	0.3958	0.4279	0.4600	0.4814	0.5028 (22b)
Effective ac	0.6488	0.6430	0.6374	0.6108	0.6058	0.5826	0.5826	0.5783	0.5915	0.6058	0.6159	0.6264 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			8.4500	1.1450	9.6756		(27)
Brick and Block	44.4900		44.4900	0.2200	9.7878	42.2200	1878.3678 (29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.2300	3.0219	113.5000	1491.3900 (29a)
Dormers	12.7400	8.4500	4.2900	0.2300	0.9867	9.0000	38.6100 (29a)
Pitched Roof	54.4600		54.4600	0.1000	5.4460	9.1000	495.5860 (30)
Sloping Ceiling	7.8300		7.8300	0.1700	1.3311	9.1000	71.2530 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5811		(33)
Party Floor 1			61.3600			70.0000	4295.2000 (32d)
Ground Floor Stud			115.6400			9.0000	1040.7600 (32c)

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 9311.1668 (34)  
151.7465 (35)  
8.1808 (36)  
(33) + (36) = 40.7618 (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	30.2166	29.9475	29.6837	28.4447	28.2128	27.1337	27.1337	26.9339	27.5494	28.2128	28.6818	29.1721 (38)
Heat transfer coeff	70.9784	70.7093	70.4455	69.2065	68.9747	67.8955	67.8955	67.6957	68.3112	68.9747	69.4436	69.9339 (39)
Average = Sum(39)m / 12 =												69.2054 (39)
HLP	1.1568	1.1524	1.1481	1.1279	1.1241	1.1065	1.1065	1.1033	1.1133	1.1241	1.1317	1.1397 (40)
HLP (average)												1.1279 (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												2.0198 (42)
Average daily hot water use (litres/day)												82.1706 (43)
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1063	17.5851	18.1463	15.8204	15.1800	13.0992	12.1383	13.9289	14.0953	16.4267	17.9310	19.4719 (46)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.5452	0.4595	0.4563	0.3822	0.3518	0.2906	0.2693	0.3228	0.3405	0.4130	0.4685	0.5280	(61)
Total heat required for water heating calculated for each month	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)
Heat gains from water heating, kWh/month	44.7054	39.0953	40.3383	35.1640	33.7370	29.1092	26.9740	30.9565	31.3297	36.5157	39.8642	43.2948	(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	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.3214	37.5895	30.5698	23.1433	17.2999	14.6053	15.7816	20.5135	27.5331	34.9596	40.8031	43.4977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	263.2289	265.9604	259.0772	244.4235	225.9259	208.5407	196.9263	194.1948	201.0781	215.7318	234.2294	251.6146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	(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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	(71)
Water heating gains (Table 5)	60.0878	58.1775	54.2182	48.8389	45.3454	40.4295	36.2553	41.6082	43.5134	49.0803	55.3670	58.1919	(72)
Total internal gains	458.1732	454.2624	436.4002	408.9407	381.1062	356.1105	341.4982	348.8514	364.6596	392.3067	422.9344	445.8391	(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		
Southeast				4.5200	36.7938		0.6300	0.7000	0.7700	50.8259 (77)		
Northwest				3.9300	11.2829		0.6300	0.7000	0.7700	13.5515 (81)		
Solar gains	64.3774	114.1598	168.1545	228.3919	274.1099	280.1736	266.7689	231.4312	188.8212	129.3946	77.9290	54.5632 (83)
Total gains	522.5506	568.4222	604.5547	637.3327	655.2160	636.2841	608.2671	580.2826	553.4809	521.7013	500.8634	500.4023 (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	36.4398	36.5784	36.7154	37.3727	37.4983	38.0943	38.0943	38.2068	37.8625	37.4983	37.2451	36.9840	
alpha	3.4293	3.4386	3.4477	3.4915	3.4999	3.5396	3.5396	3.5471	3.5242	3.4999	3.4830	3.4656	
util living area	0.9654	0.9518	0.9259	0.8697	0.7695	0.6147	0.4701	0.5076	0.7127	0.8825	0.9483	0.9695	(86)
MIT	19.4908	19.6744	19.9743	20.3676	20.6930	20.9025	20.9713	20.9621	20.8276	20.4255	19.9061	19.4643	(87)
Th 2	19.9548	19.9583	19.9618	19.9781	19.9812	19.9955	19.9955	19.9982	19.9900	19.9812	19.9750	19.9685	(88)
util rest of house	0.9587	0.9426	0.9112	0.8431	0.7217	0.5381	0.3713	0.4083	0.6425	0.8531	0.9369	0.9636	(89)
MIT 2	18.6023	18.7845	19.0789	19.4658	19.7613	19.9417	19.9850	19.9833	19.8852	19.5295	19.0271	18.5868	(90)
Living area fraction	18.8997	19.0824	19.3786	19.7677	20.0732	20.2633	20.3152	20.3109	20.2006	19.8295	19.3213	18.8806	(92)
Temperature adjustment	18.8997	19.0824	19.3786	19.7677	20.0732	20.2633	20.3152	20.3109	20.2006	19.8295	19.3213	18.8806	(93)
adjusted MIT	18.8997	19.0824	19.3786	19.7677	20.0732	20.2633	20.3152	20.3109	20.2006	19.8295	19.3213	18.8806	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	496.5401	530.4048	544.9980	533.3520	475.9269	356.0321	245.5730	255.5949	364.3569	442.4070	464.7637	478.2537	(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	1036.2643	1002.8255	907.2391	752.1151	577.5392	384.5128	252.2436	264.7532	416.7423	636.5999	848.6915	1026.6688	(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	401.5548	317.4667	269.5074	157.5094	75.5996	0.0000	0.0000	0.0000	0.0000	144.4795	276.4280	408.0208	(98)
Space heating												2050.5663	(98)
Space heating per m <sup>2</sup>												33.4186	(99)

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2273.3551 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	401.5548	317.4667	269.5074	157.5094	75.5996	0.0000	0.0000	0.0000	0.0000	144.4795	276.4280	408.0208	(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)	445.1827	351.9587	298.7887	174.6224	83.8133	0.0000	0.0000	0.0000	0.0000	160.1769	306.4612	452.3513	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)
Efficiency of water heater (217)m	86.2875	85.9987	85.4081	84.0948	81.7366	76.4000	76.4000	76.4000	76.4000	83.6698	85.5236	86.4207	(217)
Fuel for water heating, kWh/month	155.9757	136.8552	142.1780	125.8714	124.2429	114.6841	106.2717	121.9663	123.4411	131.3786	140.3222	150.8212	(219)
Water heating fuel used												1574.0084	(219)
Annual totals kWh/year													
Space heating fuel - main system												2273.3551	(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)												298.9637	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4221.3273	(238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2273.3551	3.4800	79.1128 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1574.0084	3.4800	54.7755 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	298.9637	13.1900	39.4333 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			303.2141 (255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1973 (257)
SAP value	83.2970
SAP rating (Section 12)	83 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2273.3551	0.2160	491.0447 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1574.0084	0.2160	339.9858 (264)
Space and water heating			831.0305 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	298.9637	0.5190	155.1622 (268)
Energy saving/generation technologies			
PV Unit	-418.0000	0.5190	-216.9420 (269)
Total kg/year			808.1757 (272)
CO2 emissions per m2			13.1700 (273)
EI value			89.8180
EI rating			90 (274)
EI band			B

#### Calculation of stars for heating and DHW

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	$3.48 / 0.8206 = 4.241$ , stars = 4
Water heating environmental impact	$0.216 / 0.8206 = 0.2632$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	61.3600 (1b)	x 2.3000 (2b)	= 141.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1280 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					1 * 10 = 10.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.2126 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4626 (18)
					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.4279 (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	0.5455	0.5028	0.4921	0.4600	0.4600	0.4279	0.4279	0.4172	0.4279	0.4814	0.4707	0.5028 (22b)
Effective ac	0.6488	0.6264	0.6211	0.6058	0.6058	0.5915	0.5915	0.5870	0.5915	0.6159	0.6108	0.6264 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			8.4500	1.1450	9.6756		(27)
Brick and Block	44.4900		44.4900	0.2200	9.7878	42.2200	1878.3678 (29a)
Wall to Corridor	15.2600	2.1200	13.1400	0.2300	3.0219	113.5000	1491.3900 (29a)
Dormers	12.7400	8.4500	4.2900	0.2300	0.9867	9.0000	38.6100 (29a)
Pitched Roof	54.4600		54.4600	0.1000	5.4460	9.1000	495.5860 (30)
Sloping Ceiling	7.8300		7.8300	0.1700	1.3311	9.1000	71.2530 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			134.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5811		(33)
Party Floor 1			61.3600			70.0000	4295.2000 (32d)
Ground Floor Stud			115.6400			9.0000	1040.7600 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9311.1668 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							151.7465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1808 (36)
Total fabric heat loss							(33) + (36) = 40.7618 (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	30.2166	29.1721	28.9243	28.2128	28.2128	27.5494	27.5494	27.3389	27.5494	28.6818	28.4447	29.1721 (38)
Heat transfer coeff	70.9784	69.9339	69.6861	68.9747	68.9747	68.3112	68.3112	68.1007	68.3112	69.4436	69.2065	69.9339 (39)
Average = Sum(39)m / 12 =												69.1805 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1568	1.1397	1.1357	1.1241	1.1241	1.1133	1.1133	1.1099	1.1133	1.1317	1.1279	1.1397 (40)
HLP (average)												1.1275 (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												2.0198 (42)
Average daily hot water use (litres/day)												82.1706 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.3877	87.1008	83.8140	80.5272	77.2404	73.9535	73.9535	77.2404	80.5272	83.8140	87.1008	90.3877 (44)
Energy conte	134.0423	117.2342	120.9752	105.4691	101.2001	87.3280	80.9223	92.8595	93.9685	109.5112	119.5401	129.8128 (45)
Energy content (annual)										Total = Sum(45)m =		1292.8634 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1063	17.5851	18.1463	15.8204	15.1800	13.0992	12.1383	13.9289	14.0953	16.4267	17.9310	19.4719 (46)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.5452	0.4595	0.4563	0.3822	0.3518	0.2906	0.2693	0.3228	0.3405	0.4130	0.4685	0.5280	(61)
Total heat required for water heating calculated for each month	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)
Heat gains from water heating, kWh/month	44.7054	39.0953	40.3383	35.1640	33.7370	29.1092	26.9740	30.9565	31.3297	36.5157	39.8642	43.2948	(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	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	121.1889	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.3214	37.5895	30.5698	23.1433	17.2999	14.6053	15.7816	20.5135	27.5331	34.9596	40.8031	43.4977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	263.2289	265.9604	259.0772	244.4235	225.9259	208.5407	196.9263	194.1948	201.0781	215.7318	234.2294	251.6146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	49.1387	(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)	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	-80.7926	(71)
Water heating gains (Table 5)	60.0878	58.1775	54.2182	48.8389	45.3454	40.4295	36.2553	41.6082	43.5134	49.0803	55.3670	58.1919	(72)
Total internal gains	458.1732	454.2624	436.4002	408.9407	381.1062	356.1105	341.4982	348.8514	364.6596	392.3067	422.9344	445.8391	(73)

#### 6. Solar gains

[Jan]			Area m <sup>2</sup>			Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Southeast			4.5200			46.3896	0.6300	0.7000			0.7700			64.0812 (77)
Northwest			3.9300			15.0428	0.6300	0.7000			0.7700			18.0673 (81)
Solar gains	82.1486	124.8718	183.9777	256.0906	294.7468	326.4449	303.2375	267.9191	219.6282	149.9794	98.6084	66.4383	(83)	
Total gains	540.3218	579.1342	620.3779	665.0314	675.8530	682.5554	644.7357	616.7706	584.2878	542.2862	521.5428	512.2774	(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	36.4398	36.9840	37.1155	37.4983	37.4983	37.8625	37.8625	37.9796	37.8625	37.2451	37.3727	36.9840		
alpha	3.4293	3.4656	3.4744	3.4999	3.4999	3.5242	3.5242	3.5320	3.5242	3.4830	3.4915	3.4656		
util living area	0.9544	0.9416	0.9084	0.8379	0.7145	0.5259	0.3831	0.3981	0.6264	0.8359	0.9258	0.9593	(86)	
MIT	19.6887	19.8318	20.1281	20.4878	20.7843	20.9472	20.9871	20.9856	20.9016	20.5859	20.1309	19.6807	(87)	
Th 2	19.9548	19.9685	19.9718	19.9812	19.9812	19.9900	19.9900	19.9928	19.9900	19.9750	19.9781	19.9685	(88)	
util rest of house	0.9452	0.9302	0.8901	0.8056	0.6576	0.4429	0.2826	0.2944	0.5435	0.7944	0.9088	0.9510	(89)	
MIT 2	18.7970	18.9462	19.2344	19.5781	19.8366	19.9647	19.9865	19.9888	19.9378	19.6695	19.2471	18.8003	(90)	
Living area fraction	19.0955	19.2426	19.5336	19.8826	20.1538	20.2936	20.3214	20.3225	20.2604	19.9763	19.5429	19.0950	(92)	
Temperature adjustment	19.0955	19.2426	19.5336	19.8826	20.1538	20.2936	20.3214	20.3225	20.2604	19.9763	19.5429	19.0950	(92)	
adjusted MIT	19.0955	19.2426	19.5336	19.8826	20.1538	20.2936	20.3214	20.3225	20.2604	19.9763	19.5429	19.0950	(93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	505.7266	533.0996	546.5974	533.4226	451.4217	319.9368	203.8480	202.9689	331.2904	430.8124	469.4638	482.6970	(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	972.0838	947.0902	852.5098	709.2407	521.0228	334.2877	206.3967	205.8318	359.3441	567.7885	771.1628	950.7538	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	346.9698	278.2017	227.5988	126.5891	51.7832	0.0000	0.0000	0.0000	0.0000	101.9102	217.2233	348.2342	(98)
Space heating												1698.5102	(98)
Space heating per m <sup>2</sup>												27.6811	(99)

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1883.0490 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	346.9698	278.2017	227.5988	126.5891	51.7832	0.0000	0.0000	0.0000	0.0000	101.9102	217.2233	348.2342	(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)	384.6672	308.4276	252.3268	140.3426	57.4093	0.0000	0.0000	0.0000	0.0000	112.9825	240.8240	386.0690	(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	134.5875	117.6937	121.4315	105.8513	101.5519	87.6186	81.1916	93.1822	94.3090	109.9243	120.0086	130.3408	(64)
Efficiency of water heater (217)m	85.8653	85.6033	84.8668	83.3444	80.5625	76.4000	76.4000	76.4000	76.4000	82.4700	84.7522	85.9707	(216)
Fuel for water heating, kWh/month	156.7426	137.4874	143.0849	127.0048	126.0536	114.6841	106.2717	121.9663	123.4411	133.2900	141.5994	151.6107	(219)
Water heating fuel used												1583.2365	(219)
Annual totals kWh/year													
Space heating fuel - main system												1883.0490	(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)													298.9637 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3840.2492 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1883.0490	7.6100	143.3000 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1583.2365	7.6100	120.4843 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	298.9637	31.0800	92.9179 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	31.0800	0.0000 (252)
Total energy cost			485.0123 (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	1883.0490	0.2160	406.7386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1583.2365	0.2160	341.9791 (264)
Space and water heating			748.7177 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	298.9637	0.5190	155.1622 (268)
Energy saving/generation technologies			
PV Unit	-418.0000	0.5190	-216.9420 (269)
Total kg/year			725.8628 (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	1883.0490	1.2200	2297.3198 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1583.2365	1.2200	1931.5485 (264)
Space and water heating			4228.8683 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	298.9637	3.0700	917.8187 (268)
Energy saving/generation technologies			
PV Unit	-418.0000	3.0700	-1283.2600 (269)
Primary energy kWh/year			4093.6770 (272)
Primary energy kWh/m2/year			66.7157 (273)

#### SAP 2012 EPC IMPROVEMENTS

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 83  
Current environmental impact rating: B 90

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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  
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0		0.00 kg/m²

Potential energy efficiency rating: B 83  
Potential environmental impact rating: B 90

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	£116	£116	£0
Mains gas	£369	£369	£0
Space heating	£272	£272	£0
Water heating	£120	£120	£0
Lighting	£93	£93	£0
Total cost of fuels	£485	£485	£0
Total cost of uses	£485	£485	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	67 kWh/m²	67 kWh/m²	0 kWh/m²

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014  
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No improvements selected / applicable

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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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  
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No improvements selected / applicable

# U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 36	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1
Project	Plot 36		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	15.07	TER	19.77
Environmental	90 B	% DER<TER	23.76		
CO <sub>2</sub> Emissions (t/year)	0.73	DFEE	43.05	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	16.97		

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 000006 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)	Density (kg/m <sup>3</sup> )	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	<b>Mineral wool batt</b>						
	Main construction	350	0.0380	9.2105	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	<b>Mineral wool batt</b>						
	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	<b>Plasterboard, standard</b>						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.772 m<sup>2</sup> K/W Lower limit = 11.430 m<sup>2</sup> K/W Average = 11.601 m<sup>2</sup> K/W  
Total correction = 0.0096 m<sup>2</sup> K/W U-value (unrounded) = 0.1 W/m<sup>2</sup> K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m<sup>2</sup> K

Kappa: 9.10 kJ/m<sup>2</sup> K

# U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 36	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1
Project	Plot 36		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	15.07	TER	19.77
Environmental	90 B	% DER<TER	23.76		
CO <sub>2</sub> Emissions (t/year)	0.73	DFEE	43.05	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	16.97		

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

### Roof 000007 - Insulation between and below

#### Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)	Density (kg/m <sup>3</sup> )	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	<b>Tiling</b>						
	Main construction	30	1.5000	0.0200	100.00		
Layer 2	<b>airspace/timber battens</b>						
	Main construction	25	0.2500	0.1000	91.59		
	Main construction	25	0.1563	0.1600	8.41		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	<b>Breather membrane</b>						
	Main construction	1	0.0000	0.0000	100.00		
Layer 4	<b>Standard cavity</b>						
	Main construction	50	0.2948	0.1696	87.50		
	Main construction	50	0.1300	0.3846	12.50		
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)						
Layer 5	<b>Celotex GA4000</b>						
	Main construction	100	0.0220	4.5455	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	<b>Celotex GA4000</b>						
	Main construction	50	0.0220	2.2727	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 7	<b>Plasterboard, standard</b>						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 6.480 m <sup>2</sup> K/W	Lower limit = 5.595 m <sup>2</sup> K/W	Average = 6.037 m <sup>2</sup> K/W
	Total correction = 0.0036 m <sup>2</sup> K/W	U-value (unrounded) = 0.17 W/m <sup>2</sup> K	

Unheated space: None

Total thickness: 269 mm

U-value: 0.17 W/m<sup>2</sup> K

Kappa: 9.10 kJ/m<sup>2</sup> K

# U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 36	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1
Project	Plot 36		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	15.07	TER	19.77
Environmental	90 B	% DER<TER	23.76		
CO <sub>2</sub> Emissions (t/year)	0.73	DFEE	43.05	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	16.97		

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 <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)	Density (kg/m <sup>3</sup> )	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	<b>Brick, outer leaf</b>						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	<b>Supafil 34</b>						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	<b>Supabloc</b>						
	Main construction	140	0.1100	1.2727	94.04	460	1000
	Main construction	140	0.8803	0.1590	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	<b>airspace/plaster dabs</b>						
	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	<b>Plasterboard, standard</b>						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.657 m <sup>2</sup> K/W	Lower limit = 4.366 m <sup>2</sup> K/W	Average = 4.511 m <sup>2</sup> K/W
	Total correction = 0.0004 m <sup>2</sup> K/W	U-value (unrounded) = 0.22 W/m <sup>2</sup> K	

Unheated space: None		
Total thickness: 370 mm	U-value: 0.22 W/m² K	Kappa: 42.22 kJ/m² K

# U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 36	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1
Project	Plot 36		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	15.07	TER	19.77
Environmental	90 B	% DER<TER	23.76		
CO <sub>2</sub> Emissions (t/year)	0.73	DFEE	43.05	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	16.97		

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 Wall to Corridor

#### Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)	Density (kg/m <sup>3</sup> )	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	<b>Plasterboard, standard</b>						
	Main construction	12.5	0.2100	0.0595	100.00		
Layer 2	<b>airspace/plaster dabs</b>						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	<b>Masterblock Masterlite Pro</b>						
	Main construction	100	0.5700	0.1754	100.00	1450	1000
Layer 4	<b>Supafil 40</b>						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	<b>Masterblock Masterlite Pro</b>						
	Main construction	100	0.5700	0.1754	100.00	1450	1000
Layer 6	<b>airspace/plaster dabs</b>						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	<b>Plasterboard, standard</b>						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 3.480 m <sup>2</sup> K/W	Lower limit = 3.480 m <sup>2</sup> K/W	Average = 3.480 m <sup>2</sup> K/W
	Total correction = 0.0052 m <sup>2</sup> K/W	U-value (unrounded) = 0.29 W/m <sup>2</sup> K	

Unheated space: None

Total thickness: 355 mm

U-value: 0.29 W/m<sup>2</sup> K

Kappa: 113.50 kJ/m<sup>2</sup> K

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 36			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev1		
Property	Plot 36				
SAP Rating	83 B	DER	15.07	TER	19.77
Environmental	90 B	% DER<TER	23.76		
CO <sub>2</sub> Emissions (t/year)	0.73	DFEE	43.05	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	16.97		
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	Flat, Detached
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements				
	Ground Floor:	Heat Loss Perimeter 31.53 m	Internal Floor Area 61.36 m <sup>2</sup>	Average Storey Height 2.30 m

7.0 Living Area	20.54	m <sup>2</sup>
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	151.75	kJ/m <sup>2</sup> K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
Brick and Block	Cavity Wall	Other	0.22	42.22	44.49	44.49
Wall to Corridor	Cavity Wall	Other	0.29	113.50	15.26	13.14
Dormers	Timber Frame	Timber framed wall (one layer of plasterboard)	0.23	9.00	12.74	4.29

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
		Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill		110.00	

9.2 Internal Walls					
Description		Construction		Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Ground Floor Stud		Plasterboard on timber frame		9.00	115.64

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
Pitched Roof	External Plane Roof	Other	0.10	9.10	54.46	54.46
Sloping Ceiling	External Slope Roof	Other	0.17	9.10	7.83	7.83

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

### 11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete plank floor (screed laid on rubber), carpeted	70.00	61.36

### 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	[2] Wall to Corridor	South West							2.12	
Windows	Window	[3] Dormers	North West	None	0.00					3.93	
North Elevation	Window	[3] Dormers	South East	None	0.00					4.52	

### 14.0 Conservatory

None

### 15.0 Draught Proofing

100

%

### 16.0 Draught Lobby

Yes

### 17.0 Thermal Bridging

Calculate Bridges

### 17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	8.05	0.021	No	Knauf P5
Independently assessed	E4 Jamb	10.44	0.014	No	Knauf P6
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	63.06	0.070	No	
Table K1 - Approved	E11 Eaves (insulation at rafter level)	7.20	0.040	No	
Independently assessed	E12 Gable (insulation at ceiling level)	10.98	0.044	No	Knauf P21
Independently assessed	E13 Gable (insulation at rafter level)	3.08	0.010	No	Knauf P20
Independently assessed	E16 Corner (normal)	7.40	0.039	No	Knauf P23
Table K1 - Default	R1 Head of roof window	8.05	0.080	No	
Table K1 - Default	R3 Jamb of roof window	6.36	0.080	No	
Table K1 - Default	R6 Flat ceiling	10.17	0.060	No	
Table K1 - Default	R8 Roof to wall (rafter)	9.24	0.060	No	

Y-value 0.061 W/m²K

### 18.0 Pressure Testing

Yes

Designed AP<sub>50</sub> 5.00 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP<sub>50</sub> m³/(h.m²) @ 50 Pa

### 19.0 Mechanical Ventilation

#### Summer Overheating

Windows open in hot weather Windows half open

Cross ventilation possible Yes

Night Ventilation Yes

Air change rate 4.00

#### Mechanical Ventilation

Mechanical Ventilation System Present No

### 20.0 Fans, Open Fireplaces, Flues

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				1
Number of flueless gas fires				0

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**21.0 Fixed Cooling System**

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**22.0 Lighting**

**Internal**

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings  %

**External**

External lights fitted

Light and motion sensor

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**23.0 Electricity Tariff**

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**24.0 Main Heating 1**

Description

Percentage of Heat  %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heat Emitter

Flow Temperature

Combi boiler type

Combi keep hot type

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**25.0 Main Heating 2**

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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

## SUMMARY FOR INPUT DATA

### Calculation Type: New Build (As Designed)

Waste Water Heat Recovery Storage System	<input type="text" value="No"/>	
Solar Panel	<input type="text" value="No"/>	
Water use <= 125 litres/person/day	<input type="text" value="Yes"/>	
SAP Code	<input type="text" value="901"/>	
<hr/>		
29.0 Hot Water Cylinder	<input type="text" value="None"/>	
<hr/>		
32.0 Photovoltaic Unit	<input type="text" value="More Dwellings, One Block"/>	
Apportioned	<input type="text" value="418.00"/>	kWh/Year

#### Recommendations

##### Lower cost measures

None

##### Further measures to achieve even higher standards

None

# BLOCK COMPLIANCE

## Calculation Type: New Build (As Designed)

Block Reference	SAP 0931 EV1	Issued on Date	08/02/2024
Block Name	Block Ev1		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID E477-0001
Client	Foreman Homes, FORE		

### Block Compliance Report - DER

Block Reference: SAP 0931 EV1		Block Name: Block Ev1			
Property-Assessment Reference	Multiplier	Floor Area (m <sup>2</sup> )	DER (kgCO <sub>2</sub> /m <sup>2</sup> )	TER (kgCO <sub>2</sub> /m <sup>2</sup> )	% DER/TER
SAP 0931 Plot 31-Rev B	1	61.4	16.69	20.60	18.98 %
SAP 0931 Plot 32-Rev B	1	61.36	16.21	20.36	20.40 %
SAP 0931 Plot 35-Rev B	1	61.4	15.14	19.66	23.00 %
SAP 0931 Plot 36-Rev B	1	61.36	15.07	19.77	23.76 %
SAP 0931 Plot 33-Rev B	1	61.4	13.93	18.04	22.80 %
SAP 0931 Plot 34-Rev B	1	61.36	15.24	17.89	14.80 %
Totals:	6	368.28	92.28	116.32	
Average DER = 15.38 kgCO <sub>2</sub> /m <sup>2</sup>		% DER/TER	PASS		
Average TER = 19.39 kgCO <sub>2</sub> /m <sup>2</sup>		20.68 %			

### Block Compliance Report - DFEE

Block Reference: SAP 0931 EV1		Block Name: Block Ev1			
Property-Assessment Reference	Multiplier	Floor Area (m <sup>2</sup> )	DFEE (kWh/m <sup>2</sup> /yr)	TFEE (kWh/m <sup>2</sup> /yr)	% DFEE/TFEE
SAP 0931 Plot 31-Rev B	1	61.4	49.89	56.54	11.76 %
SAP 0931 Plot 32-Rev B	1	61.36	47.85	55.48	13.75 %
SAP 0931 Plot 35-Rev B	1	61.4	43.79	51.58	15.11 %
SAP 0931 Plot 36-Rev B	1	61.36	43.05	51.84	16.97 %
SAP 0931 Plot 33-Rev B	1	61.4	38.67	43.34	10.78 %
SAP 0931 Plot 34-Rev B	1	61.36	37.36	42.70	12.49 %
Totals:	6	368.28	260.61	301.49	
Average DFEE = 43.44 kWh/m <sup>2</sup> /yr		% DFEE/TFEE	PASS		
Average TFEE = 50.25 kWh/m <sup>2</sup> /yr		13.55 %			