



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 129

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

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

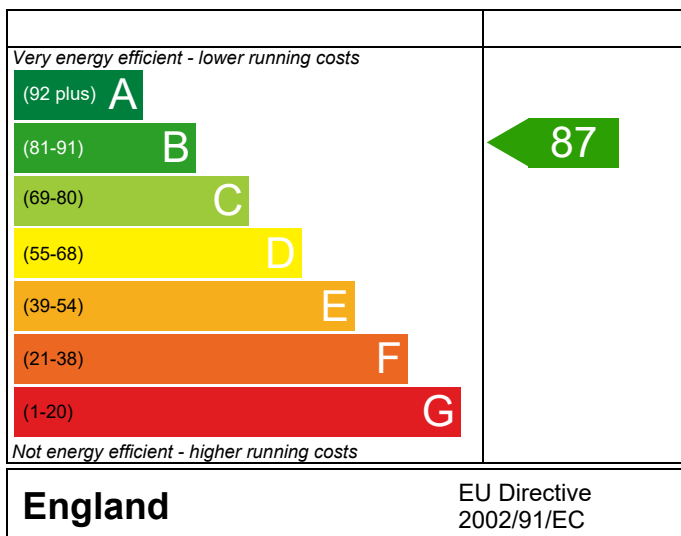
Plot 129

Dwelling type: House, End-Terrace
Date of assessment: 28/03/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 69.92 m²
DRRN: 3052-3768-7223

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

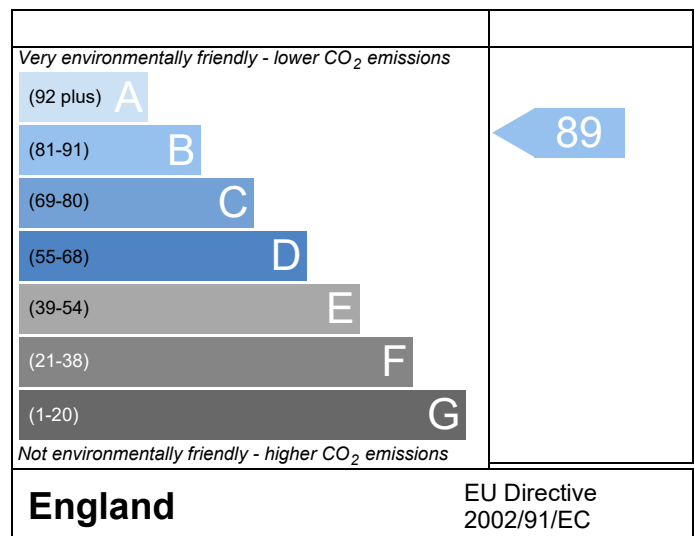
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 129				Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref		Newton (HA)		
Property	Plot 129					
SAP Rating	87 B	DER	15.13	TER	19.44	
Environmental	89 B	% DER<TER	22.17			
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TFEE	53.59	
General Requirements Compliance	Pass	% DFEE<TFEE	11.59			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.44	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.13	kgCO ₂ /m ²	Pass
	-4.31 (-22.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.59	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.38	kWh/m ² /yr	
	-6.2 (-11.6%)	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

6.46 m², No overhang

Windows facing South

4.36 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

0.70

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	£76	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£76	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 129	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Newton (HA)
Property	Plot 129		

SAP Rating	87 B	DER	15.13	TER	19.44
Environmental	89 B	% DER<TER	22.17		
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TFEE	53.59
General Requirements Compliance	Pass	% DFEE<TFEE	11.59		

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	0.910	2.73	2.48	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	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.62	0.23	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	6.35	0.13	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	20.10	0.32	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	16.74	2.68	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.74	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.19	0.49	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	17.22	0.76	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.58	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	9.38	0.56	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.61	1.38	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.61	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.069	8.61	0.59	Knauf P29

Total: **10.22** W/mK:
Y-Value: **0.065** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 70 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) 19.44 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.4 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: 6.46 m², No overhang
Windows facing South: 4.36 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 0.70 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	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (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) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3887 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4956	0.4859	0.4762	0.4276	0.4179	0.3693	0.3693	0.3596	0.3887	0.4179	0.4373	0.4568 (22b)
Effective ac	0.6228	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			18.0000	629.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.2149	35.9376	35.6657	34.3889	34.1500	33.0379	33.0379	32.8319	33.4662	34.1500	34.6333	35.1385 (38)
Heat transfer coeff	86.6297	86.3524	86.0805	84.8037	84.5648	83.4527	83.4527	83.2467	83.8810	84.5648	85.0480	85.5533 (39)
Average = Sum(39)m / 12 =												84.8025 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2390	1.2350	1.2311	1.2129	1.2095	1.1935	1.1935	1.1906	1.1997	1.2095	1.2164	1.2236 (40)
HLP (average)												1.2129 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 = 1376.7047 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	19.0938	20.7347 (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	25.2847	22.8154	25.2242	24.3701	25.1531	24.3078	25.0970	25.1334	24.3418	25.1948	24.4289 (61)
Total heat required for water heating calculated for each month											
168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210 (64)
Total per year (kWh/year) = Sum(64)m =	1673.3288 (64)										
Heat gains from water heating, kWh/month	53.7805	47.2121	49.1388	43.4352	42.1194	36.9965	34.9258	39.1614	39.3562	45.0725	48.4319 (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	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4564	16.3928	13.3315	10.0928	7.5445	6.3694	6.8823	8.9459	12.0072	15.2459	17.7942	18.9694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.1103	199.1557	194.0014	183.0284	169.1771	156.1588	147.4618	145.4164	150.5707	161.5436	175.3949	188.4133	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	72.2856	70.2561	66.0468	60.3266	56.6121	51.3841	46.9432	52.6363	54.6613	60.5813	67.2665	70.2689	(72)
Total internal gains	347.5150	345.4673	333.0424	313.1106	292.9965	273.5750	260.9501	266.6613	276.9020	297.0336	320.1184	337.3142	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.4600	10.6334	0.6300	0.7000	0.7700		20.9931	
South					4.3600	46.7521	0.6300	0.7000	0.7700		62.2958 (74)	
Solar gains	83.2889	142.1434	198.1329	256.3856	300.5708	305.2139	291.3539	256.7368	217.7243	157.7993	99.7395	71.3302 (83)
Total gains	430.8039	487.6107	531.1753	569.4963	593.5673	578.7888	552.3040	523.3981	494.6263	454.8329	419.8579	408.6445 (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	35.0587	35.1713	35.2823	35.8136	35.9147	36.3933	36.3933	36.4834	36.2075	35.9147	35.7106	35.4998
alpha	3.3372	3.3448	3.3522	3.3876	3.3943	3.4262	3.4262	3.4322	3.4138	3.3943	3.3807	3.3667
util living area	0.9876	0.9803	0.9664	0.9345	0.8670	0.7420	0.5990	0.6420	0.8300	0.9455	0.9803	0.9896 (86)
MIT	19.0952	19.2967	19.6267	20.0726	20.4892	20.8026	20.9314	20.9114	20.6830	20.1554	19.5545	19.0659 (87)
Th 2	19.8889	19.8921	19.8952	19.9097	19.9124	19.9252	19.9252	19.9275	19.9203	19.9124	19.9069	19.9012 (88)
util rest of house	0.9849	0.9759	0.9584	0.9175	0.8289	0.6632	0.4776	0.5243	0.7684	0.9280	0.9751	0.9873 (89)
MIT 2	18.1614	18.3634	18.6917	19.1377	19.5320	19.8110	19.8993	19.8912	19.7165	19.2257	18.6317	18.1414 (90)
Living area fraction	18.3898	18.5917	18.9204	19.3664	19.7661	20.0535	20.1517	20.1407	fLA = Living area / (4) =			0.2446 (91)
MIT	18.3898	18.5917	18.9204	19.3664	19.7661	20.0535	20.1517	20.1407	19.9529	19.4531	18.8574	18.3675 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3898	18.5917	18.9204	19.3664	19.7661	20.0535	20.1517	20.1407	19.9529	19.4531	18.8574	18.3675 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9690	0.9494	0.9070	0.8229	0.6737	0.5052	0.5499	0.7705	0.9186	0.9684	0.9828	(94)
Useful gains	422.0827	472.4781	504.2746	516.5488	488.4392	389.9494	279.0132	287.8196	381.1307	417.8018	406.6044	401.6158	(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	1220.5963	1182.3094	1069.1509	887.5873	682.1047	455.1073	296.3998	311.4048	490.9461	748.6617	999.9433	1212.0739	(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	594.0941	477.0066	420.2680	267.1478	144.0871	0.0000	0.0000	0.0000	0.0000	246.1597	427.2041	602.9808	(98)
Space heating												3178.9482	(98)
Space heating per m2												(98) / (4) =	45.4655 (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													3504.9043 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	594.0941	477.0066	420.2680	267.1478	144.0871	0.0000	0.0000	0.0000	0.0000	246.1597	427.2041	602.9808	(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)	655.0100	525.9169	463.3605	294.5400	158.8612	0.0000	0.0000	0.0000	0.0000	271.3999	471.0078	664.8080	(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	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(64)
Efficiency of water heater (217)m	89.9044	89.8476	89.7339	89.4844	88.9862	87.2000	87.2000	87.2000	87.2000	89.3886	89.7559	87.2000	(216)
Fuel for water heating, kWh/month	186.8868	164.3363	171.6681	152.7405	149.3670	134.5172	127.5998	142.2187	142.6652	158.6419	169.0375	181.8125	(219)
Water heating fuel used												1881.4916	(219)
Annual totals kWh/year													
Space heating fuel - main system												3504.9043	(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)												325.9458	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.70 * 1080 * 1.00) =										-604.5338		-604.5338	(233)
Total delivered energy for all uses												5182.8079	(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	3504.9043	0.2160	757.0593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1881.4916	0.2160	406.4022 (264)
Space and water heating			1163.4615 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	325.9458	0.5190	169.1659 (268)
Energy saving/generation technologies			
PV Unit	-604.5338	0.5190	-313.7530 (269)
Total CO2, kg/year			1057.7993 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1300 (273)

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

DER		15.1300	ZC1
Total Floor Area	TFA	69.9200	
Assumed number of occupants	N	2.2442	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.7053	ZC2
CO2 emissions from cooking, equation (L16)		2.4723	ZC3
Total CO2 emissions		34.3076	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3076	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	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3635 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3362 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4287	0.4203	0.4119	0.3699	0.3615	0.3194	0.3194	0.3110	0.3362	0.3615	0.3783	0.3951 (22b)
Effective ac	0.5919	0.5883	0.5848	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5715	0.5780 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			10.8200	1.3258	14.3447		(27)
Ground Floor			34.9600	0.1300	4.5448		(28a)
Brick and Block	84.2300	12.9400	71.2900	0.1800	12.8322		(29a)
Party Wall Step	2.5700		2.5700	0.1800	0.4626		(29a)
External Roof 1	34.9600		34.9600	0.1300	4.5448		(30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.8491		(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)							9.2105 (36)
Total fabric heat loss						(33) + (36) =	48.0596 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.4161	34.2087	34.0053	33.0500	32.8713	32.0392	32.0392	31.8852	32.3597	32.8713	33.2328	33.6108 (38)
Heat transfer coeff	82.4757	82.2683	82.0649	81.1096	80.9309	80.0988	80.0988	79.9448	80.4193	80.9309	81.2924	81.6704 (39)
Average = Sum(39)m / 12 =												81.1087 (39)
HLP	1.1796	1.1766	1.1737	1.1600	1.1575	1.1456	1.1456	1.1434	1.1502	1.1575	1.1626	1.1681 (40)
HLP (average)												1.1600 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2442 (42)
Average daily hot water use (litres/day)												87.4993 (43)
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (45)
Energy content (annual)										Total = Sum(45)m =		1376.7047 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	19.0938	20.7347 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.0476	42.6901	45.4805	42.2873	41.9134	38.8353	40.1298	41.9134	42.2873	45.4805	45.7394	49.0476 (61)
Total heat required for water heating calculated for each month	191.7824	167.5269	174.3008	154.5961	149.6763	131.8265	126.2998	140.7947	142.3496	162.0934	173.0315	187.2786 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	191.7824	167.5269	174.3008	154.5961	149.6763	131.8265	126.2998	140.7947	142.3496	162.0934	173.0315	187.2786 (64)
Heat gains from water heating, kWh/month	59.7212	52.1808	54.2029	47.9145	46.3095	40.6284	38.6840	43.3564	43.8425	50.1439	53.7595	58.2237 (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	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4564	16.3928	13.3315	10.0928	7.5445	6.3694	6.8823	8.9459	12.0072	15.2459	17.7942	18.9694 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.1103	199.1557	194.0014	183.0284	169.1771	156.1588	147.4618	145.4164	150.5707	161.5436	175.3949	188.4133 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209 (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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672 (71)
Water heating gains (Table 5)	80.2705	77.6499	72.8534	66.5479	62.2440	56.4283	51.9946	58.2747	60.8924	67.3978	74.6660	78.2577 (72)
Total internal gains	355.4998	352.8611	339.8490	319.3319	298.6283	278.6192	266.0014	272.2997	283.1331	303.8500	327.5179	345.3030 (73)

6. Solar gains

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.8725	59.0210	59.1673	59.8641	59.9963	60.6195	60.6195	60.7364	60.3780	59.9963	59.7295	59.4530
alpha	4.9248	4.9347	4.9445	4.9909	4.9998	5.0413	5.0413	5.0491	5.0252	4.9998	4.9820	4.9635
util living area	0.9976	0.9951	0.9891	0.9699	0.9125	0.7759	0.6077	0.6571	0.8737	0.9770	0.9951	0.9981 (86)
MIT	19.7447	19.8879	20.1202	20.4328	20.7238	20.9198	20.9816	20.9730	20.8424	20.4760	20.0555	19.7198 (87)
Th 2	19.9364	19.9388	19.9411	19.9521	19.9542	19.9638	19.9638	19.9656	19.9601	19.9542	19.9500	19.9456 (88)
util rest of house	0.9967	0.9934	0.9851	0.9578	0.8752	0.6868	0.4769	0.5276	0.8076	0.9653	0.9931	0.9975 (89)
MIT 2	18.2687	18.4793	18.8185	19.2746	19.6720	19.9073	19.9567	19.9539	19.8288	19.3424	18.7325	18.2390 (90)
Living area fraction	18.6297	18.8238	19.1369	19.5578	19.9292	20.1550	20.2073	20.2031	20.0767	19.6196	19.0560	18.6011 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6297	18.8238	19.1369	19.5578	19.9292	20.1550	20.2073	20.2031	20.0767	19.6196	19.0560	18.6011 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	436.6862	490.4992	527.6858	548.0027	523.7533	411.5697	283.7741	295.8633	408.8928	443.3061	423.2387	415.0715 (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	1181.8497	1145.4872	1037.0422	864.4537	665.9998	444.9451	288.9427	304.0392	480.6395	729.9647	971.9358	1176.1474 (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	554.4016	440.1519	378.9611	227.8447	105.8314	0.0000	0.0000	0.0000	0.0000	213.2740	395.0619	566.2405 (98)
Space heating												2881.7673 (98)
Space heating per m2												41.2152 (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													3085.4039 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	554.4016	440.1519	378.9611	227.8447	105.8314	0.0000	0.0000	0.0000	0.0000	213.2740	395.0619	566.2405	(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)	593.5778	471.2547	405.7400	243.9451	113.3099	0.0000	0.0000	0.0000	0.0000	228.3448	422.9785	606.2532	(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	191.7824	167.5269	174.3008	154.5961	149.6763	131.8265	126.2998	140.7947	142.3496	162.0934	173.0315	187.2786	(64)
Efficiency of water heater (217)m	87.5691	87.3704	86.9544	86.0261	84.1963	80.3000	80.3000	80.3000	80.3000	85.7429	87.0646	80.3000	(216)
Fuel for water heating, kWh/month	219.0068	191.7432	200.4509	179.7084	177.7705	164.1675	157.2850	175.3359	177.2723	189.0458	198.7393	213.6428	(219)
Water heating fuel used												2244.1684	(219)
Annual totals kWh/year													
Space heating fuel - main system												3085.4039	(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)												325.9458	(232)
Total delivered energy for all uses												5730.5181	(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	3085.4039	0.2160	666.4472 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2244.1684	0.2160	484.7404 (264)
Space and water heating			1151.1876 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	325.9458	0.5190	169.1659 (268)
Total CO2, kg/m2/year			1359.2785 (272)
Emissions per m2 for space and water heating			16.4644 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4194 (272b)
Emissions per m2 for pumps and fans			0.5567 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4644 * 1.00) + 2.4194 + 0.5567, rounded to 2 d.p.			19.4400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3635 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3362 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4287	0.4203	0.4119	0.3699	0.3615	0.3194	0.3194	0.3110	0.3362	0.3615	0.3783	0.3951 (22b)
Effective ac	0.5919	0.5883	0.5848	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5715	0.5780 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			9.0000	314.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10618.9948 (34)
151.8735 (35)
10.2245 (36)
(33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.4161	34.2087	34.0053	33.0500	32.8713	32.0392	32.0392	31.8852	32.3597	32.8713	33.2328	33.6108 (38)
Heat transfer coeff	84.8309	84.6234	84.4201	83.4648	83.2860	82.4540	82.4540	82.2999	82.7745	83.2860	83.6476	84.0256 (39)
Average = Sum(39)m / 12 =												83.4639 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2133	1.2103	1.2074	1.1937	1.1912	1.1793	1.1793	1.1771	1.1838	1.1912	1.1963	1.2017 (40)
HLP (average)												1.1937 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.2442 (42)
87.4993 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 = 1376.7047 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.3312	26.5278	27.3743	23.8656	22.8996	19.7606	18.3111	21.0123	21.2632	24.7803	27.0496	29.3741 (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	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4564	16.3928	13.3315	10.0928	7.5445	6.3694	6.8823	8.9459	12.0072	15.2459	17.7942	18.9694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.1103	199.1557	194.0014	183.0284	169.1771	156.1588	147.4618	145.4164	150.5707	161.5436	175.3949	188.4133	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	40.7677	39.4759	36.7935	33.1467	30.7791	27.4453	24.6117	28.2423	29.5323	33.3068	37.5689	39.4813	(72)
Total internal gains	312.9971	311.6871	300.7891	282.9307	264.1634	246.6362	235.6186	239.2673	248.7729	266.7590	287.4208	303.5266	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	6.4600				10.6334	0.6300	0.7000	0.7700	20.9931 (74)			
South	4.3600				46.7521	0.6300	0.7000	0.7700	62.2958 (78)			

Solar gains	83.2889	142.1434	198.1329	256.3856	300.5708	305.2139	291.3539	256.7368	217.7243	157.7993	99.7395	71.3302 (83)
Total gains	396.2860	453.8305	498.9220	539.3163	564.7342	551.8501	526.9725	496.0041	466.4972	424.5583	387.1603	374.8569 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.7718	34.8570	34.9410	35.3409	35.4167	35.7741	35.7741	35.8411	35.6356	35.4167	35.2637	35.1050	
alpha	3.3181	3.3238	3.3294	3.3561	3.3611	3.3849	3.3849	3.3894	3.3757	3.3611	3.3509	3.3403	
util living area	0.9894	0.9826	0.9695	0.9393	0.8747	0.7544	0.6132	0.6591	0.8425	0.9514	0.9831	0.9912	(86)
MIT	19.0375	19.2431	19.5797	20.0309	20.4595	20.7847	20.9234	20.9001	20.6562	20.1095	19.4953	19.0018	(87)
Th 2	19.9094	19.9118	19.9141	19.9250	19.9271	19.9366	19.9366	19.9384	19.9329	19.9271	19.9229	19.9186	(88)
util rest of house	0.9871	0.9788	0.9624	0.9237	0.8389	0.6781	0.4927	0.5430	0.7845	0.9359	0.9787	0.9893	(89)
MIT 2	18.1223	18.3281	18.6628	19.1125	19.5197	19.8094	19.9067	19.8961	19.7074	19.1960	18.5883	18.0936	(90)
Living area fraction	18.3461	18.5518	18.8870	19.3371	19.7495	20.0480	20.1554	20.1416	19.9395	19.4194	18.8102	18.3157	(91)
Temperature adjustment	18.3461	18.5518	18.8870	19.3371	19.7495	20.0480	20.1554	20.1416	19.9395	19.4194	18.8102	18.3157	(92)
adjusted MIT	18.3461	18.5518	18.8870	19.3371	19.7495	20.0480	20.1554	20.1416	19.9395	19.4194	18.8102	18.3157	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	389.3714	441.2659	475.7778	492.4119	469.7835	379.1662	273.8083	281.4634	366.1840	393.3145	376.5348	369.3509	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1191.5460	1155.2662	1045.7142	871.1293	670.4139	449.2062	293.1545	307.9356	483.3593	734.5332	979.5264	1186.0808	(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	596.8179	479.8082	424.0327	272.6765	149.2690	0.0000	0.0000	0.0000	0.0000	253.8667	434.1540	607.6470	(98)
Space heating												3218.2721	(98)
Space heating per m2												46.0279	(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	775.0679	610.1598	625.4796	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7476	0.8209	0.7943	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	579.4583	500.8608	496.8224	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	728.7780	698.0462	663.3214	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	107.5102	146.7060	123.8752	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												378.0914 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	26.8775	36.6765	30.9688	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												94.5228 (107)
Space cooling per m2												1.3519 (108)
Energy for space heating												46.0279 (99)
Energy for space cooling												1.3519 (108)
Total												47.3798 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.4 (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	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
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											2 * 10 =	20.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										20.0000	/ (5) =	0.1135 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3635 (18)		
Number of sides sheltered												1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3362 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
Adj infilt rate	0.4287	0.4203	0.4119	0.3699	0.3615	0.3194	0.3194	0.3110	0.3362	0.3615	0.3783	0.3951 (22b)		
Effective ac	0.5919	0.5883	0.5848	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5715	0.5780 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			10.8200	1.3258	14.3447			(27)					
Ground Floor			34.9600	0.1300	4.5448			(28a)					
Brick and Block	84.2300	12.9400	71.2900	0.1800	12.8322			(29a)					
Party Wall Step	2.5700		2.5700	0.1800	0.4626			(29a)					
External Roof 1	34.9600		34.9600	0.1300	4.5448			(30)					
Total net area of external elements Aum(A, m2)			156.7200					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.8491			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2105	(36)					
Total fabric heat loss						(33) + (36) =	48.0596	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.4161	Feb 34.2087	Mar 34.0053	Apr 33.0500	May 32.8713	Jun 32.0392	Jul 32.0392	Aug 31.8852	Sep 32.3597	Oct 32.8713	Nov 33.2328	Dec 33.6108	(38)
Heat transfer coeff	82.4757	82.2683	82.0649	81.1096	80.9309	80.0988	80.0988	79.9448	80.4193	80.9309	81.2924	81.6704	(39)
Average = Sum(39)m / 12 =												81.1087	(39)
HLP	Jan 1.1796	Feb 1.1766	Mar 1.1737	Apr 1.1600	May 1.1575	Jun 1.1456	Jul 1.1456	Aug 1.1434	Sep 1.1502	Oct 1.1575	Nov 1.1626	Dec 1.1681	(40)
HLP (average)												1.1600	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2442 (42)
Average daily hot water use (litres/day)												87.4993 (43)
Daily hot water use	Jan 96.2492	Feb 92.7493	Mar 89.2493	Apr 85.7493	May 82.2493	Jun 78.7494	Jul 78.7494	Aug 82.2493	Sep 85.7493	Oct 89.2493	Nov 92.7493	Dec 96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (45)
Energy content (annual)												Total = Sum(45)m = 1376.7047 (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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.3312	26.5278	27.3743	23.8656	22.8996	19.7606	18.3111	21.0123	21.2632	24.7803	27.0496	29.3741	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	112.2091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4564	16.3928	13.3315	10.0928	7.5445	6.3694	6.8823	8.9459	12.0072	15.2459	17.7942	18.9694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.1103	199.1557	194.0014	183.0284	169.1771	156.1588	147.4618	145.4164	150.5707	161.5436	175.3949	188.4133	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	34.2209	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	40.7677	39.4759	36.7935	33.1467	30.7791	27.4453	24.6117	28.2423	29.5323	33.3068	37.5689	39.4813	(72)
Total internal gains	312.9971	311.6871	300.7891	282.9307	264.1634	246.6362	235.6186	239.2673	248.7729	266.7590	287.4208	303.5266	(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		
North			6.4600		10.6334		0.6300		0.7000		0.7700		20.9931 (74)
South			4.3600		46.7521		0.6300		0.7000		0.7700		62.2958 (78)

Solar gains	83.2889	142.1434	198.1329	256.3856	300.5708	305.2139	291.3539	256.7368	217.7243	157.7993	99.7395	71.3302	(83)
Total gains	396.2860	453.8305	498.9220	539.3163	564.7342	551.8501	526.9725	496.0041	466.4972	424.5583	387.1603	374.8569	(84)

7. Mean internal temperature (heating season)													

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	58.8725	59.0210	59.1673	59.8641	59.9963	60.6195	60.6195	60.7364	60.3780	59.9963	59.7295	59.4530	
alpha	4.9248	4.9347	4.9445	4.9909	4.9998	5.0413	5.0413	5.0491	5.0252	4.9998	4.9820	4.9635	
util living area	0.9985	0.9967	0.9921	0.9767	0.9277	0.8023	0.6368	0.6908	0.8973	0.9835	0.9968	0.9988	(86)
MIT	19.6885	19.8341	20.0705	20.3904	20.6932	20.9060	20.9774	20.9662	20.8169	20.4311	20.0029	19.6644	(87)
Th 2	19.9364	19.9388	19.9411	19.9521	19.9542	19.9638	19.9638	19.9656	19.9601	19.9542	19.9500	19.9456	(88)
util rest of house	0.9979	0.9955	0.9891	0.9669	0.8949	0.7159	0.5026	0.5592	0.8382	0.9749	0.9955	0.9984	(89)
MIT 2	18.7418	18.8889	19.1258	19.4494	19.7360	19.9173	19.9577	19.9553	19.8523	19.4939	19.0666	18.7251	(90)
Living area fraction									fLA = Living area / (4) =				
MIT	18.9733	19.1200	19.3569	19.6795	19.9701	20.1591	20.2070	20.2025	20.0882	19.7231	19.2956	18.9548	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9733	19.1200	19.3569	19.6795	19.9701	20.1591	20.2070	20.2025	20.0882	19.7231	19.2956	18.9548	(93)

8. Space heating requirement													

Utilisation	0.9972	0.9943	0.9869	0.9636	0.8955	0.7342	0.5360	0.5918	0.8470	0.9723	0.9943	0.9979	(94)
Useful gains	395.1932	451.2249	492.3635	519.6959	505.6932	405.1525	282.4413	293.5144	395.1242	412.7886	384.9726	374.0711	(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	1210.1927	1169.8583	1055.0980	874.3204	669.3042	445.2808	288.9201	303.9909	481.5691	738.3390	991.4103	1205.0313	(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	606.3596	482.9217	418.6744	255.3296	121.7266	0.0000	0.0000	0.0000	0.0000	242.2095	436.6351	618.2344	(98)
Space heating												3182.0908	(98)
Space heating per m2												45.5105	(99)

8c. Space cooling requirement													

Calculated for June, July and August. See Table 10b													
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	752.9291	592.7314	607.5802	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8206	0.8946	0.8690	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	617.8368	530.2637	528.0144	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	728.7780	698.0462	663.3214	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	79.8776	124.8302	100.6684	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												305.3762	(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	19.9694	31.2076	25.1671	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												76.3441 (107)
Space cooling per m2												1.0919 (108)
Energy for space heating												45.5105 (99)
Energy for space cooling												1.0919 (108)
Total												46.6023 (109)
Target Fabric Energy Efficiency (TFEE)												53.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3887 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4956	0.4568	0.4471	0.4179	0.4179	0.3887	0.3887	0.3790	0.3887	0.4373	0.4276	0.4568 (22b)
Effective ac	0.6228	0.6043	0.5999	0.5873	0.5873	0.5756	0.5756	0.5718	0.5756	0.5956	0.5914	0.6043 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			18.0000	629.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.2149	35.1385	34.8831	34.1500	34.1500	33.4662	33.4662	33.2493	33.4662	34.6333	34.3889	35.1385 (38)
Heat transfer coeff	86.6297	85.5533	85.2979	84.5648	84.5648	83.8810	83.8810	83.6641	83.8810	85.0480	84.8037	85.5533 (39)
Average = Sum(39)m / 12 =												84.7769 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2390	1.2236	1.2199	1.2095	1.2095	1.1997	1.1997	1.1966	1.1997	1.2164	1.2129	1.2236 (40)
HLP (average)												1.2125 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2442 (42)
Average daily hot water use (litres/day) 87.4993 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 = 1376.7047 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	19.0938	20.7347 (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	25.2847	22.8154	25.2242	24.3701	25.1531	24.3078	25.0970	25.1334	24.3418	25.1948	24.4289	25.2730 (61)
Total heat required for water heating calculated for each month	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.7805	47.2121	49.1388	43.4352	42.1194	36.9965	34.9258	39.1614	39.3562	45.0725	48.4319	52.2801 (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	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1410	40.9820	33.3288	25.2321	18.8613	15.9235	17.2059	22.3648	30.0180	38.1148	44.4856	47.4234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1944	297.2473	289.5543	273.1768	252.5031	233.0728	220.0922	217.0394	224.7324	241.1099	261.7835	281.2138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	72.2856	70.2561	66.0468	60.3266	56.6121	51.3841	46.9432	52.6363	54.6613	60.5813	67.2665	70.2689	(72)
Total internal gains	511.2140	507.0782	487.5228	457.3284	426.5694	398.9732	382.8342	390.6334	408.0046	438.3989	472.1285	497.4990	(73)

6. Solar gains

[Jan]												Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W		
North												6.4600	13.8645		0.6300		0.7000		0.7700		27.3722		(74)	
South												4.3600	58.2505		0.6300		0.7000		0.7700		77.6172		(78)	
Solar gains	104.9894	153.4490	214.1419	285.1358	321.8158	354.6632	330.0706	295.2987	250.5017	180.5107	124.6271											85.8362 (83)		
Total gains	616.2034	660.5273	701.6647	742.4641	748.3852	753.6364	712.9048	685.9321	658.5063	618.9096	596.7556											583.3352 (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	35.0587	35.4998	35.6060	35.9147	35.9147	36.2075	36.2075	36.3014	36.2075	35.7106	35.8136	35.4998
alpha	3.3372	3.3667	3.3737	3.3943	3.3943	3.4138	3.4138	3.4201	3.4138	3.3807	3.3876	3.3667
util living area	0.9591	0.9478	0.9199	0.8612	0.7519	0.5699	0.4206	0.4345	0.6607	0.8526	0.9335	0.9637 (86)
MIT	19.5816	19.7213	20.0196	20.3900	20.7225	20.9242	20.9802	20.9783	20.8715	20.5221	20.0397	19.5696 (87)
Th 2	19.8889	19.9012	19.9041	19.9124	19.9124	19.9203	19.9203	19.9227	19.9203	19.9069	19.9097	19.9012 (88)
util rest of house	0.9503	0.9369	0.9026	0.8302	0.6940	0.4779	0.3044	0.3155	0.5724	0.8115	0.9170	0.9558 (89)
MIT 2	18.6401	18.7850	19.0761	19.4320	19.7264	19.8845	19.9151	19.9170	19.8528	19.5557	19.1046	18.6382 (90)
Living area fraction	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	fLA = Living area / (4) =		0.2446 (91)
MIT	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9402	0.9261	0.8913	0.8221	0.6973	0.4976	0.3328	0.3445	0.5885	0.8065	0.9064	0.9464	(94)
Ext temp.	579.3700	611.6935	625.3883	610.3868	521.8828	375.0089	237.2246	236.2758	387.5106	499.1230	540.8705	552.0405	(95)
Heat loss rate W	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Month fracti	1166.9334	1139.0586	1024.1597	851.2511	623.2421	397.4951	241.2054	240.6643	427.9555	679.7073	927.1809	1143.5049	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
RHI space heating demand	437.1472	354.3894	296.6859	173.4223	75.4113	0.0000	0.0000	0.0000	0.0000	134.3547	278.1434	440.0495	(98)
Space heating												2189.6037	(98)
RHI space heating demand												2190	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (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) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3887 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4956	0.4859	0.4762	0.4276	0.4179	0.3693	0.3693	0.3596	0.3887	0.4179	0.4373	0.4568 (22b)
Effective ac	0.6228	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			18.0000	629.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10933.6348 (34)
156.3735 (35)
10.2245 (36)
(33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.2149	35.9376	35.6657	34.3889	34.1500	33.0379	33.0379	32.8319	33.4662	34.1500	34.6333	35.1385 (38)
Heat transfer coeff	86.6297	86.3524	86.0805	84.8037	84.5648	83.4527	83.4527	83.2467	83.8810	84.5648	85.0480	85.5533 (39)
Average = Sum(39)m / 12 =												84.8025 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2390	1.2350	1.2311	1.2129	1.2095	1.1935	1.1935	1.1906	1.1997	1.2095	1.2164	1.2236 (40)
HLP (average)												1.2129 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.2442 (42)
87.4993 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 =	1376.7047 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	19.0938	20.7347	(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	25.2847	22.8154	25.2242	24.3701	25.1531	24.3078	25.0970	25.1334	24.3418	25.1948	24.4289	25.2730	(61)
Total heat required for water heating calculated for each month	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(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	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(64)
Heat gains from water heating, kWh/month	53.7805	47.2121	49.1388	43.4352	42.1194	36.9965	34.9258	39.1614	39.3562	45.0725	48.4319	52.2801	(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	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1410	40.9820	33.3288	25.2321	18.8613	15.9235	17.2059	22.3648	30.0180	38.1148	44.4856	47.4234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1944	297.2473	289.5543	273.1768	252.5031	233.0728	220.0922	217.0394	224.7324	241.1099	261.7835	281.2138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	72.2856	70.2561	66.0468	60.3266	56.6121	51.3841	46.9432	52.6363	54.6613	60.5813	67.2665	70.2689	(72)
Total internal gains	511.2140	507.0782	487.5228	457.3284	426.5694	398.9732	382.8342	390.6334	408.0046	438.3989	472.1285	497.4990	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					6.4600	10.6334	0.6300	0.7000			0.7700	20.9931
South					4.3600	46.7521	0.6300	0.7000			0.7700	62.2958 (74)

Solar gains	83.2889	142.1434	198.1329	256.3856	300.5708	305.2139	291.3539	256.7368	217.7243	157.7993	99.7395	71.3302 (83)
Total gains	594.5029	649.2216	685.6557	713.7140	727.1403	704.1871	674.1881	647.3702	625.7289	596.1982	571.8680	568.8292 (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	35.0587	35.1713	35.2823	35.8136	35.9147	36.3933	36.3933	36.4834	36.2075	35.9147	35.7106	35.4998	
alpha	3.3372	3.3448	3.3522	3.3876	3.3943	3.4262	3.4262	3.4322	3.4138	3.3943	3.3807	3.3667	
util living area	0.9691	0.9567	0.9347	0.8883	0.8017	0.6578	0.5115	0.5474	0.7424	0.8949	0.9538	0.9729	(86)
MIT	19.3762	19.5639	19.8650	20.2637	20.6176	20.8663	20.9578	20.9460	20.7848	20.3499	19.8055	19.3449	(87)
Th 2	19.8889	19.8921	19.8952	19.9097	19.9124	19.9252	19.9252	19.9275	19.9203	19.9124	19.9069	19.9012	(88)
util rest of house	0.9627	0.9478	0.9208	0.8630	0.7544	0.5758	0.3998	0.4367	0.6698	0.8661	0.9428	0.9673	(89)
MIT 2	18.4376	18.6239	18.9201	19.3132	19.6382	19.8517	19.9102	19.9068	19.7901	19.4030	18.8751	18.4162	(90)
Living area fraction	18.6672	18.8538	19.1512	19.5457	19.8777	20.0998	20.1664	20.1610	20.0334	19.6346	19.1027	18.6433	(91)
MIT	18.6672	18.8538	19.1512	19.5457	19.8777	20.0998	20.1664	20.1610	20.0334	19.6346	19.1027	18.6433	(92)
Temperature adjustment	18.6672	18.8538	19.1512	19.5457	19.8777	20.0998	20.1664	20.1610	20.0334	19.6346	19.1027	18.6433	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9538	0.9375	0.9094	0.8532	0.7527	0.5901	0.4261	0.4621	0.6783	0.8574	0.9327	0.9590	(94)
Ext temp.	567.0093	608.6148	623.5038	608.9158	547.3005	415.5754	287.2522	299.1716	424.4019	511.1752	533.3615	545.5090	(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	1244.6222	1204.9440	1089.0238	902.7917	691.5462	458.9746	297.6233	313.0878	497.6964	764.0046	1020.8026	1235.6743	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	504.1440	400.7332	346.3469	211.5906	107.3188	0.0000	0.0000	0.0000	0.0000	188.1051	350.9576	513.4830	(98)
Space heating per m2													(98) / (4) =

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												2891.5978	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	504.1440	400.7332	346.3469	211.5906	107.3188	0.0000	0.0000	0.0000	0.0000	188.1051	350.9576	513.4830	(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)	555.8368	441.8228	381.8598	233.2863	118.3228	0.0000	0.0000	0.0000	0.0000	207.3926	386.9433	566.1334	(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	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(64)
Efficiency of water heater (217)m	89.7990	89.7303	89.5930	89.2934	88.7296	87.2000	87.2000	87.2000	87.2000	89.1617	89.6144	87.2000	(216)
Fuel for water heating, kWh/month	187.1062	164.5511	171.9383	153.0671	149.7990	134.5172	127.5998	142.2187	142.6652	159.0455	169.3044	182.0166	(219)
Water heating fuel used												1883.8290	(219)
Annual totals kWh/year													
Space heating fuel - main system												2891.5978	(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)												325.9458	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.70 * 1080 * 1.00) =										-604.5338		-604.5338	(233)
Total delivered energy for all uses												4571.8387	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2891.5978	3.4800	100.6276 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1883.8290	3.4800	65.5572 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	325.9458	13.1900	42.9922 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-604.5338	13.1900	-79.7380 (252)
Total energy cost			259.3316 (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] =	0.9478 (257)
SAP value	86.7784	
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	2891.5978	0.2160	624.5851	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1883.8290	0.2160	406.9071	(264)
Space and water heating			1031.4922	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	325.9458	0.5190	169.1659	(268)
Energy saving/generation technologies				
PV Unit	-604.5338	0.5190	-313.7530	(269)
Total kg/year			925.8300	(272)
CO2 emissions per m2			13.2400	(273)
EI value			89.2046	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8871 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8871 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (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) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3887 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4956	0.4568	0.4471	0.4179	0.4179	0.3887	0.3887	0.3790	0.3887	0.4373	0.4276	0.4568 (22b)
Effective ac	0.6228	0.6043	0.5999	0.5873	0.5873	0.5756	0.5756	0.5718	0.5756	0.5956	0.5914	0.6043 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			18.0000	629.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.2149	35.1385	34.8831	34.1500	34.1500	33.4662	33.4662	33.2493	33.4662	34.6333	34.3889	35.1385 (38)
Heat transfer coeff	86.6297	85.5533	85.2979	84.5648	84.5648	83.8810	83.8810	83.6641	83.8810	85.0480	84.8037	85.5533 (39)
Average = Sum(39)m / 12 =												84.7769 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2390	1.2236	1.2199	1.2095	1.2095	1.1997	1.1997	1.1966	1.1997	1.2164	1.2129	1.2236 (40)
HLP (average)												1.2125 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2442 (42)
Average daily hot water use (litres/day) 87.4993 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 =	1376.7047 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	19.0938	20.7347	(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	25.2847	22.8154	25.2242	24.3701	25.1531	24.3078	25.0970	25.1334	24.3418	25.1948	24.4289	25.2730	(61)
Total heat required for water heating calculated for each month	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(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	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(64)
Heat gains from water heating, kWh/month	53.7805	47.2121	49.1388	43.4352	42.1194	36.9965	34.9258	39.1614	39.3562	45.0725	48.4319	52.2801	(65)
Total per year (kWh/year) = Sum(64)m =												1673.3288	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1410	40.9820	33.3288	25.2321	18.8613	15.9235	17.2059	22.3648	30.0180	38.1148	44.4856	47.4234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1944	297.2473	289.5543	273.1768	252.5031	233.0728	220.0922	217.0394	224.7324	241.1099	261.7835	281.2138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	72.2856	70.2561	66.0468	60.3266	56.6121	51.3841	46.9432	52.6363	54.6613	60.5813	67.2665	70.2689	(72)
Total internal gains	511.2140	507.0782	487.5228	457.3284	426.5694	398.9732	382.8342	390.6334	408.0046	438.3989	472.1285	497.4990	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North					6.4600	13.8645	0.6300	0.7000	0.7700				27.3722 (74)
South					4.3600	58.2505	0.6300	0.7000	0.7700				77.6172 (78)

Solar gains	104.9894	153.4490	214.1419	285.1358	321.8158	354.6632	330.0706	295.2987	250.5017	180.5107	124.6271	85.8362	(83)
Total gains	616.2034	660.5273	701.6647	742.4641	748.3852	753.6364	712.9048	685.9321	658.5063	618.9096	596.7556	583.3352	(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	35.0587	35.4998	35.6060	35.9147	35.9147	36.2075	36.2075	36.3014	36.2075	35.7106	35.8136	35.4998	
alpha	3.3372	3.3667	3.3737	3.3943	3.3943	3.4138	3.4138	3.4201	3.4138	3.3807	3.3876	3.3667	
util living area	0.9591	0.9478	0.9199	0.8612	0.7519	0.5699	0.4206	0.4345	0.6607	0.8526	0.9335	0.9637	(86)
MIT	19.5816	19.7213	20.0196	20.3900	20.7225	20.9242	20.9802	20.9783	20.8715	20.5221	20.0397	19.5696	(87)
Th 2	19.8889	19.9012	19.9041	19.9124	19.9124	19.9203	19.9203	19.9227	19.9203	19.9069	19.9097	19.9012	(88)
util rest of house	0.9503	0.9369	0.9026	0.8302	0.6940	0.4779	0.3044	0.3155	0.5724	0.8115	0.9170	0.9558	(89)
MIT 2	18.6401	18.7850	19.0761	19.4320	19.7264	19.8845	19.9151	19.9170	19.8528	19.5557	19.1046	18.6382	(90)
Living area fraction	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660	(91)
MIT	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660	(92)
Temperature adjustment	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660	(93)
adjusted MIT	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9402	0.9261	0.8913	0.8221	0.6973	0.4976	0.3328	0.3445	0.5885	0.8065	0.9064	0.9464	(94)
Useful gains	579.3700	611.6935	625.3883	610.3868	521.8828	375.0089	237.2246	236.2758	387.5106	499.1230	540.8705	552.0405	(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	1166.9334	1139.0586	1024.1597	851.2511	623.2421	397.4951	241.2054	240.6643	427.9555	679.7073	927.1809	1143.5049	(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	437.1472	354.3894	296.6859	173.4223	75.4113	0.0000	0.0000	0.0000	0.0000	134.3547	278.1434	440.0495	(98)
Space heating												2189.6037	(98)
Space heating per m2												31.3158	(99)
(98) / (4) =													

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													2414.1165 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	437.1472	354.3894	296.6859	173.4223	75.4113	0.0000	0.0000	0.0000	0.0000	134.3547	278.1434	440.0495	(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)	481.9704	390.7270	327.1068	191.2043	83.1437	0.0000	0.0000	0.0000	0.0000	148.1309	306.6631	485.1703	(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	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210	163.5041	(64)
Efficiency of water heater (217)m	89.7004	89.6418	89.4726	89.1233	88.4353	87.2000	87.2000	87.2000	87.2000	88.8684	89.4330	87.2000	(216)
Fuel for water heating, kWh/month	187.3119	164.7135	172.1695	153.3592	150.2974	134.5172	127.5998	142.2187	142.6652	159.5705	169.6476	182.2292	(219)
Water heating fuel used												1886.2998	(219)
Annual totals kWh/year													
Space heating fuel - main system												2414.1165	(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)												325.9458	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.70 * 1234 * 1.00) =										-691.3003		-691.3003	(233)
Total delivered energy for all uses												4010.0618	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2414.1165	9.7400	235.1350 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1886.2998	9.7400	183.7256 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	325.9458	36.8500	120.1110 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-691.3003	36.8500	-254.7442 (252)
Total energy cost			415.8649 (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	2414.1165	0.2160	521.4492 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1886.2998	0.2160	407.4408 (264)
Space and water heating			928.8899 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	325.9458	0.5190	169.1659 (268)
Energy saving/generation technologies			
PV Unit	-691.3003	0.5190	-358.7849 (269)
Total kg/year			778.1959 (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	2414.1165	1.2200	2945.2222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1886.2998	1.2200	2301.2858 (264)
Space and water heating			5246.5080 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	325.9458	3.0700	1000.6535 (268)
Energy saving/generation technologies			
PV Unit	-691.3003	3.0700	-2122.2920 (269)
Primary energy kWh/year			4355.1195 (272)
Primary energy kWh/m2/year			62.2872 (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	-£ 76	-184 kg (23.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£76 2.64 kg/m²	B 88	B 91
Total Savings	£76 2.64 kg/m²		

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

Fuel prices for cost data on this page from database revision number 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	£148	£166	-£18
Mains gas	£523	£428	£95
Space heating	£367	£367	£0
Water heating	£184	£107	£76
Lighting	£120	£120	£0
Generated (PV)	-£255	-£255	£0
Total cost of fuels	£416	£339	£77
Total cost of uses	£416	£339	£76
Delivered energy	57 kWh/m²	44 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	62 kWh/m²	47 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (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) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3887 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4956	0.4859	0.4762	0.4276	0.4179	0.3693	0.3693	0.3596	0.3887	0.4179	0.4373	0.4568 (22b)
Effective ac	0.6228	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			18.0000	629.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.2149	35.9376	35.6657	34.3889	34.1500	33.0379	33.0379	32.8319	33.4662	34.1500	34.6333	35.1385 (38)
Heat transfer coeff	86.6297	86.3524	86.0805	84.8037	84.5648	83.4527	83.4527	83.2467	83.8810	84.5648	85.0480	85.5533 (39)
Average = Sum(39)m / 12 =												84.8025 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2390	1.2350	1.2311	1.2129	1.2095	1.1935	1.1935	1.1906	1.1997	1.2095	1.2164	1.2236 (40)
HLP (average)												1.2129 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 = 1376.7047 (45)										
Distribution loss (46)m = 0.15 x (45)m											
	21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	20.7347 (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 (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 (57)
Combi loss	25.2847	22.8154	25.2242	24.3701	25.1531	24.3078	25.0970	25.1334	24.3418	25.1948	25.2730 (61)
Total heat required for water heating calculated for each month	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210
Aperture area of solar collector											163.5041 (62)
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											1.3173 (H8)
Collector performance factor											0.5319 (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											87.4993 (H14)
Solar storage volume factor											0.8571 (H15)
Solar input											0.9692 (H16)
Solar input	-23.8388	-39.7801	-67.7501	-90.7985	-112.1739	-110.2848	-108.8273	-95.0830	-74.4691	-50.8536	-28.2763
Solar input (sum of months) = Sum (63)m =											-822.0845 (63)
Output from w/h	144.1807	107.8720	86.2945	45.8804	20.7421	7.0142	2.4397	28.9317	49.9350	90.9541	123.4448
Total per year (kWh/year) = Sum (64)m =											851.2443 (64)
Heat gains from water heating, kWh/month	53.7805	47.2121	49.1388	43.4352	42.1194	36.9965	34.9258	39.1614	39.3562	45.0725	48.4319
											52.2801 (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	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1410	40.9820	33.3288	25.2321	18.8613	15.9235	17.2059	22.3648	30.0180	38.1148	44.4856	47.4234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1944	297.2473	289.5543	273.1768	252.5031	233.0728	220.0922	217.0394	224.7324	241.1099	261.7835	281.2138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	72.2856	70.2561	66.0468	60.3266	56.6121	51.3841	46.9432	52.6363	54.6613	60.5813	67.2665	70.2689	(72)
Total internal gains	511.2140	507.0782	487.5228	457.3284	426.5694	398.9732	382.8342	390.6334	408.0046	438.3989	472.1285	497.4990	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.4600	10.6334	0.6300		0.7000	0.7700		20.9931 (74)	
South					4.3600	46.7521	0.6300		0.7000	0.7700		62.2958 (78)	

Solar gains	83.2889	142.1434	198.1329	256.3856	300.5708	305.2139	291.3539	256.7368	217.7243	157.7993	99.7395	71.3302 (83)	
Total gains	594.5029	649.2216	685.6557	713.7140	727.1403	704.1871	674.1881	647.3702	625.7289	596.1982	571.8680	568.8292 (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	35.0587	35.1713	35.2823	35.8136	35.9147	36.3933	36.3933	36.4834	36.2075	35.9147	35.7106	35.4998
alpha	3.3372	3.3448	3.3522	3.3876	3.3943	3.4262	3.4262	3.4322	3.4138	3.3943	3.3807	3.3667
util living area	0.9691	0.9567	0.9347	0.8883	0.8017	0.6578	0.5115	0.5474	0.7424	0.8949	0.9538	0.9729 (86)
MIT	19.3762	19.5639	19.8650	20.2637	20.6176	20.8663	20.9578	20.9460	20.7848	20.3499	19.8055	19.3449 (87)
Th 2	19.8889	19.8921	19.8952	19.9097	19.9124	19.9252	19.9252	19.9275	19.9203	19.9124	19.9069	19.9012 (88)
util rest of house	0.9627	0.9478	0.9208	0.8630	0.7544	0.5758	0.3998	0.4367	0.6698	0.8661	0.9428	0.9673 (89)
MIT 2	18.4376	18.6239	18.9201	19.3132	19.6382	19.8517	19.9102	19.9068	19.7901	19.4030	18.8751	18.4162 (90)
Living area fraction									fLA = Living area / (4) =			0.2446 (91)
MIT	18.6672	18.8538	19.1512	19.5457	19.8777	20.0998	20.1664	20.1610	20.0334	19.6346	19.1027	18.6433 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6672	18.8538	19.1512	19.5457	19.8777	20.0998	20.1664	20.1610	20.0334	19.6346	19.1027	18.6433 (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	0.9538	0.9375	0.9094	0.8532	0.7527	0.5901	0.4261	0.4621	0.6783	0.8574	0.9327	0.9590	(94)
Useful gains	567.0093	608.6148	623.5038	608.9158	547.3005	415.5754	287.2522	299.1716	424.4019	511.1752	533.3615	545.5090	(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	1244.6222	1204.9440	1089.0238	902.7917	691.5462	458.9746	297.6233	313.0878	497.6964	764.0046	1020.8026	1235.6743	(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	504.1440	400.7332	346.3469	211.5906	107.3188	0.0000	0.0000	0.0000	0.0000	188.1051	350.9576	513.4830	(98)
Space heating												2622.6792	(98)
Space heating per m2											(98) / (4) =	37.5097	(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													2891.5978	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	504.1440	400.7332	346.3469	211.5906	107.3188	0.0000	0.0000	0.0000	0.0000	188.1051	350.9576	513.4830	(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)	555.8368	441.8228	381.8598	233.2863	118.3228	0.0000	0.0000	0.0000	0.0000	207.3926	386.9433	566.1334	(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	144.1807	107.8720	86.2945	45.8804	20.7421	7.0142	2.4397	28.9317	49.9350	90.9541	123.4448	143.5550	(64)	
Efficiency of water heater	89.8976	89.9344	89.9796	90.0559	90.1142	87.2000	87.2000	87.2000	87.2000	89.5288	89.7625	89.9115	(216)	
(217)m	89.8976	89.9344	89.9796	90.0559	90.1142	87.2000	87.2000	87.2000	87.2000	89.5288	89.7625	89.9115	(217)	
Fuel for water heating, kWh/month	160.3833	119.9453	95.9044	50.9465	23.0176	8.0438	2.7978	33.1786	57.2649	101.5921	137.5238	159.6626	(219)	
Water heating fuel used												950.2607	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2891.5978	(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)													325.9458	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.70 * 1080 * 1.00) =										-604.5338		-604.5338	(233)	
Total delivered energy for all uses												3688.2705	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2891.5978	3.4800	100.6276	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	950.2607	3.4800	33.0691	(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	325.9458	13.1900	42.9922	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-604.5338	13.1900	-79.7380	(252)
Total energy cost			233.4384	(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] =	0.8532	(257)
SAP value		88.0985	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	2891.5978	0.2160	624.5851	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	950.2607	0.2160	205.2563	(264)
Space and water heating			829.8414	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	325.9458	0.5190	169.1659	(268)
Energy saving/generation technologies				
PV Unit	-604.5338	0.5190	-313.7530	(269)
Total kg/year			750.1293	(272)
CO2 emissions per m2			10.7300	(273)
EI value			91.2533	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9600 (1b)	x 2.3900 (2b)	= 83.5544 (1b) - (3b)
First floor	34.9600 (1c)	x 2.6500 (2c)	= 92.6440 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1984 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3887 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4956	0.4568	0.4471	0.4179	0.4179	0.3887	0.3887	0.3790	0.3887	0.4373	0.4276	0.4568 (22b)
	0.6228	0.6043	0.5999	0.5873	0.5873	0.5756	0.5756	0.5718	0.5756	0.5956	0.5914	0.6043 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			34.9600	0.1200	4.1952	90.0000	3146.4000 (28a)
Brick and Block	84.2300	12.9400	71.2900	0.2400	17.1096	42.2200	3009.8638 (29a)
Party Wall Step	2.5700		2.5700	0.2600	0.6682	113.5000	291.6950 (29a)
External Roof 1	34.9600		34.9600	0.1000	3.4960	9.1000	318.1360 (30)
Total net area of external elements Aum(A, m ²)			156.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1903		(33)
Party Wall 1			40.3300	0.0000	0.0000	45.0000	1814.8500 (32)
GF Timber Stud			48.1300			9.0000	433.1700 (32c)
FF Timber Stud			73.4400			9.0000	660.9600 (32c)
Internal Floor 1			34.9600			18.0000	629.2800 (32d)
Internal Ceiling 1			34.9600			18.0000	629.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10933.6348 (34)
156.3735 (35)
10.2245 (36)
(33) + (36) = 50.4148 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.2149	35.1385	34.8831	34.1500	34.1500	33.4662	33.4662	33.2493	33.4662	34.6333	34.3889	35.1385 (38)
Heat transfer coeff	86.6297	85.5533	85.2979	84.5648	84.5648	83.8810	83.8810	83.6641	83.8810	85.0480	84.8037	85.5533 (39)
Average = Sum(39)m / 12 =												84.7769 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2390	1.2236	1.2199	1.2095	1.2095	1.1997	1.1997	1.1966	1.1997	1.2164	1.2129	1.2236 (40)
HLP (average)												1.2125 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.2442 (42)
87.4993 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.2492	92.7493	89.2493	85.7493	82.2493	78.7494	78.7494	82.2493	85.7493	89.2493	92.7493	96.2492 (44)
Energy conte	142.7348	124.8368	128.8204	112.3087	107.7629	92.9912	86.1700	98.8813	100.0623	116.6130	127.2922	138.2311 (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 = 1376.7047 (45)										
Distribution loss (46)m = 0.15 x (45)m											
	21.4102	18.7255	19.3231	16.8463	16.1644	13.9487	12.9255	14.8322	15.0093	17.4919	20.7347 (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 (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 (57)
Combi loss	25.2847	22.8154	25.2242	24.3701	25.1531	24.3078	25.0970	25.1334	24.3418	25.1948	25.2730 (61)
Total heat required for water heating calculated for each month	168.0195	147.6522	154.0446	136.6789	132.9160	117.2990	111.2670	124.0147	124.4041	141.8077	151.7210
Aperture area of solar collector											163.5041 (62)
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1234.4649 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2073.9010 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.5064 (H8)
Collector performance factor											0.4851 (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											87.4993 (H14)
Solar storage volume factor											0.8571 (H15)
Solar input											0.9692 (H16)
Solar input	-28.1364	-40.1655	-68.0737	-92.8908	-109.6315	-116.6686	-112.3613	-100.2410	-79.3349	-54.3204	-33.0799
	Solar input (sum of months) = Sum(63)m =										-857.3788 (H17)
Output from w/h	139.8831	107.4867	85.9708	43.7880	23.2845	0.6304	0.0000	23.7737	45.0692	87.4873	118.6411
	Total per year (kWh/year) = Sum(64)m =										817.0443 (64)
Heat gains from water heating, kWh/month	53.7805	47.2121	49.1388	43.4352	42.1194	36.9965	34.9258	39.1614	39.3562	45.0725	48.4319
											52.2801 (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	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	134.6509	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1410	40.9820	33.3288	25.2321	18.8613	15.9235	17.2059	22.3648	30.0180	38.1148	44.4856	47.4234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1944	297.2473	289.5543	273.1768	252.5031	233.0728	220.0922	217.0394	224.7324	241.1099	261.7835	281.2138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	50.7093	(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)	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	-89.7672	(71)
Water heating gains (Table 5)	72.2856	70.2561	66.0468	60.3266	56.6121	51.3841	46.9432	52.6363	54.6613	60.5813	67.2665	70.2689	(72)
Total internal gains	511.2140	507.0782	487.5228	457.3284	426.5694	398.9732	382.8342	390.6334	408.0046	438.3989	472.1285	497.4990	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.4600	13.8645		0.6300		0.7000		0.7700		27.3722 (74)
South				4.3600	58.2505		0.6300		0.7000		0.7700		77.6172 (78)
Solar gains	104.9894	153.4490	214.1419	285.1358	321.8158	354.6632	330.0706	295.2987	250.5017	180.5107	124.6271		85.8362 (83)
Total gains	616.2034	660.5273	701.6647	742.4641	748.3852	753.6364	712.9048	685.9321	658.5063	618.9096	596.7556		583.3352 (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	35.0587	35.4998	35.6060	35.9147	35.9147	36.2075	36.2075	36.3014	36.2075	35.7106	35.8136	35.4998
alpha	3.3372	3.3667	3.3737	3.3943	3.3943	3.4138	3.4138	3.4201	3.4138	3.3807	3.3876	3.3667
util living area	0.9591	0.9478	0.9199	0.8612	0.7519	0.5699	0.4206	0.4345	0.6607	0.8526	0.9335	0.9637 (86)
MIT	19.5816	19.7213	20.0196	20.3900	20.7225	20.9242	20.9802	20.9783	20.8715	20.5221	20.0397	19.5696 (87)
Th 2	19.8889	19.9012	19.9041	19.9124	19.9124	19.9203	19.9203	19.9227	19.9203	19.9069	19.9097	19.9012 (88)
util rest of house	0.9503	0.9369	0.9026	0.8302	0.6940	0.4779	0.3044	0.3155	0.5724	0.8115	0.9170	0.9558 (89)
MIT 2	18.6401	18.7850	19.0761	19.4320	19.7264	19.8845	19.9151	19.9170	19.8528	19.5557	19.1046	18.6382 (90)
Living area fraction									fLA = Living area / (4) =			0.2446 (91)
MIT	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8704	19.0140	19.3069	19.6663	19.9700	20.1388	20.1756	20.1766	20.1019	19.7920	19.3333	18.8660 (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	0.9402	0.9261	0.8913	0.8221	0.6973	0.4976	0.3328	0.3445	0.5885	0.8065	0.9064	0.9464	(94)
Useful gains	579.3700	611.6935	625.3883	610.3868	521.8828	375.0089	237.2246	236.2758	387.5106	499.1230	540.8705	552.0405	(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	1166.9334	1139.0586	1024.1597	851.2511	623.2421	397.4951	241.2054	240.6643	427.9555	679.7073	927.1809	1143.5049	(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	437.1472	354.3894	296.6859	173.4223	75.4113	0.0000	0.0000	0.0000	0.0000	134.3547	278.1434	440.0495	(98)
Space heating												2189.6037	(98)
Space heating per m2											(98) / (4) =	31.3158	(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													2414.1165	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	437.1472	354.3894	296.6859	173.4223	75.4113	0.0000	0.0000	0.0000	0.0000	134.3547	278.1434	440.0495	(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)	481.9704	390.7270	327.1068	191.2043	83.1437	0.0000	0.0000	0.0000	0.0000	148.1309	306.6631	485.1703	(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	139.8831	107.4867	85.9708	43.7880	23.2845	0.6304	0.0000	23.7737	45.0692	87.4873	118.6411	141.0294	(64)	
Efficiency of water heater	89.8260	89.8606	89.8894	89.9720	89.8492	87.2000	87.2000	87.2000	87.2000	89.2867	89.6244	89.8250	(216)	
(217)m	89.8260	89.8606	89.8894	89.9720	89.8492	87.2000	87.2000	87.2000	87.2000	89.2867	89.6244	89.8250	(217)	
Fuel for water heating, kWh/month	155.7268	119.6148	95.6407	48.6685	25.9151	0.7230	0.0000	27.2634	51.6848	97.9847	132.3759	157.0046	(219)	
Water heating fuel used												912.6025	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2414.1165	(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)													325.9458	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.70 * 1234 * 1.00) =										-691.3003		-691.3003	(233)	
Total delivered energy for all uses												3086.3644	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2414.1165	9.7400	235.1350	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	912.6025	9.7400	88.8875	(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	325.9458	36.8500	120.1110	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-691.3003	36.8500	-254.7442	(252)
Total energy cost			339.4518	(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	2414.1165	0.2160	521.4492	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	912.6025	0.2160	197.1221	(264)
Space and water heating			718.5713	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	325.9458	0.5190	169.1659	(268)
Energy saving/generation technologies				
PV Unit	-691.3003	0.5190	-358.7849	(269)
Total kg/year			593.8273	(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	2414.1165	1.2200	2945.2222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	912.6025	1.2200	1113.3750 (264)
Space and water heating			4058.5972 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	325.9458	3.0700	1000.6535 (268)
Energy saving/generation technologies			
PV Unit	-691.3003	3.0700	-2122.2920 (269)
Primary energy kWh/year			3320.7087 (272)
Primary energy kWh/m2/year			47.4930 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 129	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Newton (HA)
Project	Plot 129		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.13	TER	19.44
Environmental	89 B	% DER<TER	22.17		
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TTEE	53.59
General Requirements Compliance	Pass	% DFEE<TTEE	11.59		

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	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
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 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² 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 129	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Newton (HA)
Project	Plot 129		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.13	TER	19.44
Environmental	89 B	% DER<TER	22.17		
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TFEE	53.59
General Requirements Compliance	Pass	% DFEE<TFEE	11.59		

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 129	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Newton (HA)
Project	Plot 129		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.13	TER	19.44
Environmental	89 B	% DER<TER	22.17		
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TFEE	53.59
General Requirements Compliance	Pass	% DFEE<TFEE	11.59		

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 000004

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Supafil Party Wall						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	1450	1000
	Main construction	100	0.8803	0.1136	5.96	1450	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 3.898 m ² K/W	Lower limit = 3.765 m ² K/W	Average = 3.831 m ² K/W
	Total correction = 0.0045 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: None

Total thickness: 328 mm

U-value: 0.26 W/m² K

Kappa: 113.50 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 129	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Newton (HA)
Project	Plot 129		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.13	TER	19.44
Environmental	89 B	% DER<TER	22.17		
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TFEE	53.59
General Requirements Compliance	Pass	% DFEE<TFEE	11.59		

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

Building Elements

Floor 000003

Floor Type: Suspended Floor

Area = 43.90 m², Perimeter = 18.83 m, Wall thickness = 275.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 129			Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Newton (HA)		
Property	Plot 129				
SAP Rating	87 B	DER	15.13	TER	19.44
Environmental	89 B	% DER<TER	22.17		
CO ₂ Emissions (t/year)	0.78	DFEE	47.38	TFEE	53.59
General Requirements Compliance	Pass	% DFEE<TFEE	11.59		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	16.74 m	34.96 m ²	2.39 m
	1st Storey:	16.74 m	34.96 m ²	2.65 m

7.0 Living Area	17.10	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	156.37	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	84.23	71.29
Party Wall Step	Cavity Wall	Other	0.26	113.50	2.57	2.57

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
Party Wall 1	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	40.33

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
GF Timber Stud	Plasterboard on timber frame		9.00	48.13
FF Timber Stud	Plasterboard on timber frame		9.00	73.44

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
External Roof 1	External Plane Roof	Other	0.10	9.10	34.96	34.96

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	34.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	34.96

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	34.96

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.10
Windows & Fully Glazed Do	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					4.36	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					6.46	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	2.73	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	E2 Other lintels (including other steel lintels)	3.62	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	6.35	0.021	No	Knauf P5
Independently assessed	E4 Jamb	20.10	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	16.74	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	16.74	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.19	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	17.22	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.58	0.039	No	Knauf P23
Table K1 - Approved	E18 Party wall between dwellings	9.38	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	8.61	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.61	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.61	0.069	No	Knauf P29

Y-value 0.065 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	11	
Total number of L.E.L. fittings	11	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
0.70	South	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	£76	B 88	