



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 71

Contact: Tobias Whiting
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Report Issue Date: 28/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

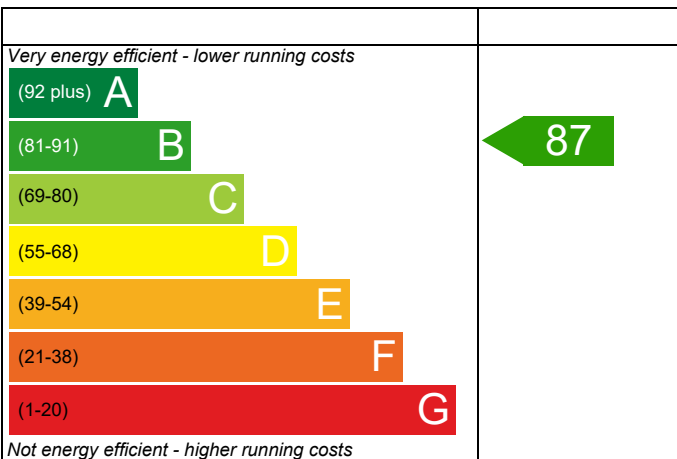
Plot 71

Dwelling type: House, Semi-Detached
 Date of assessment: 28/03/2023
 Produced by: Abacus Energy (UK) Ltd
 Total floor area: 71.04 m²
 DRRN: 0524-8742-2076

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

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

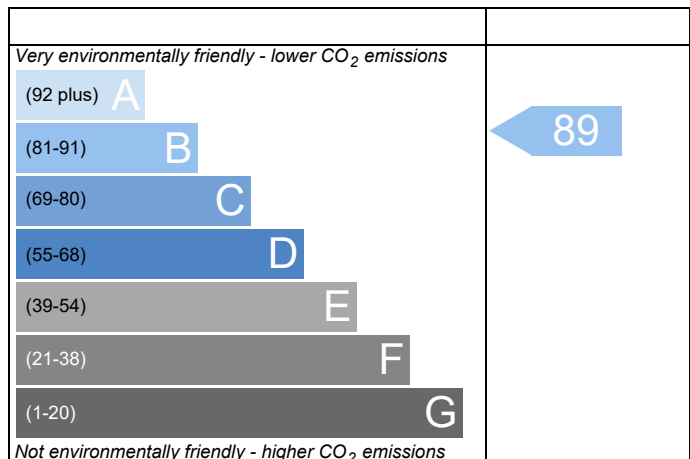
Energy Efficiency Rating



England EU Directive 2002/91/EC

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

Environmental Impact (CO₂) Rating



England EU Directive 2002/91/EC

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

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



BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 71	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)
Property	Plot 71		

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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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)	19.28	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.08	kgCO ₂ /m ²	Pass
	-4.20 (-21.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.95	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.08	kWh/m ² /yr	
	-1.8 (-3.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

6.60 m², No overhang

Windows facing South West

3.49 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.85

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£77	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£77	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 71	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)
Property	Plot 71		

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.110	0.46	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.910	5.46	4.97	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.02	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	5.92	0.12	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.32	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Default	0.320	16.80	5.38	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.80	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.10	0.55	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	7.79	0.34	Knauf P21
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	7.79	0.34	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.60	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	9.40	0.56	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	7.79	1.25	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	7.79	0.00	

Total: **14.54** W/mK:
 Y-Value: **0.094** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 71			Issued on Date	28/03/2023
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Property	Plot 71				
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Environmental	89 B	% DER<TER	21.77		
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Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 71 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.28 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.08 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 51.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Worcester Greenstar 32CDi Compact ErP

Combi boiler

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North East: 6.60 m², No overhang

Windows facing South West: 3.49 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Photovoltaic array 0.85 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3561 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m ²)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			18.0000	639.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12811.2544 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.3386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss						(33) + (36) =	53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	35.1096	34.8797	33.7998	33.5978	32.6573	32.6573	32.4831	33.0196	33.5978	34.0065	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	88.6545	88.4246	87.3448	87.1427	86.2022	86.2022	86.0281	86.5645	87.1427	87.5515	87.9787 (39)
HLP	1.2513	1.2480	1.2447	1.2295	1.2267	1.2134	1.2134	1.2110	1.2185	1.2267	1.2324	1.2384 (40)
HLP (average)												1.2295 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	25.2901	22.8200	25.2287	24.3739	25.1566	24.3107	25.0997	25.1366	24.3452	25.1989	24.4335	25.2783	(61)
Total heat required for water heating calculated for each month	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(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)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)
Total per year (kWh/year) = Sum(64)m =												1683.4385 (64)	
Heat gains from water heating, kWh/month	54.1287	47.5166	49.4530	43.7091	42.3822	37.2232	35.1358	39.4025	39.6002	45.3569	48.7424	52.6173	(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	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0413	16.9123	13.7540	10.4127	7.7836	6.5712	7.1005	9.2294	12.3877	15.7291	18.3582	19.5705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.7121	201.7845	196.5621	185.4444	171.4102	158.2200	149.4082	147.3358	152.5582	163.6759	177.7101	190.9002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	72.7537	70.7092	66.4691	60.7070	56.9653	51.6989	47.2256	52.9603	55.0002	60.9636	67.6977	70.7222	(72)
Total internal gains	351.5736	349.4726	336.8518	316.6306	296.2257	276.5568	263.8009	269.5922	280.0127	300.4352	323.8326	341.2595	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m ²	Table 6a	Specific data	Specific data	factor	W							
		W/m ²	or Table 6b	or Table 6c	Table 6d								
Northeast	6.6000	11.2829	0.6300	0.7000	0.7700	22.7582 (75)							
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439 (79)							
Solar gains	62.0021	113.1719	174.9257	250.3970	311.1846	322.4466	305.2498	257.8336	200.7358	130.4929	75.6409	52.1701	(83)
Total gains	413.5757	462.6445	511.7776	567.0276	607.4103	599.0034	569.0506	527.4258	480.7485	430.9281	399.4735	393.4296	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0351	40.1410	40.2454	40.7429	40.8374	41.2829	41.2829	41.3665	41.1102	40.8374	40.6467	40.4493	
alpha	3.6690	3.6761	3.6830	3.7162	3.7225	3.7522	3.7522	3.7578	3.7407	3.7225	3.7098	3.6966	
util living area	0.9933	0.9892	0.9793	0.9516	0.8849	0.7559	0.6098	0.6649	0.8652	0.9660	0.9892	0.9945	(86)
MIT	19.2217	19.3927	19.7045	20.1389	20.5454	20.8348	20.9460	20.9247	20.6974	20.1838	19.6329	19.1947	(87)
Th 2	19.8792	19.8818	19.8844	19.8965	19.8987	19.9093	19.9093	19.9112	19.9052	19.8987	19.8941	19.8894	(88)
util rest of house	0.9916	0.9864	0.9736	0.9370	0.8471	0.6730	0.4818	0.5403	0.8062	0.9530	0.9859	0.9931	(89)
MIT 2	18.2648	18.4367	18.7477	19.1820	19.5657	19.8182	19.8908	19.8826	19.7134	19.2330	18.6859	18.2454	(90)
Living area fraction												fLA = Living area / (4) = 0.2500 (91)	
MIT	18.5040	18.6757	18.9869	19.4213	19.8106	20.0723	20.1546	20.1432	19.9594	19.4707	18.9227	18.4827	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5040	18.6757	18.9869	19.4213	19.8106	20.0723	20.1546	20.1432	19.9594	19.4707	18.9227	18.4827	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9887	0.9823	0.9675	0.9291	0.8435	0.6869	0.5128	0.5694	0.8097	0.9463	0.9818	0.9906	(94)
Useful gains	408.9178	454.4518	495.1537	526.8031	512.3439	411.4532	291.7807	300.3015	389.2455	407.8050	392.2179	389.7200	(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	1262.5828	1221.2752	1104.1505	918.9764	706.7799	471.7281	306.4127	322.0160	507.2128	773.0210	1035.0926	1256.5767	(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	635.1268	515.3053	453.0936	282.3648	144.6604	0.0000	0.0000	0.0000	0.0000	271.7207	462.8698	644.9414	(98)
Space heating												3410.0828 (98)	
Space heating per m ²												(98) / (4) = 48.0023 (99)	

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3759.7385 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	635.1268	515.3053	453.0936	282.3648	144.6604	0.0000	0.0000	0.0000	0.0000	271.7207	462.8698	644.9414	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	700.2500	568.1425	499.5520	311.3173	159.4933	0.0000	0.0000	0.0000	0.0000	299.5818	510.3305	711.0710	(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	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)
Efficiency of water heater (217)m	89.9411	89.8925	89.7815	89.5232	88.9845	87.2000	87.2000	87.2000	87.2000	89.4637	89.8060	87.2000	(216)
Fuel for water heating, kWh/month	187.9766	165.2741	172.6309	153.5953	150.2589	135.2999	128.3251	143.0511	143.5078	159.4659	169.9842	182.8685	(219)
Water heating fuel used													1892.2382 (219)
Annual totals kWh/year													
Space heating fuel - main system													3759.7385 (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)													336.2752 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1029 * 1.00) =													-699.8470 (233)
Total delivered energy for all uses													5363.4049 (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	3759.7385	0.2160	812.1035 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1892.2382	0.2160	408.7234 (264)
Space and water heating			1220.8270 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.2752	0.5190	174.5268 (268)
Energy saving/generation technologies			
PV Unit	-699.8470	0.5190	-363.2206 (269)
Total CO2, kg/year			1071.0582 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0800 (273)

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

DER			15.0800 ZC1
Total Floor Area		TFA	71.0400
Assumed number of occupants		N	2.2711
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6589 ZC2
CO2 emissions from cooking, equation (L16)			2.4424 ZC3
Total CO2 emissions			34.1813 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			34.1813 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1689 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.4189 (18)							
Number of sides sheltered				2	(19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3561 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			10.0900	1.3258	13.3769		(27)					
Ground Floor			35.5200	0.1300	4.6176		(28a)					
Brick and Block	81.6600	12.2400	69.4200	0.1800	12.4956		(29a)					
Stepped Party Wall	2.3400		2.3400	0.1800	0.4212		(29a)					
External Roof 1	35.5200		35.5200	0.1300	4.6176		(30)					
Total net area of external elements Aum(A, m ²)			155.0400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		37.6789 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2485 (36)					
Total fabric heat loss							(33) + (36) = 45.9274 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.3441	Feb 35.1096	Mar 34.8797	Apr 33.7998	May 33.5978	Jun 32.6573	Jul 32.6573	Aug 32.4831	Sep 33.0196	Oct 33.5978	Nov 34.0065	Dec 34.4338 (38)
Heat transfer coeff	81.2715	81.0370	80.8071	79.7272	79.5252	78.5847	78.5847	78.4105	78.9470	79.5252	79.9339	80.3612 (39)
Average = Sum(39)m / 12 =												79.7263 (39)
HLP	Jan 1.1440	Feb 1.1407	Mar 1.1375	Apr 1.1223	May 1.1194	Jun 1.1062	Jul 1.1062	Aug 1.1038	Sep 1.1113	Oct 1.1194	Nov 1.1252	Dec 1.1312 (40)
HLP (average)												1.1223 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)
Energy content (annual)												Total = Sum(45)m = 1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	49.4060	43.0021	45.8128	42.5964	42.2197	39.1191	40.4231	42.2197	42.5964	45.8128	46.0736	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	49.4060	(61)
Total heat required for water heating calculated for each month	193.1840	168.7512	175.5747	155.7259	150.7702	132.7899	127.2229	141.8237	143.3900	163.2781	174.2961	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	(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	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	193.1840	168.7512	175.5747	155.7259	150.7702	132.7899	127.2229	141.8237	143.3900	163.2781	174.2961	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	188.6473	(64)
Heat gains from water heating, kWh/month	60.1577	52.5621	54.5990	48.2647	46.6480	40.9253	38.9667	43.6733	44.1630	50.5104	54.1524	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	58.6492	(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	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0413	16.9123	13.7540	10.4127	7.7836	6.5712	7.1005	9.2294	12.3877	15.7291	18.3582	19.5705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.7121	201.7845	196.5621	185.4444	171.4102	158.2200	149.4082	147.3358	152.5582	163.6759	177.7101	190.9002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	80.8571	78.2174	73.3858	67.0343	62.6989	56.8407	52.3746	58.7006	61.3375	67.8903	75.2116	78.8296	(72)
Total internal gains	359.6771	356.9808	343.7685	322.9579	301.9592	281.6986	268.9499	275.3325	286.3500	307.3619	331.3465	349.3670	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	6.6000	11.2829	0.6300	0.7000	0.7700	22.7582
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439
Solar gains	62.0021	113.1719	174.9257	250.3970	311.1846	322.4466
Total gains	421.6792	470.1527	518.6943	573.3548	613.1439	604.1452

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	60.7019	60.8776	61.0508	61.8776	62.0348	62.7773	62.7773	62.9167	62.4892	62.0348	61.7177	61.3895		
alpha	5.0468	5.0585	5.0701	5.1252	5.1357	5.1852	5.1852	5.1944	5.1659	5.1357	5.1145	5.0926		
util living area	0.9981	0.9963	0.9910	0.9706	0.9045	0.7530	0.5841	0.6450	0.8808	0.9817	0.9963	0.9985	(86)	
MIT	19.7608	19.8926	20.1285	20.4576	20.7541	20.9360	20.9862	20.9776	20.8460	20.4719	20.0629	19.7409	(87)	
Th 2	19.9650	19.9677	19.9703	19.9827	19.9850	19.9958	19.9958	19.9978	19.9916	19.9850	19.9803	19.9754	(88)	
util rest of house	0.9975	0.9951	0.9877	0.9588	0.8656	0.6643	0.4600	0.5198	0.8179	0.9722	0.9947	0.9980	(89)	
MIT 2	18.3125	18.5068	18.8521	19.3330	19.7355	19.9514	19.9905	19.9881	19.8615	19.3606	18.7652	18.2909	(90)	
Living area fraction									fLA = Living area / (4) =			0.2500	(91)	
MIT	18.6746	18.8533	19.1712	19.6141	19.9901	20.1976	20.2394	20.2355	20.1076	19.6385	19.0896	18.6534	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6746	18.8533	19.1712	19.6141	19.9901	20.1976	20.2394	20.2355	20.1076	19.6385	19.0896	18.6534	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9963	0.9931	0.9840	0.9533	0.8658	0.6837	0.4913	0.5511	0.8265	0.9678	0.9928	0.9971	(94)	
Useful gains	420.1017	466.8940	510.4202	546.5946	530.8582	413.0342	282.0810	293.8438	402.5550	423.7606	404.0399	400.3595	(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	1168.2452	1130.7293	1023.9223	854.2083	659.2730	439.8851	286.0016	300.7399	474.2810	718.7854	958.3761	1161.4955	(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	556.6188	446.0973	382.0455	221.4819	95.5406	0.0000	0.0000	0.0000	0.0000	219.4985	399.1221	566.2852	(98)	
Space heating												2886.6898	(98)	
Space heating per m2												(98) / (4) =	40.6347	(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												3090.6744 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	556.6188	446.0973	382.0455	221.4819	95.5406	0.0000	0.0000	0.0000	0.0000	219.4985	399.1221	566.2852 (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)	595.9516	477.6203	409.0423	237.1327	102.2918	0.0000	0.0000	0.0000	0.0000	235.0091	427.3256	606.3010 (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	193.1840	168.7512	175.5747	155.7259	150.7702	132.7899	127.2229	141.8237	143.3900	163.2781	174.2961	188.6473 (64)
Efficiency of water heater (217)m	87.5624	87.3834	86.9563	85.9376	83.9376	80.3000	80.3000	80.3000	80.3000	85.7968	87.0711	80.3000 (216)
Fuel for water heating, kWh/month	220.6243	193.1158	201.9115	181.2081	179.6217	165.3673	158.4345	176.6173	178.5679	190.3079	200.1767	215.2396 (219)
Water heating fuel used												2261.1926 (219)
Annual totals kWh/year												
Space heating fuel - main system												3090.6744 (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)												336.2752 (232)
Total delivered energy for all uses												5763.1421 (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	3090.6744	0.2160	667.5857 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2261.1926	0.2160	488.4176 (264)
Space and water heating			1156.0033 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.2752	0.5190	174.5268 (268)
Total CO2, kg/m2/year			1369.4551 (272)
Emissions per m2 for space and water heating			16.2726 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4567 (272b)
Emissions per m2 for pumps and fans			0.5479 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2726 * 1.00) + 2.4567 + 0.5479, rounded to 2 d.p.			19.2800 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3561 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m2)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			9.0000	319.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12491.5744 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							175.8386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss						(33) + (36) =	53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	35.1096	34.8797	33.7998	33.5978	32.6573	32.6573	32.4831	33.0196	33.5978	34.0065	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	88.6545	88.4246	87.3448	87.1427	86.2022	86.2022	86.0281	86.5645	87.1427	87.5515	87.9787 (39)
												87.3438 (39)
HLP	1.2513	1.2480	1.2447	1.2295	1.2267	1.2134	1.2134	1.2110	1.2185	1.2267	1.2324	1.2384 (40)
HLP (average)												1.2295 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1386.7662 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	30.5528	26.7217	27.5744	24.0400	23.0670	19.9050	18.4450	21.1659	21.4186	24.9614	27.2473	29.5888	65							

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	19.0413	16.9123	13.7540	10.4127	7.7836	6.5712	7.1005	9.2294	12.3877	15.7291	18.3582	19.5705	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	199.7121	201.7845	196.5621	185.4444	171.4102	158.2200	149.4082	147.3358	152.5582	163.6759	177.7101	190.9002	(68)
Pumps, fans	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Total internal gains	41.0656	39.7644	37.0624	33.3889	31.0040	27.6459	24.7916	28.4487	29.7481	33.5502	37.8434	39.7699	(72)
	316.8856	315.5278	304.4451	286.3126	267.2644	249.5038	238.3669	242.0806	251.7606	270.0218	290.9783	307.3072	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	6.6000	11.2829	0.6300	0.7000	0.7700	22.7582 (75)							
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439 (79)							
Solar gains	62.0021	113.1719	174.9257	250.3970	311.1846	322.4466	305.2498	257.8336	200.7358	130.4929	75.6409	52.1701	(83)
Total gains	378.8877	428.6997	479.3708	536.7095	578.4490	571.9504	543.6166	499.9142	452.4964	400.5147	366.6192	359.4773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	39.0361	39.1394	39.2411	39.7263	39.8184	40.2528	40.2528	40.3343	40.0843	39.8184	39.6325	39.4400	
util living area	3.6024	3.6093	3.6161	3.6484	3.6546	3.6835	3.6835	3.6890	3.6723	3.6546	3.6422	3.6293	
	0.9945	0.9909	0.9820	0.9566	0.8946	0.7721	0.6290	0.6870	0.8797	0.9711	0.9911	0.9955	(86)
MIT	19.1321	19.3080	19.6295	20.0789	20.5031	20.8127	20.9364	20.9110	20.6614	20.1226	19.5542	19.1053	(87)
Th 2	19.8792	19.8818	19.8844	19.8965	19.8987	19.9093	19.9093	19.9112	19.9052	19.8987	19.8941	19.8894	(88)
util rest of house	0.9932	0.9885	0.9770	0.9434	0.8594	0.6916	0.5004	0.5631	0.8251	0.9600	0.9884	0.9944	(89)
MIT 2	18.1785	18.3554	18.6765	19.1267	19.5301	19.8036	19.8867	19.8762	19.6857	19.1765	18.6106	18.1593	(90)
Living area fraction	18.4169	18.5936	18.9148	19.3648	19.7734	20.0559	20.1491	20.1349	19.9296	19.4130	18.8465	18.3958	(91)
Temperature adjustment	18.4169	18.5936	18.9148	19.3648	19.7734	20.0559	20.1491	20.1349	19.9296	19.4130	18.8465	18.3958	(92)
adjusted MIT	18.4169	18.5936	18.9148	19.3648	19.7734	20.0559	20.1491	20.1349	19.9296	19.4130	18.8465	18.3958	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9906	0.9848	0.9712	0.9354	0.8546	0.7038	0.5310	0.5913	0.8266	0.9534	0.9848	0.9922	(94)
Ext temp.	375.3344	422.1694	465.5732	502.0302	494.3477	402.5597	288.6781	295.5929	374.0381	381.8632	361.0618	356.6807	(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	1254.8351	1213.9968	1097.7703	914.0424	703.5340	470.3100	305.9441	321.3050	504.6405	767.9897	1028.4248	1248.9262	(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	(98)
Space heating per m2	654.3485	532.1080	470.3546	296.6488	155.6346	0.0000	0.0000	0.0000	0.0000	287.2781	480.5014	663.8307	(98)
												3540.7047 (98)	
												49.8410 (99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	810.3011	637.8966	653.8134	0.0000	0.0000	0.0000	0.0000	(100)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.7570	0.8307	0.7957	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.3868	529.8844	520.2618	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	753.4289	718.6454	669.1104	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	100.8303	140.4382	110.7433	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												352.0118 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.2076	35.1095	27.6858	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												88.0030 (107)
Space cooling per m2												1.2388 (108)
Energy for space heating												49.8410 (99)
Energy for space cooling												1.2388 (108)
Total												51.0798 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1689 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.4189 (18)							
Number of sides sheltered				2	(19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3561 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			10.0900	1.3258	13.3769		(27)					
Ground Floor			35.5200	0.1300	4.6176		(28a)					
Brick and Block	81.6600	12.2400	69.4200	0.1800	12.4956		(29a)					
Stepped Party Wall	2.3400		2.3400	0.1800	0.4212		(29a)					
External Roof 1	35.5200		35.5200	0.1300	4.6176		(30)					
Total net area of external elements Aum(A, m ²)			155.0400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		37.6789 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2485 (36)					
Total fabric heat loss							(33) + (36) = 45.9274 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.3441	Feb 35.1096	Mar 34.8797	Apr 33.7998	May 33.5978	Jun 32.6573	Jul 32.6573	Aug 32.4831	Sep 33.0196	Oct 33.5978	Nov 34.0065	Dec 34.4338 (38)
Heat transfer coeff	81.2715	81.0370	80.8071	79.7272	79.5252	78.5847	78.5847	78.4105	78.9470	79.5252	79.9339	80.3612 (39)
Average = Sum(39)m / 12 =												79.7263 (39)
HLP	Jan 1.1440	Feb 1.1407	Mar 1.1375	Apr 1.1223	May 1.1194	Jun 1.1062	Jul 1.1062	Aug 1.1038	Sep 1.1113	Oct 1.1194	Nov 1.1252	Dec 1.1312 (40)
HLP (average)												1.1223 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)
Energy content (annual)												Total = Sum(45)m = 1386.7662 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.5528	26.7217	27.5744	24.0400	23.0670	19.9050	18.4450	21.1659	21.4186	24.9614	27.2473	29.5888	29.5888	29.5888	29.5888	29.5888	29.5888	(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	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	113.5553	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0413	16.9123	13.7540	10.4127	7.7836	6.5712	7.1005	9.2294	12.3877	15.7291	18.3582	19.5705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.7121	201.7845	196.5621	185.4444	171.4102	158.2200	149.4082	147.3358	152.5582	163.6759	177.7101	190.9002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	34.3555	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	41.0656	39.7644	37.0624	33.3889	31.0040	27.6459	24.7916	28.4487	29.7481	33.5502	37.8434	39.7699	(72)
Total internal gains	316.8856	315.5278	304.4451	286.3126	267.2644	249.5038	238.3669	242.0806	251.7606	270.0218	290.9783	307.3072	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	6.6000	11.2829	0.6300	0.7000	0.7700	22.7582 (75)							
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439 (79)							
Solar gains	62.0021	113.1719	174.9257	250.3970	311.1846	322.4466	305.2498	257.8336	200.7358	130.4929	75.6409	52.1701	(83)
Total gains	378.8877	428.6997	479.3708	536.7095	578.4490	571.9504	543.6166	499.9142	452.4964	400.5147	366.6192	359.4773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	60.7019	60.8776	61.0508	61.8776	62.0348	62.7773	62.7773	62.9167	62.4892	62.0348	61.7177	61.3895	21.0000 (85)
tau	5.0468	5.0585	5.0701	5.1252	5.1357	5.1852	5.1852	5.1944	5.1659	5.1357	5.1145	5.0926	
alpha	0.9988	0.9976	0.9936	0.9774	0.9208	0.7800	0.6125	0.6790	0.9047	0.9874	0.9977	0.9991	(86)
util living area	0.9988	0.9976	0.9936	0.9774	0.9208	0.7800	0.6125	0.6790	0.9047	0.9874	0.9977	0.9991	(86)
MIT	19.7046	19.8386	20.0786	20.4152	20.7249	20.9243	20.9829	20.9717	20.8198	20.4262	20.0102	19.6855	(87)
Th 2	19.9650	19.9677	19.9703	19.9827	19.9850	19.9958	19.9958	19.9978	19.9916	19.9850	19.9803	19.9754	(88)
util rest of house	0.9984	0.9967	0.9912	0.9680	0.8863	0.6932	0.4846	0.5513	0.8491	0.9806	0.9967	0.9988	(89)
MIT 2	18.7808	18.9166	19.1576	19.4989	19.7906	19.9590	19.9912	19.9891	19.8839	19.5149	19.0983	18.7700	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	19.0117	19.1471	19.3879	19.7280	20.0242	20.2004	20.2391	20.2348	20.1179	19.7427	19.3263	18.9989	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.0117	19.1471	19.3879	19.7280	20.0242	20.2004	20.2391	20.2348	20.1179	19.7427	19.3263	18.9989	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9958	0.9893	0.9650	0.8879	0.7127	0.5170	0.5836	0.8575	0.9784	0.9958	0.9984	(94)
Useful gains	378.1032	426.9000	474.2616	517.9185	513.5886	407.6038	281.0375	291.7579	388.0258	391.8770	365.0942	358.9104	(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	1195.6456	1154.5416	1041.4302	863.2868	661.9832	440.1020	285.9790	300.6861	475.0929	727.0789	977.2941	1189.2566	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	608.2516	488.9752	421.9734	248.6652	110.4056	0.0000	0.0000	0.0000	0.0000	249.3902	440.7840	617.7775	(98)
Space heating	3186.2226 (98)												
Space heating per m2	(98) / (4) = 44.8511 (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	738.6961	581.5267	595.9200	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8465	0.9128	0.8830	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	625.2950	530.8208	526.1796	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	753.4289	718.6454	669.1104	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	92.2564	139.7415	106.3405	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling	338.3384 (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	23.0641	34.9354	26.5851	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											84.5846 (107)	
Space cooling per m2											1.1907 (108)	
Energy for space heating											44.8511 (99)	
Energy for space cooling											1.1907 (108)	
Total											46.0418 (109)	
Target Fabric Energy Efficiency (TFEE)											52.9 (109)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3561 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 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	0.4540	0.4184	0.4095	0.3828	0.3828	0.3561	0.3561	0.3472	0.3561	0.4006	0.3917	0.4184 (22b)
Effective ac	0.6031	0.5875	0.5838	0.5733	0.5733	0.5634	0.5634	0.5603	0.5634	0.5802	0.5767	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m ²)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			18.0000	639.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12811.2544 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.3386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss						(33) + (36) =	53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	34.4338	34.2178	33.5978	33.5978	33.0196	33.0196	32.8361	33.0196	34.0065	33.7998	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	87.9787	87.7628	87.1427	87.1427	86.5645	86.5645	86.3811	86.5645	87.5515	87.3448	87.9787 (39)
HLP	1.2513	1.2384	1.2354	1.2267	1.2267	1.2185	1.2185	1.2159	1.2185	1.2324	1.2295	1.2384 (40)
HLP (average)												1.2292 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m														
	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Total heat required for water heating calculated for each month	25.2901	22.8200	25.2287	24.3739	25.1566	24.3107	25.0997	25.1366	24.3452	25.1989	24.4335	25.2783	(61)	
Solar input	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(62)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Solar input (sum of months) = Sum(63)m =					0.0000 (63)	
	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)	
												Total per year (kWh/year) = Sum(64)m =	1683.4385 (64)	
RHI water heating demand													1683 (64)	
Heat gains from water heating, kWh/month	54.1287	47.5166	49.4530	43.7091	42.3822	37.2232	35.1358	39.4025	39.6002	45.3569	48.7424	52.6173	(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	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.6032	42.2808	34.3850	26.0317	19.4590	16.4281	17.7511	23.0736	30.9693	39.3227	45.8954	48.9263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.0777	301.1708	293.3763	276.7826	255.8361	236.1493	222.9973	219.9042	227.6988	244.2924	265.2390	284.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	72.7537	70.7092	66.4691	60.7070	56.9653	51.6989	47.2256	52.9603	55.0002	60.9636	67.6977	70.7222	(72)
Total internal gains	517.7545	513.4807	493.5503	462.8412	431.5803	403.5962	387.2939	395.2580	412.9882	443.8986	478.1519	503.8941	(73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains							
	m2	Table 6a	g		factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	6.6000	15.0428	0.6300	0.7000	0.7700	30.3421 (75)							
Southwest	3.4900	46.3896	0.6300	0.7000	0.7700	49.4786 (79)							
Solar gains	79.8207	125.1263	193.7003	283.8247	337.4753	378.4267	349.6976	301.4636	236.2723	152.9940	96.6207	64.0501	(83)
Total gains	597.5752	638.6070	687.2506	746.6659	769.0555	782.0229	736.9916	696.7217	649.2605	596.8926	574.7726	567.9442	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0351	40.4493	40.5489	40.8374	40.8374	41.1102	41.1102	41.1975	41.1102	40.6467	40.7429	40.4493	
alpha	3.6690	3.6966	3.7033	3.7225	3.7225	3.7407	3.7407	3.7465	3.7407	3.7098	3.7162	3.6966	
util living area	0.9735	0.9656	0.9418	0.8841	0.7684	0.5759	0.4235	0.4450	0.6936	0.8874	0.9552	0.9767	(86)
MIT	19.6668	19.7883	20.0773	20.4448	20.7650	20.9427	20.9864	20.9840	20.8848	20.5412	20.0819	19.6562	(87)
Th 2	19.8792	19.8894	19.8918	19.8987	19.8987	19.9052	19.9052	19.9073	19.9052	19.8941	19.8965	19.8894	(88)
util rest of house	0.9670	0.9572	0.9271	0.8541	0.7079	0.4795	0.3035	0.3201	0.6007	0.8495	0.9421	0.9708	(89)
MIT 2	18.7046	18.8310	19.1139	19.4660	19.7461	19.8801	19.9021	19.9035	19.8474	19.5588	19.1263	18.7023	(90)
Living area fraction	18.9451	19.0703	19.3547	19.7107	20.0008	20.1457	20.1731	20.1737	20.1067	19.8044	19.3652	18.9408	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9451	19.0703	19.3547	19.7107	20.0008	20.1457	20.1731	20.1737	20.1067	19.8044	19.3652	18.9408	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	573.6361	606.2501	631.1357	633.2568	549.1692	392.3937	245.8635	244.8602	402.1070	504.8914	536.9043	547.6769	(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	1204.0134	1176.3046	1057.9562	881.0778	644.9292	410.8132	248.7127	248.2300	442.0631	700.7971	957.7517	1182.5043	(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	469.0007	383.0766	317.5544	178.4311	71.2455	0.0000	0.0000	0.0000	0.0000	145.7539	303.0101	472.3116	(98)
Space heating												2340.3838 (98)	
RHI space heating demand												2340 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3561 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m2)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			18.0000	639.3600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12811.2544 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.3386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss							(33) + (36) = 53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	35.1096	34.8797	33.7998	33.5978	32.6573	32.6573	32.4831	33.0196	33.5978	34.0065	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	88.6545	88.4246	87.3448	87.1427	86.2022	86.2022	86.0281	86.5645	87.1427	87.5515	87.9787 (39)
HLP	1.2513	1.2480	1.2447	1.2295	1.2267	1.2134	1.2134	1.2110	1.2185	1.2267	1.2324	1.2384 (40)
HLP (average)												1.2295 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m														
	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	25.2901	22.8200	25.2287	24.3739	25.1566	24.3107	25.0997	25.1366	24.3452	25.1989	24.4335	25.2783	(61)	
Total heat required for water heating calculated for each month	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(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)	
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)	
Total per year (kWh/year) = Sum(64)m =													1683.4385 (64)	
Heat gains from water heating, kWh/month	54.1287	47.5166	49.4530	43.7091	42.3822	37.2232	35.1358	39.4025	39.6002	45.3569	48.7424	52.6173	(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	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.6032	42.2808	34.3850	26.0317	19.4590	16.4281	17.7511	23.0736	30.9693	39.3227	45.8954	48.9263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.0777	301.1708	293.3763	276.7826	255.8361	236.1493	222.9973	219.9042	227.6988	244.2924	265.2390	284.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	72.7537	70.7092	66.4691	60.7070	56.9653	51.6989	47.2256	52.9603	55.0002	60.9636	67.6977	70.7222	(72)
Total internal gains	517.7545	513.4807	493.5503	462.8412	431.5803	403.5962	387.2939	395.2580	412.9882	443.8986	478.1519	503.8941	(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	FF	Access	Gains						
		m ²	Table 6a	g	Specific data	factor	W						
			W/m ²	or Table 6b	or Table 6c	Table 6d							
Northeast		6.6000	11.2829	0.6300	0.7000	0.7700	22.7582 (75)						
Southwest		3.4900	36.7938	0.6300	0.7000	0.7700	39.2439 (79)						
Solar gains	62.0021	113.1719	174.9257	250.3970	311.1846	322.4466	305.2498	257.8336	200.7358	130.4929	75.6409	52.1701	(83)
Total gains	579.7566	626.6526	668.4760	713.2382	742.7649	726.0429	692.5437	653.0917	613.7240	574.3915	553.7928	556.0642	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0351	40.1410	40.2454	40.7429	40.8374	41.2829	41.2829	41.3665	41.1102	40.8374	40.6467	40.4493	
alpha	3.6690	3.6761	3.6830	3.7162	3.7225	3.7522	3.7522	3.7578	3.7407	3.7225	3.7098	3.6966	
util living area	0.9804	0.9722	0.9544	0.9106	0.8212	0.6705	0.5202	0.5659	0.7782	0.9241	0.9699	0.9830	(86)
MIT	19.4827	19.6439	19.9314	20.3219	20.6661	20.8916	20.9682	20.9563	20.8003	20.3746	19.8691	19.4527	(87)
Th 2	19.8792	19.8818	19.8844	19.8965	19.8987	19.9093	19.9093	19.9112	19.9052	19.8987	19.8941	19.8894	(88)
util rest of house	0.9758	0.9656	0.9430	0.8871	0.7727	0.5839	0.4031	0.4484	0.7041	0.8993	0.9615	0.9790	(89)
MIT 2	18.5225	18.6832	18.9668	19.3508	19.6646	19.8530	19.8991	19.8959	19.7877	19.4094	18.9166	18.5007	(90)
Living area fraction													fLA = Living area / (4) = 0.2500 (91)
MIT	18.7625	18.9234	19.2080	19.5936	19.9150	20.1126	20.1664	20.1610	20.0409	19.6507	19.1547	18.7387	(92)
Temperature adjustment													0.0000
adjusted MIT	18.7625	18.9234	19.2080	19.5936	19.9150	20.1126	20.1664	20.1610	20.0409	19.6507	19.1547	18.7387	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9697	0.9583	0.9344	0.8794	0.7735	0.6013	0.4319	0.4769	0.7144	0.8925	0.9544	0.9735	(94)
Useful gains	562.1937	600.5463	624.6402	627.2505	574.5123	436.5833	299.1350	311.4633	438.4690	512.6313	528.5212	541.3142	(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	1285.5622	1243.2368	1123.6986	934.0298	715.8757	475.2001	307.4283	323.5491	514.2683	788.7029	1055.4094	1279.0974	(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	538.1861	431.8880	371.2995	220.8811	105.1743	0.0000	0.0000	0.0000	0.0000	205.3973	379.3595	548.9107	(98)
Space heating													2801.0966 (98)
Space heating per m ²													(98) / (4) = 39.4299 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3088.3093 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	538.1861	431.8880	371.2995	220.8811	105.1743	0.0000	0.0000	0.0000	0.0000	205.3973	379.3595	548.9107	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	593.3695	476.1720	409.3709	243.5293	115.9585	0.0000	0.0000	0.0000	0.0000	226.4579	418.2574	605.1937	(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	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)
Efficiency of water heater (217)m	89.8380	89.7777	89.6404	89.3244	88.7071	87.2000	87.2000	87.2000	87.2000	89.2320	89.6673	87.2000	(216)
Fuel for water heating, kWh/month	188.1922	165.4856	172.9026	153.9372	150.7287	135.2999	128.3251	143.0511	143.5078	159.8800	170.2472	183.0676	(219)
Water heating fuel used													1894.6249 (219)
Annual totals kWh/year													
Space heating fuel - main system													3088.3093 (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)													336.2752 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1029 * 1.00) =													-699.8470 (233)
Total delivered energy for all uses													4694.3625 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3088.3093	3.4800	107.4732 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1894.6249	3.4800	65.9329 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	336.2752	13.1900	44.3547 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-699.8470	13.1900	-92.3098 (252)
Total energy cost			255.3435 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9242 (257)
SAP value		87.1074
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3088.3093	0.2160	667.0748 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1894.6249	0.2160	409.2390 (264)
Space and water heating			1076.3138 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.2752	0.5190	174.5268 (268)
Energy saving/generation technologies			
PV Unit	-699.8470	0.5190	-363.2206 (269)
Total kg/year			926.5450 (272)
CO2 emissions per m2			13.0400 (273)
EI value			89.3005
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency $3.48 / 0.8874 = 3.922$, stars = 4
Water heating environmental impact $0.216 / 0.8874 = 0.2434$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5200 (1b)	x 2.3900 (2b)	= 84.8928 (1b) - (3b)
First floor	35.5200 (1c)	x 2.6100 (2c)	= 92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3561 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 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	0.4540	0.4184	0.4095	0.3828	0.3828	0.3561	0.3561	0.3472	0.3561	0.4006	0.3917	0.4184 (22b)
Effective ac	0.6031	0.5875	0.5838	0.5733	0.5733	0.5634	0.5634	0.5603	0.5634	0.5802	0.5767	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m ²)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			18.0000	639.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12811.2544 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.3386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss						(33) + (36) =	53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	34.4338	34.2178	33.5978	33.5978	33.0196	33.0196	32.8361	33.0196	34.0065	33.7998	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	87.9787	87.7628	87.1427	87.1427	86.5645	86.5645	86.3811	86.5645	87.5515	87.3448	87.9787 (39)
HLP	1.2513	1.2384	1.2354	1.2267	1.2267	1.2185	1.2185	1.2159	1.2185	1.2324	1.2295	1.2384 (40)
HLP (average)												1.2292 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m														
	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	25.2901	22.8200	25.2287	24.3739	25.1566	24.3107	25.0997	25.1366	24.3452	25.1989	24.4335	25.2783	(61)	
Total heat required for water heating calculated for each month	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(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)	
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)	
Total per year (kWh/year) = Sum(64)m =													1683.4385 (64)	
Heat gains from water heating, kWh/month	54.1287	47.5166	49.4530	43.7091	42.3822	37.2232	35.1358	39.4025	39.6002	45.3569	48.7424	52.6173	(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	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.6032	42.2808	34.3850	26.0317	19.4590	16.4281	17.7511	23.0736	30.9693	39.3227	45.8954	48.9263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.0777	301.1708	293.3763	276.7826	255.8361	236.1493	222.9973	219.9042	227.6988	244.2924	265.2390	284.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	72.7537	70.7092	66.4691	60.7070	56.9653	51.6989	47.2256	52.9603	55.0002	60.9636	67.6977	70.7222	(72)
Total internal gains	517.7545	513.4807	493.5503	462.8412	431.5803	403.5962	387.2939	395.2580	412.9882	443.8986	478.1519	503.8941	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast		6.6000	15.0428	0.6300	0.7000	0.7700	30.3421	(75)					
Southwest		3.4900	46.3896	0.6300	0.7000	0.7700	49.4786	(79)					
Solar gains	79.8207	125.1263	193.7003	283.8247	337.4753	378.4267	349.6976	301.4636	236.2723	152.9940	96.6207	64.0501	(83)
Total gains	597.5752	638.6070	687.2506	746.6659	769.0555	782.0229	736.9916	696.7217	649.2605	596.8926	574.7726	567.9442	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0351	40.4493	40.5489	40.8374	40.8374	41.1102	41.1102	41.1975	41.1102	40.6467	40.7429	40.4493	
alpha	3.6690	3.6966	3.7033	3.7225	3.7225	3.7407	3.7407	3.7465	3.7407	3.7098	3.7162	3.6966	
util living area	0.9735	0.9656	0.9418	0.8841	0.7684	0.5759	0.4235	0.4450	0.6936	0.8874	0.9552	0.9767	(86)
MIT	19.6668	19.7883	20.0773	20.4448	20.7650	20.9427	20.9864	20.9840	20.8848	20.5412	20.0819	19.6562	(87)
Th 2	19.8792	19.8894	19.8918	19.8987	19.8987	19.9052	19.9052	19.9073	19.9052	19.8941	19.8965	19.8894	(88)
util rest of house	0.9670	0.9572	0.9271	0.8541	0.7079	0.4795	0.3035	0.3201	0.6007	0.8495	0.9421	0.9708	(89)
MIT 2	18.7046	18.8310	19.1139	19.4660	19.7461	19.8801	19.9021	19.9035	19.8474	19.5588	19.1263	18.7023	(90)
Living area fraction													fLA = Living area / (4) = 0.2500 (91)
MIT	18.9451	19.0703	19.3547	19.7107	20.0008	20.1457	20.1731	20.1737	20.1067	19.8044	19.3652	18.9408	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9451	19.0703	19.3547	19.7107	20.0008	20.1457	20.1731	20.1737	20.1067	19.8044	19.3652	18.9408	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9599	0.9493	0.9183	0.8481	0.7141	0.5018	0.3336	0.3514	0.6193	0.8459	0.9341	0.9643	(94)
Useful gains	573.6361	606.2501	631.1357	633.2568	549.1692	392.3937	245.8635	244.8602	402.1070	504.8914	536.9043	547.6769	(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	1204.0134	1176.3046	1057.9562	881.0778	644.9292	410.8132	248.7127	248.2300	442.0631	700.7971	957.7517	1182.5043	(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	469.0007	383.0766	317.5544	178.4311	71.2455	0.0000	0.0000	0.0000	0.0000	145.7539	303.0101	472.3116	(98)
Space heating													2340.3838 (98)
Space heating per m ²													(98) / (4) = 32.9446 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2580.3570 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.0007	383.0766	317.5544	178.4311	71.2455	0.0000	0.0000	0.0000	0.0000	145.7539	303.0101	472.3116	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	517.0900	422.3557	350.1151	196.7267	78.5507	0.0000	0.0000	0.0000	0.0000	160.6988	334.0795	520.7404	(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	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(64)
Efficiency of water heater (217)m	89.7455	89.6939	89.5215	89.1428	88.3856	87.2000	87.2000	87.2000	87.2000	88.9343	89.4966	87.2000	(216)
Fuel for water heating, kWh/month	188.3861	165.6401	173.1323	154.2508	151.2770	135.2999	128.3251	143.0511	143.5078	160.4152	170.5719	183.2696	(219)
Water heating fuel used													1897.1269 (219)
Annual totals kWh/year													
Space heating fuel - main system													2580.3570 (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)													336.2752 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1182 * 1.00) =													-803.5605 (233)
Total delivered energy for all uses													4085.1986 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2580.3570	9.7400	251.3268 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1897.1269	9.7400	184.7802 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	336.2752	36.8500	123.9174 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-803.5605	36.8500	-296.1120 (252)
Total energy cost			395.5498 (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	2580.3570	0.2160	557.3571 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1897.1269	0.2160	409.7794 (264)
Space and water heating			967.1365 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.2752	0.5190	174.5268 (268)
Energy saving/generation technologies			
PV Unit	-803.5605	0.5190	-417.0479 (269)
Total kg/year			763.5405 (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	2580.3570	1.2200	3148.0355 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1897.1269	1.2200	2314.4948 (264)
Space and water heating			5462.5303 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	336.2752	3.0700	1032.3649 (268)
Energy saving/generation technologies			
PV Unit	-803.5605	3.0700	-2466.9306 (269)
Primary energy kWh/year			4258.2145 (272)
Primary energy kWh/m2/year			59.9411 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 77	-185 kg (24.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£77	2.61 kg/m ²	B 88 B 91
Total Savings	£77	2.61 kg/m ²	

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

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£152	£170	-£18
Mains gas	£540	£445	£95
Space heating	£383	£383	£0
Water heating	£185	£108	£77
Lighting	£124	£124	£0
Generated (PV)	-£296	-£296	£0
Total cost of fuels	£396	£319	£77
Total cost of uses	£396	£319	£77
Delivered energy	58 kWh/m ²	44 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m ²	11 kg/m ²	8 kg/m ²	3 kg/m ²
Primary energy	60 kWh/m ²	45 kWh/m ²	15 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.5200 (1b)	2.3900 (2b)	84.8928 (1b) - (3b)
First floor	35.5200 (1c)	2.6100 (2c)	92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3561 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m2)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			18.0000	639.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12811.2544 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.3386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss						(33) + (36) =	53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	35.1096	34.8797	33.7998	33.5978	32.6573	32.6573	32.4831	33.0196	33.5978	34.0065	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	88.6545	88.4246	87.3448	87.1427	86.2022	86.2022	86.0281	86.5645	87.1427	87.5515	87.9787 (39)
HLP	1.2513	1.2480	1.2447	1.2295	1.2267	1.2134	1.2134	1.2110	1.2185	1.2267	1.2324	1.2384 (40)
HLP (average)												1.2295 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	25.2901	22.8200	25.2287	24.3739	25.1566	24.3107	25.0997	25.1366	24.3452	25.1989	24.4335	25.2783	(61)
Total heat required for water heating calculated for each month													
	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													3.0000 (H1)
Collector heat loss coefficient													0.7000 (H2)
Collector 2nd order heat loss coefficient													1.8000 (H3)
Collector effective heat loss coefficient													0.0050 (H3a)
Collector performance ratio													1.8063 (H3b)
Annual solar radiation per m2													2.5804 (H4)
Overshading factor													1079.5246 (H5)
Solar energy available													0.8000 (H6)
Adjustment factor for showers													1813.6014 (H7)
Solar-to-load ratio													1.0000 (H7a)
Utilisation factor													1.3078 (H8)
Collector performance factor													0.5345 (H9)
Dedicated solar storage volume													0.8793 (H10)
Effective solar volume													75.0000 (H11)
Daily hot water demand													75.0000 (H13)
Volume ratio Veff/V													88.1388 (H14)
Solar storage volume factor													0.8509 (H15)
Solar input													0.9677 (H16)
Solar input	-23.9189	-39.9137	-67.9776	-91.1034	-112.5506	-110.6552	-109.1928	-95.4023	-74.7192	-51.0244	-28.3712	-824.8455	(H17)
Output from w/h													
	145.1493	108.6554	87.0130	46.4000	21.1564	7.3263	2.7066	29.3383	50.4196	91.6397	124.2848	144.5036	(64)
Heat gains from water heating, kWh/month													
	54.1287	47.5166	49.4530	43.7091	42.3822	37.2232	35.1358	39.4025	39.6002	45.3569	48.7424	52.6173	(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	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.6032	42.2808	34.3850	26.0317	19.4590	16.4281	17.7511	23.0736	30.9693	39.3227	45.8954	48.9263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.0777	301.1708	293.3763	276.7826	255.8361	236.1493	222.9973	219.9042	227.6988	244.2924	265.2390	284.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	72.7537	70.7092	66.4691	60.7070	56.9653	51.6989	47.2256	52.9603	55.0002	60.9636	67.6977	70.7222	(72)
Total internal gains	517.7545	513.4807	493.5503	462.8412	431.5803	403.5962	387.2939	395.2580	412.9882	443.8986	478.1519	503.8941	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	6.6000	11.2829	0.6300	0.7000	0.7700	22.7582 (75)							
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439 (79)							
Solar gains	62.0021	113.1719	174.9257	250.3970	311.1846	322.4466	305.2498	257.8336	200.7358	130.4929	75.6409	52.1701	(83)
Total gains	579.7566	626.6526	668.4760	713.2382	742.7649	726.0429	692.5437	653.0917	613.7240	574.3915	553.7928	556.0642	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0351	40.1410	40.2454	40.7429	40.8374	41.2829	41.2829	41.3665	41.1102	40.8374	40.6467	40.4493	
alpha	3.6690	3.6761	3.6830	3.7162	3.7225	3.7522	3.7522	3.7578	3.7407	3.7225	3.7098	3.6966	
util living area	0.9804	0.9722	0.9544	0.9106	0.8212	0.6705	0.5202	0.5659	0.7782	0.9241	0.9699	0.9830	(86)
MIT	19.4827	19.6439	19.9314	20.3219	20.6661	20.8916	20.9682	20.9563	20.8003	20.3746	19.8691	19.4527	(87)
Th 2	19.8792	19.8818	19.8844	19.8965	19.8987	19.9093	19.9093	19.9112	19.9052	19.8987	19.8941	19.8894	(88)
util rest of house	0.9758	0.9656	0.9430	0.8871	0.7727	0.5839	0.4031	0.4484	0.7041	0.8993	0.9615	0.9790	(89)
MIT 2	18.5225	18.6832	18.9668	19.3508	19.6646	19.8530	19.8991	19.8959	19.7877	19.4094	18.9166	18.5007	(90)
Living area fraction												0.2500 (91)	
MIT	18.7625	18.9234	19.2080	19.5936	19.9150	20.1126	20.1664	20.1610	20.0409	19.6507	19.1547	18.7387	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7625	18.9234	19.2080	19.5936	19.9150	20.1126	20.1664	20.1610	20.0409	19.6507	19.1547	18.7387	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9697	0.9583	0.9344	0.8794	0.7735	0.6013	0.4319	0.4769	0.7144	0.8925	0.9544	0.9735	(94)
Useful gains	562.1937	600.5463	624.6402	627.2505	574.5123	436.5833	299.1350	311.4633	438.4690	512.6313	528.5212	541.3142	(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													
	1285.5622	1243.2368	1123.6986	934.0298	715.8757	475.2001	307.4283	323.5491	514.2683	788.7029	1055.4094	1279.0974	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	538.1861	431.8880	371.2995	220.8811	105.1743	0.0000	0.0000	0.0000	0.0000	205.3973	379.3595	548.9107	(98)
Space heating												2801.0966	(98)
Space heating per m2												(98) / (4) =	39.4299 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3088.3093 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	538.1861	431.8880	371.2995	220.8811	105.1743	0.0000	0.0000	0.0000	0.0000	205.3973	379.3595	548.9107	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	593.3695	476.1720	409.3709	243.5293	115.9585	0.0000	0.0000	0.0000	0.0000	226.4579	418.2574	605.1937	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.1493	108.6554	87.0130	46.4000	21.1564	7.3263	2.7066	29.3383	50.4196	91.6397	124.2848	144.5036	(64)
Efficiency of water heater	89.9333	89.9741	90.0141	90.0724	90.0944	87.2000	87.2000	87.2000	87.2000	89.5906	89.8104	89.9476	(217)
(217)m	89.9333	89.9741	90.0141	90.0724	90.0944	87.2000	87.2000	87.2000	87.2000	89.5906	89.8104	89.9476	(217)
Fuel for water heating, kWh/month	161.3966	120.7630	96.6660	51.5141	23.4825	8.4018	3.1039	33.6448	57.8206	102.2872	138.3857	160.6530	(219)
												958.1192	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													3088.3093 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													336.2752 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1029 * 1.00) =										-699.8470			-699.8470 (233)
Total delivered energy for all uses													3807.8568 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3088.3093	3.4800	107.4732	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	958.1192	3.4800	33.3425	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	336.2752	13.1900	44.3547	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.8470	13.1900	-92.3098	(252)
Total energy cost			229.3481	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8301 (257)
SAP value		88.4199
SAP rating (Section 12)		88 (258)
SAP band		B

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

Energy Emission factor Emissions

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3088.3093	0.2160	667.0748 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	958.1192	0.2160	206.9538 (264)
Space and water heating			874.0286 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	336.2752	0.5190	174.5268 (268)
Energy saving/generation technologies			
PV Unit	-699.8470	0.5190	-363.2206 (269)
Total kg/year			750.2098 (272)
CO2 emissions per m2			10.5600 (273)
EI value			91.3368
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.5200 (1b)	x 2.3900 (2b)	= 84.8928 (1b) - (3b)
First floor	35.5200 (1c)	x 2.6100 (2c)	= 92.7072 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.0400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 177.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					3 * 10 = 30.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1689 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4189 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3561 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 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	0.4540	0.4184	0.4095	0.3828	0.3828	0.3561	0.3561	0.3472	0.3561	0.4006	0.3917	0.4184 (22b)
Effective ac	0.6031	0.5875	0.5838	0.5733	0.5733	0.5634	0.5634	0.5603	0.5634	0.5802	0.5767	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.0900	1.1450	11.5534		(27)
Ground Floor			35.5200	0.1200	4.2624	90.0000	3196.8000 (28a)
Brick and Block	81.6600	12.2400	69.4200	0.2400	16.6608	42.2200	2930.9124 (29a)
Stepped Party Wall	2.3400		2.3400	0.2600	0.6084	60.0000	140.4000 (29a)
External Roof 1	35.5200		35.5200	0.1000	3.5520	9.1000	323.2320 (30)
Total net area of external elements Aum(A, m2)			155.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0020		(33)
Party Wall 1			34.3400	0.0000	0.0000	110.0000	3777.4000 (32)
GF Timber Stud			63.1100			9.0000	567.9900 (32c)
FF Timber Stud			66.2000			9.0000	595.8000 (32c)
Internal Floor 1			35.5200			18.0000	639.3600 (32d)
Internal Ceiling 1			35.5200			18.0000	639.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12811.2544 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.3386 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5429 (36)
Total fabric heat loss						(33) + (36) =	53.5449 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.3441	34.4338	34.2178	33.5978	33.5978	33.0196	33.0196	32.8361	33.0196	34.0065	33.7998	34.4338 (38)
Average = Sum(39)m / 12 =	88.8891	87.9787	87.7628	87.1427	87.1427	86.5645	86.5645	86.3811	86.5645	87.5515	87.3448	87.9787 (39)
HLP	1.2513	1.2384	1.2354	1.2267	1.2267	1.2185	1.2185	1.2159	1.2185	1.2324	1.2295	1.2384 (40)
HLP (average)												1.2292 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.2711 (42)
Average daily hot water use (litres/day)												88.1388 (43)
Daily hot water use	96.9527	93.4271	89.9016	86.3760	82.8505	79.3249	79.3249	82.8505	86.3760	89.9016	93.4271	96.9527 (44)
Energy conte	143.7780	125.7491	129.7619	113.1295	108.5505	93.6708	86.7998	99.6040	100.7936	117.4652	128.2225	139.2413 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1386.7662 (45)
Distribution loss (46)m = 0.15 x (45)m														
	21.5667	18.8624	19.4643	16.9694	16.2826	14.0506	13.0200	14.9406	15.1190	17.6198	19.2334	20.8862	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	25.2901	22.8200	25.2287	24.3739	25.1566	24.3107	25.0997	25.1366	24.3452	25.1989	24.4335	25.2783	(61)	
Total heat required for water heating calculated for each month	169.0681	148.5691	154.9906	137.5035	133.7071	117.9815	111.8995	124.7406	125.1388	142.6641	152.6560	164.5196	(62)	
Aperture area of solar collector													3.0000 (H1)	
Zero-loss collector efficiency													0.7000 (H2)	
Collector heat loss coefficient													1.8000 (H3)	
Collector 2nd order heat loss coefficient													0.0050 (H3a)	
Collector effective heat loss coefficient													1.8063 (H3b)	
Collector performance ratio													2.5804 (H4)	
Annual solar radiation per m2													1234.4649 (H5)	
Overshading factor													0.8000 (H6)	
Solar energy available													2073.9010 (H7)	
Adjustment factor for showers													1.0000 (H7a)	
Solar-to-load ratio													1.4955 (H8)	
Utilisation factor													0.4876 (H9)	
Collector performance factor													0.8793 (H10)	
Dedicated solar storage volume													75.0000 (H11)	
Effective solar volume													75.0000 (H13)	
Daily hot water demand													88.1388 (H14)	
Volume ratio Veff/V													0.8509 (H15)	
Solar storage volume factor													0.9677 (H16)	
Solar input	-28.2384	-40.3112	-68.3206	-93.2277	-110.0290	-117.0917	-112.7687	-100.6045	-79.6226	-54.5174	-33.1999	-860.4878	(H17)	
Solar input (sum of months) = Sum(63)m =													-860.4878 (63)	
Output from w/h	140.8297	108.2579	86.6700	44.2758	23.6781	0.8899	0.0000	24.1361	45.5162	88.1467	119.4561	141.9634	(64)	
Total per year (kWh/year) = Sum(64)m =													823.8199 (64)	
Heat gains from water heating, kWh/month	54.1287	47.5166	49.4530	43.7091	42.3822	37.2232	35.1358	39.4025	39.6002	45.3569	48.7424	52.6173	(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	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	136.2664	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.6032	42.2808	34.3850	26.0317	19.4590	16.4281	17.7511	23.0736	30.9693	39.3227	45.8954	48.9263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.0777	301.1708	293.3763	276.7826	255.8361	236.1493	222.9973	219.9042	227.6988	244.2924	265.2390	284.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	50.8977	(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)	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	-90.8443	(71)
Water heating gains (Table 5)	72.7537	70.7092	66.4691	60.7070	56.9653	51.6989	47.2256	52.9603	55.0002	60.9636	67.6977	70.7222	(72)
Total internal gains	517.7545	513.4807	493.5503	462.8412	431.5803	403.5962	387.2939	395.2580	412.9882	443.8986	478.1519	503.8941	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast		6.6000	15.0428	0.6300		0.7000		30.3421	(75)				
Southwest		3.4900	46.3896	0.6300		0.7000		49.4786	(79)				
Solar gains	79.8207	125.1263	193.7003	283.8247	337.4753	378.4267	349.6976	301.4636	236.2723	152.9940	96.6207	64.0501	(83)
Total gains	597.5752	638.6070	687.2506	746.6659	769.0555	782.0229	736.9916	696.7217	649.2605	596.8926	574.7726	567.9442	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0351	40.4493	40.5489	40.8374	40.8374	41.1102	41.1102	41.1975	41.1102	40.6467	40.7429	40.4493	
alpha	3.6690	3.6966	3.7033	3.7225	3.7225	3.7407	3.7407	3.7465	3.7407	3.7098	3.7162	3.6966	
util living area	0.9735	0.9656	0.9418	0.8841	0.7684	0.5759	0.4235	0.4450	0.6936	0.8874	0.9552	0.9767	(86)
MIT	19.6668	19.7883	20.0773	20.4448	20.7650	20.9427	20.9864	20.9840	20.8848	20.5412	20.0819	19.6562	(87)
Th 2	19.8792	19.8894	19.8918	19.8987	19.8987	19.9052	19.9052	19.9073	19.9052	19.8941	19.8965	19.8894	(88)
util rest of house	0.9670	0.9572	0.9271	0.8541	0.7079	0.4795	0.3035	0.3201	0.6007	0.8495	0.9421	0.9708	(89)
MIT 2	18.7046	18.8310	19.1139	19.4660	19.7461	19.8801	19.9021	19.9035	19.8474	19.5588	19.1263	18.7023	(90)
Living area fraction													fLA = Living area / (4) =
MIT	18.9451	19.0703	19.3547	19.7107	20.0008	20.1457	20.1731	20.1737	20.1067	19.8044	19.3652	18.9408	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9451	19.0703	19.3547	19.7107	20.0008	20.1457	20.1731	20.1737	20.1067	19.8044	19.3652	18.9408	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9599	0.9493	0.9183	0.8481	0.7141	0.5018	0.3336	0.3514	0.6193	0.8459	0.9341	0.9643	(94)
Useful gains	573.6361	606.2501	631.1357	633.2568	549.1692	392.3937	245.8635	244.8602	402.1070	504.8914	536.9043	547.6769	(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													
Month fracti	1204.0134	1176.3046	1057.9562	881.0778	644.9292	410.8132	248.7127	248.2300	442.0631	700.7971	957.7517	1182.5043	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	469.0007	383.0766	317.5544	178.4311	71.2455	0.0000	0.0000	0.0000	0.0000	145.7539	303.0101	472.3116	(98)
Space heating per m2												2340.3838	(98)
											(98) / (4) =	32.9446	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)	
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														90.7000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														2580.3570	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	469.0007	383.0766	317.5544	178.4311	71.2455	0.0000	0.0000	0.0000	0.0000	145.7539	303.0101	472.3116	(98)		
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)		
Space heating fuel (main heating system)	517.0900	422.3557	350.1151	196.7267	78.5507	0.0000	0.0000	0.0000	0.0000	160.6988	334.0795	520.7404	(211)		
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)		
Water heating															
Water heating requirement	140.8297	108.2579	86.6700	44.2758	23.6781	0.8899	0.0000	24.1361	45.5162	88.1467	119.4561	141.9634	(64)		
Efficiency of water heater	89.8670	89.9049	89.9261	89.9820	89.8009	87.2000	87.2000	87.2000	87.2000	89.3485	89.6822	89.8664	(217)		
Fuel for water heating, kWh/month	156.7090	120.4138	96.3792	49.2052	26.3673	1.0205	0.0000	27.6790	52.1974	98.6549	133.1994	157.9716	(219)		
Water heating fuel used												919.7974	(219)		
Annual totals kWh/year															
Space heating fuel - main system														2580.3570	(211)
Space heating fuel - secondary														0.0000	(215)
Electricity for pumps and fans:															
central heating pump														30.0000	(230c)
main heating flue fan														45.0000	(230e)
pump for solar water heating														50.0000	(230g)
Total electricity for the above, kWh/year														125.0000	(231)
Electricity for lighting (calculated in Appendix L)														336.2752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 0.85 * 1182 * 1.00) =										-803.5605				-803.5605	(233)
Total delivered energy for all uses														3157.8691	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2580.3570	9.7400	251.3268	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	919.7974	9.7400	89.5883	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	336.2752	36.8500	123.9174	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-803.5605	36.8500	-296.1120	(252)
Total energy cost			318.7829	(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	2580.3570	0.2160	557.3571	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	919.7974	0.2160	198.6762	(264)
Space and water heating			756.0334	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	336.2752	0.5190	174.5268	(268)
Energy saving/generation technologies				
PV Unit	-803.5605	0.5190	-417.0479	(269)
Total kg/year			578.3873	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2580.3570	1.2200	3148.0355 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.7974	1.2200	1122.1529 (264)
Space and water heating			4270.1884 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	336.2752	3.0700	1032.3649 (268)
Energy saving/generation technologies			
PV Unit	-803.5605	3.0700	-2466.9306 (269)
Primary energy kWh/year			3219.3726 (272)
Primary energy kWh/m2/year			45.3177 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 71		Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)	
Project	Plot 71			
Calculation Type	New Build (As Designed)			

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40 Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	150	0.0400	3.7500	100.00		
Layer 2	Earthwool Loft Roll 40 Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	200	0.0400	5.0000	100.00		
Layer 3	Earthwool Loft Roll 40 Main construction Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	100 100	0.0400 0.1300	2.5000 0.7692	87.50 12.50		
Layer 4	Plasterboard, standard Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 71	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)
Project	Plot 71		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

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

Wall 000001

Wall Type: Standard Wall

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

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

Unheated space:	None	
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 71	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)
Project	Plot 71		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

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

Wall 000009

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Supabloc *7				
	Main construction	100	0.1900	0.5263	94.04
	Main construction	100	0.8803	0.1136	5.96
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Supafil Party Wall				
	Main construction	100	0.0400	2.5000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 3	Supabloc *7				
	Main construction	100	0.1900	0.5263	94.04
	Main construction	100	0.8803	0.1136	5.96
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	airspace/plaster dabs				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance: Upper limit = 3.898 m² K/W Lower limit = 3.765 m² K/W Average = 3.831 m² K/W
 Total correction = 0.0003 m² K/W U-value (unrounded) = 0.26 W/m² K

Unheated space: None		
Total thickness: 328 mm	U-value: 0.26 W/m² K	Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 71	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)
Project	Plot 71		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

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

Floor 000008

Floor Type: Suspended Floor

Area = 42.22 m², Perimeter = 18.37 m, Wall thickness = 300.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	EPS 200 Lower portion						
	Main construction	55	0.0340	1.6176	80.65		
	Main construction	55	2.0000	0.0275	19.35		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	EPS Upper portion						
	Main construction	100	0.0340	2.9412	87.10		
	Main construction	100	2.0000	0.0500	12.90		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Grey EPS 100 Topsheet						
	Main construction	155	0.0300	5.1667	100.00	15	1450
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 9.271 m² K/W Lower limit = 6.052 m² K/W Average = 7.661 m² K/W
 Total correction = 0.0046 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 71	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley V5 (HA-SO)
Property	Plot 71		

SAP Rating	87 B	DER	15.08	TER	19.28
Environmental	89 B	% DER<TER	21.77		
CO ₂ Emissions (t/year)	0.76	DFEE	51.08	TFEE	52.95
General Requirements Compliance	Pass	% DFEE<TFEE	3.53		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

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

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	16.80 m	35.52 m ²	2.39 m
1st Storey:	16.80 m	35.52 m ²	2.61 m

7.0 Living Area	17.76	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	180.34	kJ/m ² K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	81.66	69.42
Stepped Party Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.26	60.00	2.34	2.34

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	34.34

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
GF Timber Stud	Plasterboard on timber frame	9.00	63.11
FF Timber Stud	Plasterboard on timber frame	9.00	66.20

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Plane Roof	Other	0.10	9.10	35.52	35.52

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.52

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	35.52

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.52

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	Manufacture	Solid Door							1.10
Windows & Fully Glazed Door	Manufacture	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South West							2.15	
Front Elevation	Window	[1] Brick and Block	South West	None	0.00					3.49	
Rear Elevation	Window	[1] Brick and Block	North East	None	0.00					6.60	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	0.46	0.110	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.46	0.910	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.02	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	5.92	0.021	No	Knauf P5
Independently assessed	E4 Jamb	24.32	0.016	No	Knauf P6
Table K1 - Default	E5 Ground floor (normal)	16.80	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	16.80	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.10	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	7.79	0.044	No	Knauf P21
Independently assessed	E12 Gable (insulation at ceiling level)	7.79	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.60	0.039	No	Knauf P23
Table K1 - Approved	E18 Party wall between dwellings	9.40	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	7.79	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.79	0.000	No	

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted
 Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Description
 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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Combi keep hot type	Gas/Oil, time clock			
25.0 Main Heating 2	None			
Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.85	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£77	B 88	