



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 52

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

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

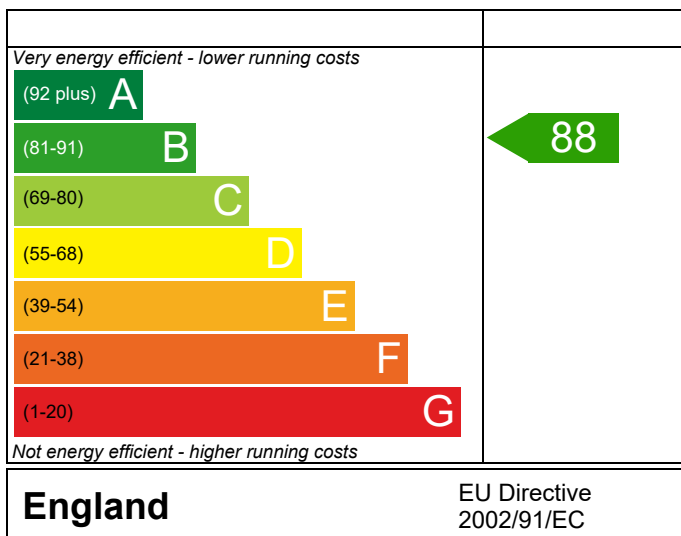
Plot 52

Dwelling type: House, Semi-Detached
Date of assessment: 08/02/2024
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.42 m²
DRRN: 2204-2622-8011

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

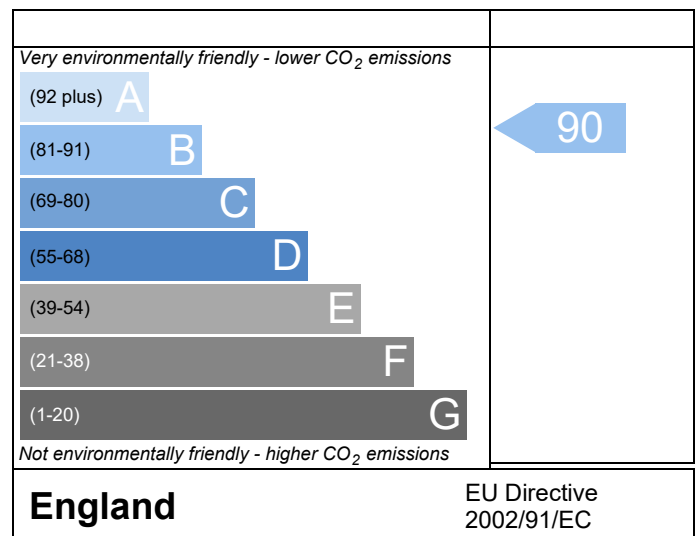
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 52				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G			
Property	Plot 52					
SAP Rating	88 B	DER	13.21	TER	18.03	
Environmental	90 B	% DER<TER	26.74			
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53	
General Requirements Compliance	Pass	% DFEE<TFEE	15.51			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.03	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.21	kgCO ₂ /m ²	Pass
	-4.82 (-26.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.53	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.70	kWh/m ² /yr	
	-7.8 (-15.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

7.00 m², No overhang

Windows facing South East

1.44 m², No overhang

Windows facing South West

3.14 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.033	W/m ² K
Photovoltaic array	0.80	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	£66	B 89	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£66	B 89	A 92	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 52				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G			
	Property					Plot 52
SAP Rating		88 B	DER	13.21	TER	18.03
Environmental		90 B	% DER<TER	26.74		
CO ₂ Emissions (t/year)		0.79	DFEE	42.70	TFEE	50.53
General Requirements Compliance		Pass	% DFEE<TFEE	15.51		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	9.77	0.42	Catnic Thermally Broken
External wall	E3 Sill	Independently assessed	0.021	7.16	0.15	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.60	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	18.37	2.94	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.37	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.66	0.58	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	17.60	0.77	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.60	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	8.80	0.32	Knauf P25 Halved
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.80	0.00	

Total: **5.99** W/mK:
Y-Value: **0.033** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Property	Plot 52					
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Environmental	90 B	% DER<TER	26.74			
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53	
General Requirements Compliance	Pass	% DFEE<TFEE	15.51			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 84 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.03 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North East: 7.00 m², No overhang
Windows facing South East: 1.44 m², No overhang
Windows facing South West: 3.14 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array 0.80 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3736 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4763	0.4670	0.4577	0.4110	0.4016	0.3549	0.3549	0.3456	0.3736	0.4016	0.4203	0.4390 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9875 (36)
Total fabric heat loss						(33) + (36) =	50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	42.4178	42.1170	40.7045	40.4402	39.2099	39.2099	38.9820	39.6838	40.4402	40.9748	41.5338 (38)
Heat transfer coeff	93.0322	92.7254	92.4247	91.0121	90.7478	89.5175	89.5175	89.2896	89.9914	90.7478	91.2824	91.8414 (39)
Average = Sum(39)m / 12 =												91.0108 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1020	1.0984	1.0948	1.0781	1.0750	1.0604	1.0604	1.0577	1.0660	1.0750	1.0813	1.0879 (40)
HLP (average)												1.0781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Total per year (kWh/year) = Sum(64)m =												1494.0575 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	383.6570	381.3899	367.2180	344.4569	321.3519	299.2078	284.9336	291.1797	302.9872	325.9642	352.2845	372.0057	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				7.0000	11.2829		0.6300	0.7000	0.7700		24.1375 (75)	
Southeast				1.4400	36.7938		0.6300	0.7000	0.7700		16.1923 (77)	
Southwest				3.1400	36.7938		0.6300	0.7000	0.7700		35.3083 (79)	
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	459.2951	518.2471	575.7679	638.5555	683.3478	672.9172	639.2653	592.6660	540.8173	482.9625	444.3416	435.7914 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.4921	44.6393	44.7846	45.4797	45.6121	46.2390	46.2390	46.3570	45.9955	45.6121	45.3450	45.0690
alpha	3.9661	3.9760	3.9856	4.0320	4.0408	4.0826	4.0826	4.0905	4.0664	4.0408	4.0230	4.0046
util living area	0.9944	0.9902	0.9800	0.9501	0.8762	0.7339	0.5803	0.6369	0.8538	0.9663	0.9904	0.9955 (86)
MIT	19.3920	19.5625	19.8606	20.2708	20.6382	20.8830	20.9661	20.9507	20.7646	20.2960	19.7790	19.3685 (87)
Th 2	19.9992	20.0022	20.0051	20.0188	20.0213	20.0333	20.0333	20.0355	20.0287	20.0213	20.0161	20.0107 (88)
util rest of house	0.9930	0.9878	0.9748	0.9360	0.8395	0.6569	0.4679	0.5256	0.7971	0.9541	0.9876	0.9943 (89)
MIT 2	18.5267	18.6986	18.9963	19.4080	19.7536	19.9677	20.0211	20.0161	19.8772	19.4397	18.9256	18.5122 (90)
Living area fraction	18.7176	18.8892	19.1869	19.5983	19.9487	20.1695	20.2296	20.2222	20.0730	19.6286	19.1139	18.7011 (92)
MIT	18.7176	18.8892	19.1869	19.5983	19.9487	20.1695	20.2296	20.2222	20.0730	19.6286	19.1139	18.7011 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7176	18.8892	19.1869	19.5983	19.9487	20.1695	20.2296	20.2222	20.0730	19.6286	19.1139	18.7011 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9906	0.9842	0.9692	0.9286	0.8364	0.6688	0.4920	0.5487	0.8002	0.9479	0.9841	0.9923 (94)
Useful gains	454.9681	510.0560	558.0464	592.9910	571.5293	450.0239	314.4934	325.1728	432.7375	457.7812	437.2892	432.4348 (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	1341.2967	1297.1520	1172.5857	973.6771	748.5503	498.5717	324.9096	341.2855	537.5154	819.3263	1096.6554	1331.7989 (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	659.4285	528.9285	457.2172	274.0939	131.7036	0.0000	0.0000	0.0000	0.0000	268.9895	474.7437	669.1269 (98)
Space heating												3464.2318 (98)
Space heating per m2												41.0357 (99)
	(98) / (4) =											41.0357 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3840.6118 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	659.4285	528.9285	457.2172	274.0939	131.7036	0.0000	0.0000	0.0000	0.0000	268.9895	474.7437	669.1269	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	731.0737	586.3952	506.8927	303.8736	146.0129	0.0000	0.0000	0.0000	0.0000	298.2146	526.3234	741.8258	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Efficiency of water heater (217)m	87.2035	86.9951	86.5393	85.4494	83.1379	76.4000	76.4000	76.4000	76.4000	85.2716	86.6706	87.3115	(216)
Fuel for water heating, kWh/month	177.6539	155.7728	161.5647	142.6285	140.6367	132.0393	122.3538	140.4266	142.1278	148.4287	159.4314	171.8355	(219)
Water heating fuel used												1794.8997	(219)
Annual totals kWh/year													
Space heating fuel - main system												3840.6118	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.5584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1029 * 1.00) =										-658.6795		-658.6795	(233)
Total delivered energy for all uses												5439.3904	(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	3840.6118	0.2160	829.5721	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1794.8997	0.2160	387.6983	(264)
Space and water heating			1217.2705	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.5584	0.5190	201.1428	(268)
Energy saving/generation technologies				
PV Unit	-658.6795	0.5190	-341.8547	(269)
Total CO2, kg/year			1115.4836	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2100	(273)

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

DER			13.2100	ZC1
Total Floor Area		TFA	84.4200	
Assumed number of occupants		N	2.5414	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.0344	ZC2
CO2 emissions from cooking, equation (L16)			2.1321	ZC3
Total CO2 emissions			31.3766	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			31.3766	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3921 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3333 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523		(27)
Ground Floor			42.2100	0.1300	5.4873		(28a)
Brick and Block	91.8500	13.7000	78.1500	0.1800	14.0670		(29a)
Step Party Wall	2.6400		2.6400	0.1800	0.4752		(29a)
Pitched Roof	42.2100		42.2100	0.1300	5.4873		(30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.9891		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1333 (36)
Total fabric heat loss						(33) + (36) =	51.1224 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1129	40.8686	40.6292	39.5048	39.2944	38.3151	38.3151	38.1337	38.6923	39.2944	39.7200	40.1649 (38)
Heat transfer coeff	92.2352	91.9910	91.7516	90.6272	90.4168	89.4374	89.4374	89.2561	89.8147	90.4168	90.8424	91.2873 (39)
Average = Sum(39)m / 12 =												90.6262 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0926	1.0897	1.0868	1.0735	1.0710	1.0594	1.0594	1.0573	1.0639	1.0710	1.0761	1.0813 (40)
HLP (average)												1.0735 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)
Energy content (annual)										Total = Sum(45)m =		1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	49.1495	45.6988	45.2947	41.9683	43.3672	45.2947	45.6988	49.1495	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	205.2087	180.9353	188.3624	167.0679	161.7512	142.4615	136.4889	152.1532	153.8335	175.1701	186.8764	200.3416	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	205.2087	180.9353	188.3624	167.0679	161.7512	142.4615	136.4889	152.1532	153.8335	175.1701	186.8764	200.3416	(64)
Heat gains from water heating, kWh/month	64.0278	56.3637	58.5757	51.7799	50.0455	43.9061	41.8048	46.8541	47.3795	54.1892	58.0679	62.4095	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	86.0589	83.8746	78.7307	71.9166	67.2654	60.9806	56.1892	62.9760	65.8049	72.8350	80.6499	83.8837	(72)
Total internal gains	400.5550	398.2874	383.5303	360.1488	336.4154	313.6465	299.3861	306.2561	318.6983	342.2957	369.1929	388.9108	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.0000	11.2829	0.6300	0.7000	0.7700	24.1375	(75)
Southeast	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923	(77)
Southwest	3.1400	36.7938	0.6300	0.7000	0.7700	35.3083	(79)

Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857	(83)
Total gains	476.1931	535.1446	592.0802	654.2474	698.4113	687.3559	653.7178	607.7424	556.5284	499.2940	461.2500	452.6965	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5603	63.7291	63.8953	64.6881	64.8386	65.5486	65.5486	65.6818	65.2733	64.8386	64.5349	64.2203	
alpha	5.2374	5.2486	5.2597	5.3125	5.3226	5.3699	5.3699	5.3788	5.3516	5.3226	5.3023	5.2814	
util living area	0.9985	0.9969	0.9921	0.9730	0.9087	0.7570	0.5856	0.6466	0.8841	0.9836	0.9970	0.9989	(86)
MIT	19.8029	19.9342	20.1638	20.4810	20.7672	20.9411	20.9879	20.9801	20.8557	20.4929	20.0946	19.7817	(87)
Th 2	20.0069	20.0093	20.0116	20.0225	20.0246	20.0341	20.0341	20.0359	20.0304	20.0246	20.0204	20.0161	(88)
util rest of house	0.9980	0.9959	0.9892	0.9622	0.8716	0.6709	0.4655	0.5253	0.8235	0.9751	0.9957	0.9985	(89)
MIT 2	18.4040	18.5974	18.9335	19.3971	19.7866	19.9929	20.0294	20.0271	19.9074	19.4207	18.8404	18.3796	(90)
Living area fraction	18.7125	18.8922	19.2049	19.6362	20.0029	20.2020	20.2408	20.2373	20.1165	19.6572	19.1170	18.6889	(92)
Temperature adjustment	18.7125	18.8922	19.2049	19.6362	20.0029	20.2020	20.2408	20.2373	20.1165	19.6572	19.1170	18.6889	(93)
adjusted MIT	18.7125	18.8922	19.2049	19.6362	20.0029	20.2020	20.2408	20.2373	20.1165	19.6572	19.1170	18.6889	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	474.7779	532.0091	583.6991	625.9100	608.0311	472.3390	321.7056	335.4841	461.8563	484.6567	458.4733	451.6609	(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	1329.3403	1287.1606	1165.6917	972.9903	750.7173	501.0325	325.6244	342.5038	540.3733	818.9209	1091.6562	1322.6487	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	635.7944	507.4618	433.0025	249.8978	106.1586	0.0000	0.0000	0.0000	0.0000	248.6925	455.8917	648.0149	(98)
Space heating												3284.9142	(98)
Space heating per m2												38.9116	(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													3517.0387 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	635.7944	507.4618	433.0025	249.8978	106.1586	0.0000	0.0000	0.0000	0.0000	248.6925	455.8917	648.0149	(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)	680.7221	543.3210	463.6001	267.5565	113.6601	0.0000	0.0000	0.0000	0.0000	266.2661	488.1067	693.8061	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	205.2087	180.9353	188.3624	167.0679	161.7512	142.4615	136.4889	152.1532	153.8335	175.1701	186.8764	200.3416	(64)
Efficiency of water heater (217)m	87.7082	87.5071	87.0798	86.0628	84.0196	80.3000	80.3000	80.3000	80.3000	85.9331	87.2108	87.7923	(216)
Fuel for water heating, kWh/month	233.9676	206.7664	216.3102	194.1234	192.5160	177.4115	169.9738	189.4809	191.5735	203.8447	214.2812	228.1995	(219)
Water heating fuel used												2418.4485	(219)
Annual totals kWh/year													
Space heating fuel - main system												3517.0387	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.5584	(232)
Total delivered energy for all uses												6398.0456	(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	3517.0387	0.2160	759.6804 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2418.4485	0.2160	522.3849 (264)
Space and water heating			1282.0653 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Total CO2, kg/m2/year			1522.1330 (272)
Emissions per m2 for space and water heating			15.1867 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3826 (272b)
Emissions per m2 for pumps and fans			0.4611 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1867 * 1.00) + 2.3826 + 0.4611, rounded to 2 d.p.			18.0300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3921 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3333 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			9.0000	379.8900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14521.2324 (34)
172.0118 (35)
5.9875 (36)
(33) + (36) = 50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1129	40.8686	40.6292	39.5048	39.2944	38.3151	38.3151	38.1337	38.6923	39.2944	39.7200	40.1649 (38)
Heat transfer coeff	91.4205	91.1762	90.9368	89.8124	89.6020	88.6227	88.6227	88.4413	88.9999	89.6020	90.0276	90.4726 (39)
Average = Sum(39)m / 12 =												89.8114 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0829	1.0800	1.0772	1.0639	1.0614	1.0498	1.0498	1.0476	1.0543	1.0614	1.0664	1.0717 (40)
HLP (average)												1.0639 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5414 (42)
94.5582 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

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Calculation Type: New Build (As Designed)

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Energy content (annual)	Total = Sum(45)m = 1487.7689 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.7781	28.6679	29.5827	25.7909	24.7470	21.3548	19.7884	22.7074	22.9786	26.7794	29.2318	31.7438 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	44.0566	42.6606	39.7617	35.8207	33.2621	29.6594	26.5973	30.5207	31.9148	35.9938	40.5997	42.6664	(72)
Total internal gains	355.5527	354.0734	341.5613	321.0530	299.4121	279.3253	266.7941	270.8009	281.8082	302.4545	326.1427	344.6935	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.0000	11.2829	0.6300	0.7000	0.7700	24.1375 (75)			
Southeast				1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)			
Southwest				3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)			
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	431.1908	490.9306	550.1112	615.1516	661.4080	653.0347	621.1258	572.2872	519.6383	459.4528	418.1998	408.4792 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1222	44.2404	44.3569	44.9122	45.0177	45.5152	45.5152	45.6085	45.3222	45.0177	44.8049	44.5845	
alpha	3.9415	3.9494	3.9571	3.9941	4.0012	4.0343	4.0343	4.0406	4.0215	4.0012	3.9870	3.9723	
util living area	0.9951	0.9912	0.9814	0.9525	0.8805	0.7413	0.5883	0.6478	0.8616	0.9692	0.9915	0.9960	(86)
MIT	19.3524	19.5260	19.8296	20.2448	20.6214	20.8742	20.9629	20.9454	20.7485	20.2658	19.7390	19.3247	(87)
Th 2	20.0148	20.0172	20.0195	20.0304	20.0325	20.0421	20.0421	20.0438	20.0384	20.0325	20.0283	20.0240	(88)
util rest of house	0.9939	0.9890	0.9766	0.9393	0.8454	0.6659	0.4765	0.5375	0.8076	0.9582	0.9891	0.9951	(89)
MIT 2	18.5017	18.6762	18.9791	19.3943	19.7496	19.9703	20.0283	20.0217	19.8738	19.4215	18.8976	18.4810	(90)
Living area fraction	18.6893	18.8636	19.1667	19.5819	19.9419	20.1696	20.2345	20.2254	20.0667	19.6077	19.0832	18.6671	(91)
MIT	18.6893	18.8636	19.1667	19.5819	19.9419	20.1696	20.2345	20.2254	20.0667	19.6077	19.0832	18.6671	(92)
Temperature adjustment													0.0000
adjusted MIT	18.6893	18.8636	19.1667	19.5819	19.9419	20.1696	20.2345	20.2254	20.0667	19.6077	19.0832	18.6671	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	427.6046	483.8692	534.2731	573.1845	556.6101	442.0415	310.7147	320.5273	420.6207	437.3647	412.2931	405.7178	(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	1315.4781	1273.1484	1151.8689	959.3669	738.4896	493.5969	322.0953	338.3229	531.0383	807.1075	1078.8194	1308.8740	(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	660.5779	530.3956	459.4913	278.0513	135.3184	0.0000	0.0000	0.0000	0.0000	275.0887	479.8989	671.9482	(98)
Space heating												3490.7704	(98)
Space heating per m2												41.3500	(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	833.0531	655.8078	672.1540	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8135	0.8796	0.8497	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	677.7004	576.8348	571.0986	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.1206	819.8908	764.6432	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	130.6226	180.8336	143.9972	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												455.4533 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	32.6556	45.2084	35.9993	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												113.8633 (107)
Space cooling per m2												1.3488 (108)
Energy for space heating												41.3500 (99)
Energy for space cooling												1.3488 (108)
Total												42.6988 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3921 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3333 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523		(27)
Ground Floor			42.2100	0.1300	5.4873		(28a)
Brick and Block	91.8500	13.7000	78.1500	0.1800	14.0670		(29a)
Step Party Wall	2.6400		2.6400	0.1800	0.4752		(29a)
Pitched Roof	42.2100		42.2100	0.1300	5.4873		(30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.9891		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1333 (36)
Total fabric heat loss						(33) + (36) =	51.1224 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1129	40.8686	40.6292	39.5048	39.2944	38.3151	38.3151	38.1337	38.6923	39.2944	39.7200	40.1649 (38)
Heat transfer coeff	92.2352	91.9910	91.7516	90.6272	90.4168	89.4374	89.4374	89.2561	89.8147	90.4168	90.8424	91.2873 (39)
Average = Sum(39)m / 12 =												90.6262 (39)
HLP	1.0926	1.0897	1.0868	1.0735	1.0710	1.0594	1.0594	1.0573	1.0639	1.0710	1.0761	1.0813 (40)
HLP (average)												1.0735 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy content (annual)	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)
Distribution loss (46)m = 0.15 x (45)m												1487.7689 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)
Heat gains from water heating, kWh/month	32.7781	28.6679	29.5827	25.7909	24.7470	21.3548	19.7884	22.7074	22.9786	26.7794	29.2318	31.7438 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	127.0699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9452	19.4915	15.8516	12.0006	8.9706	7.5734	8.1833	10.6370	14.2769	18.1278	21.1578	22.5551	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.4300	230.8004	224.8271	212.1106	196.0584	180.9715	170.8926	168.5222	174.4955	187.2120	203.2642	218.3510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	35.7070	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	44.0566	42.6606	39.7617	35.8207	33.2621	29.6594	26.5973	30.5207	31.9148	35.9938	40.5997	42.6664	(72)
Total internal gains	355.5527	354.0734	341.5613	321.0530	299.4121	279.3253	266.7941	270.8009	281.8082	302.4545	326.1427	344.6935	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					7.0000	11.2829		0.6300	0.7000	0.7700		24.1375 (75)	
Southeast					1.4400	36.7938		0.6300	0.7000	0.7700		16.1923 (77)	
Southwest					3.1400	36.7938		0.6300	0.7000	0.7700		35.3083 (79)	
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857	(83)
Total gains	431.1908	490.9306	550.1112	615.1516	661.4080	653.0347	621.1258	572.2872	519.6383	459.4528	418.1998	408.4792	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5603	63.7291	63.8953	64.6881	64.8386	65.5486	65.5486	65.6818	65.2733	64.8386	64.5349	64.2203	
alpha	5.2374	5.2486	5.2597	5.3125	5.3226	5.3699	5.3699	5.3788	5.3516	5.3226	5.3023	5.2814	
util living area	0.9991	0.9980	0.9943	0.9791	0.9238	0.7826	0.6124	0.6788	0.9065	0.9886	0.9981	0.9993	(86)
MIT	19.7526	19.8851	20.1183	20.4423	20.7406	20.9307	20.9851	20.9750	20.8320	20.4513	20.0468	19.7321	(87)
Th 2	20.0069	20.0093	20.0116	20.0225	20.0246	20.0341	20.0341	20.0359	20.0304	20.0246	20.0204	20.0161	(88)
util rest of house	0.9988	0.9973	0.9922	0.9704	0.8909	0.6983	0.4887	0.5551	0.8528	0.9824	0.9973	0.9991	(89)
MIT 2	18.8623	18.9965	19.2307	19.5588	19.8401	20.0001	20.0301	20.0281	19.9293	19.5722	19.1672	18.8493	(90)
Living area fraction									fLA = Living area / (4) =			0.2206	(91)
MIT	19.0587	19.1925	19.4265	19.7537	20.0387	20.2054	20.2407	20.2370	20.1284	19.7661	19.3612	19.0440	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0587	19.1925	19.4265	19.7537	20.0387	20.2054	20.2407	20.2370	20.1284	19.7661	19.3612	19.0440	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.4751	489.1791	544.8817	595.0777	589.5983	466.7500	320.7048	333.4430	446.5468	450.3715	416.7475	407.9721	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1361.2726	1314.7839	1186.0229	983.6357	753.9567	501.3310	325.6154	342.4739	541.4366	828.7704	1113.8341	1355.0709	(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	692.5133	554.8064	477.0090	279.7618	122.2826	0.0000	0.0000	0.0000	0.0000	281.5288	501.9023	704.6416	(98)
Space heating												3614.4458	(98)
Space heating per m2												(98) / (4) =	42.8150 (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	840.7119	661.8370	678.3462	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8520	0.9180	0.8890	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	716.2831	607.5660	603.0806	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.1206	819.8908	764.6432	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	102.8430	157.9696	120.2026	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												381.0152 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	25.7107	39.4924	30.0506	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												95.2538 (107)
Space cooling per m2												1.1283 (108)
Energy for space heating												42.8150 (99)
Energy for space cooling												1.1283 (108)
Total												43.9434 (109)
Target Fabric Energy Efficiency (TFEE)												50.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3736 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4763	0.4390	0.4296	0.4016	0.4016	0.3736	0.3736	0.3643	0.3736	0.4203	0.4110	0.4390 (22b)
Effective ac	0.6134	0.5964	0.5923	0.5806	0.5806	0.5698	0.5698	0.5663	0.5698	0.5883	0.5844	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9875 (36)
Total fabric heat loss						(33) + (36) =	50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	41.5338	41.2513	40.4402	40.4402	39.6838	39.6838	39.4438	39.6838	40.9748	40.7045	41.5338 (38)
Heat transfer coeff	93.0322	91.8414	91.5589	90.7478	90.7478	89.9914	89.9914	89.7514	89.9914	91.2824	91.0121	91.8414 (39)
Average = Sum(39)m / 12 =												90.9825 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1020	1.0879	1.0846	1.0750	1.0750	1.0660	1.0660	1.0632	1.0660	1.0813	1.0781	1.0879 (40)
HLP (average)												1.0777 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	0.6494 (61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559 (71)
Water heating gains (Table 5)												
	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786 (72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	7.0000				15.0428		0.6300		0.7000		0.7700		32.1810 (75)	
Southeast	1.4400				46.3896		0.6300		0.7000		0.7700		20.4153 (77)	
Southwest	3.1400				46.3896		0.6300		0.7000		0.7700		44.5166 (79)	
Solar gains	97.1129	150.8290	230.1329	332.3562	391.6722	437.7366	405.0716	351.5410	278.9908	183.4485	117.2537	78.1129	(83)	
Total gains	668.6947	717.6307	774.3608	841.7832	865.5429	879.9365	828.9479	784.1764	731.8357	671.3101	643.8869	633.9941	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.4921	45.0690	45.2081	45.6121	45.6121	45.9955	45.9955	46.1185	45.9955	45.3450	45.4797	45.0690	
alpha	3.9661	4.0046	4.0139	4.0408	4.0408	4.0664	4.0664	4.0746	4.0664	4.0230	4.0320	4.0046	
util living area	0.9745	0.9656	0.9394	0.8747	0.7477	0.5457	0.3957	0.4160	0.6663	0.8793	0.9547	0.9779 (86)	
MIT	19.8277	19.9524	20.2243	20.5600	20.8302	20.9649	20.9927	20.9913	20.9226	20.6324	20.2156	19.8180 (87)	
Th 2	19.9992	20.0107	20.0135	20.0213	20.0213	20.0287	20.0287	20.0310	20.0287	20.0161	20.0188	20.0107 (88)	
util rest of house	0.9685	0.9577	0.9251	0.8453	0.6908	0.4612	0.2947	0.3107	0.5817	0.8427	0.9423	0.9726 (89)	
MIT 2	18.9575	19.0884	19.3544	19.6759	19.9099	20.0128	20.0269	20.0288	19.9891	19.7446	19.3543	18.9574 (90)	
Living area fraction	fLA = Living area / (4) =												0.2206 (91)
MIT	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	20.1950	19.9404	19.5442	19.1472 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	20.1950	19.9404	19.5442	19.1472 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9621	0.9504	0.9170	0.8402	0.6966	0.4787	0.3171	0.3340	0.5972	0.8394	0.9349	0.9666	(94)
Useful gains	643.3190	682.0713	710.0961	707.2787	602.9105	421.2366	262.8284	261.8900	437.0643	563.4856	601.9910	612.8500	(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	1279.1443	1247.1106	1121.2575	932.0593	681.7747	434.0132	264.5663	263.9715	467.5026	743.0777	1014.2598	1253.3800	(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	473.0540	379.7064	305.9041	161.8420	58.6750	0.0000	0.0000	0.0000	0.0000	133.6165	296.8335	476.5543	(98)
Space heating												2286.1859	(98)
RHI space heating demand												2286	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3736 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4763	0.4670	0.4577	0.4110	0.4016	0.3549	0.3549	0.3456	0.3736	0.4016	0.4203	0.4390 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9875 (36)
Total fabric heat loss						(33) + (36) =	50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	42.4178	42.1170	40.7045	40.4402	39.2099	39.2099	38.9820	39.6838	40.4402	40.9748	41.5338 (38)
Heat transfer coeff	93.0322	92.7254	92.4247	91.0121	90.7478	89.5175	89.5175	89.2896	89.9914	90.7478	91.2824	91.8414 (39)
Average = Sum(39)m / 12 =												91.0108 (39)
HLP	1.1020	1.0984	1.0948	1.0781	1.0750	1.0604	1.0604	1.0577	1.0660	1.0750	1.0813	1.0879 (40)
HLP (average)												1.0781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Total per year (kWh/year) = Sum(64)m =												1494.0575 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast				7.0000	11.2829	0.6300	0.7000			0.7700			24.1375 (75)		
Southeast				1.4400	36.7938	0.6300	0.7000			0.7700			16.1923 (77)		
Southwest				3.1400	36.7938	0.6300	0.7000			0.7700			35.3083 (79)		
Solar gains				75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains				647.2199	703.6589	752.7777	803.5256	835.8666	815.9093	778.2080	734.1217	690.6750	644.8599	618.6903	619.6669 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.4921	44.6393	44.7846	45.4797	45.6121	46.2390	46.2390	46.3570	45.9955	45.6121	45.3450	45.0690
alpha	3.9661	3.9760	3.9856	4.0320	4.0408	4.0826	4.0826	4.0905	4.0664	4.0408	4.0230	4.0046
util living area	0.9817	0.9728	0.9534	0.9046	0.8055	0.6430	0.4901	0.5353	0.7578	0.9204	0.9707	0.9843 (86)
MIT	19.6538	19.8139	20.0859	20.4480	20.7481	20.9285	20.9816	20.9737	20.8557	20.4831	20.0155	19.6276 (87)
Th 2	19.9992	20.0022	20.0051	20.0188	20.0213	20.0333	20.0333	20.0355	20.0287	20.0213	20.0161	20.0107 (88)
util rest of house	0.9775	0.9667	0.9425	0.8816	0.7590	0.5647	0.3895	0.4333	0.6882	0.8964	0.9630	0.9808 (89)
MIT 2	18.7856	18.9455	19.2140	19.5712	19.8432	19.9954	20.0271	20.0259	19.9426	19.6127	19.1569	18.7688 (90)
Living area fraction	18.9771	19.1371	19.4063	19.7646	20.0428	20.2012	20.2376	20.2349	20.1440	19.8047	19.3463	18.9582 (92)
MIT	18.9771	19.1371	19.4063	19.7646	20.0428	20.2012	20.2376	20.2349	20.1440	19.8047	19.3463	18.9582 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9771	19.1371	19.4063	19.7646	20.0428	20.2012	20.2376	20.2349	20.1440	19.8047	19.3463	18.9582 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9721	0.9600	0.9345	0.8747	0.7601	0.5791	0.4114	0.4552	0.6972	0.8900	0.9564	0.9759 (94)
Useful gains	629.1515	675.5010	703.4701	702.8744	635.3382	472.4922	320.1600	334.1777	481.5724	573.9414	591.7381	604.7277 (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	1365.4425	1320.1374	1192.8584	988.8127	757.0883	501.4050	325.6274	342.4188	543.9066	835.3059	1117.8719	1355.4154 (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	547.8005	433.1956	364.1049	205.8755	90.5821	0.0000	0.0000	0.0000	0.0000	194.4552	378.8163	558.5116 (98)
Space heating												2773.3417 (98)
Space heating per m2												32.8517 (99)
	(98) / (4) =											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3074.6582 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	547.8005	433.1956	364.1049	205.8755	90.5821	0.0000	0.0000	0.0000	0.0000	194.4552	378.8163	558.5116	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	607.3176	480.2612	403.6640	228.2434	100.4236	0.0000	0.0000	0.0000	0.0000	215.5822	419.9737	619.1925	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Efficiency of water heater (217)m	86.7457	86.4779	85.8952	84.5228	81.8676	76.4000	76.4000	76.4000	76.4000	84.2034	86.0459	86.8772	(216)
Fuel for water heating, kWh/month	178.5914	156.7045	162.7763	144.1921	142.8188	132.0393	122.3538	140.4266	142.1278	150.3116	160.5889	172.6946	(219)
Water heating fuel used													1805.6256 (219)
Annual totals kWh/year													
Space heating fuel - main system													3074.6582 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													387.5584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1029 * 1.00) =									-658.6795				-658.6795 (233)
Total delivered energy for all uses													4684.1627 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3074.6582	3.4800	106.9981 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1805.6256	3.4800	62.8358 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.5584	13.1900	51.1190 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-658.6795	13.1900	-86.8798 (252)
Total energy cost			263.9655 (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] =	0.8566 (257)
SAP value		88.0500
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3074.6582	0.2160	664.1262 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1805.6256	0.2160	390.0151 (264)
Space and water heating			1054.1413 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Energy saving/generation technologies			
PV Unit	-658.6795	0.5190	-341.8547 (269)
Total kg/year			952.3544 (272)
CO2 emissions per m2			11.2800 (273)
EI value			90.1394
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8235 = 4.226$, stars = 4
Water heating environmental impact	$0.216 / 0.8235 = 0.2623$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3736 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4763	0.4390	0.4296	0.4016	0.4016	0.3736	0.3736	0.3643	0.3736	0.4203	0.4110	0.4390 (22b)
Effective ac	0.6134	0.5964	0.5923	0.5806	0.5806	0.5698	0.5698	0.5663	0.5698	0.5883	0.5844	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9875 (36)
Total fabric heat loss						(33) + (36) =	50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	41.5338	41.2513	40.4402	40.4402	39.6838	39.6838	39.4438	39.6838	40.9748	40.7045	41.5338 (38)
Heat transfer coeff	93.0322	91.8414	91.5589	90.7478	90.7478	89.9914	89.9914	89.7514	89.9914	91.2824	91.0121	91.8414 (39)
Average = Sum(39)m / 12 =												90.9825 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1020	1.0879	1.0846	1.0750	1.0750	1.0660	1.0660	1.0632	1.0660	1.0813	1.0781	1.0879 (40)
HLP (average)												1.0777 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Total per year (kWh/year) = Sum(64)m =												1494.0575 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	7.0000				15.0428		0.6300		0.7000		0.7700		32.1810 (75)	
Southeast	1.4400				46.3896		0.6300		0.7000		0.7700		20.4153 (77)	
Southwest	3.1400				46.3896		0.6300		0.7000		0.7700		44.5166 (79)	
Solar gains	97.1129	150.8290	230.1329	332.3562	391.6722	437.7366	405.0716	351.5410	278.9908	183.4485	117.2537	78.1129	(83)	
Total gains	668.6947	717.6307	774.3608	841.7832	865.5429	879.9365	828.9479	784.1764	731.8357	671.3101	643.8869	633.9941	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.4921	45.0690	45.2081	45.6121	45.6121	45.9955	45.9955	46.1185	45.9955	45.3450	45.4797	45.0690
alpha	3.9661	4.0046	4.0139	4.0408	4.0408	4.0664	4.0664	4.0746	4.0664	4.0230	4.0320	4.0046
util living area	0.9745	0.9656	0.9394	0.8747	0.7477	0.5457	0.3957	0.4160	0.6663	0.8793	0.9547	0.9779 (86)
MIT	19.8277	19.9524	20.2243	20.5600	20.8302	20.9649	20.9927	20.9913	20.9226	20.6324	20.2156	19.8180 (87)
Th 2	19.9992	20.0107	20.0135	20.0213	20.0213	20.0287	20.0287	20.0310	20.0287	20.0161	20.0188	20.0107 (88)
util rest of house	0.9685	0.9577	0.9251	0.8453	0.6908	0.4612	0.2947	0.3107	0.5817	0.8427	0.9423	0.9726 (89)
MIT 2	18.9575	19.0884	19.3544	19.6759	19.9099	20.0128	20.0269	20.0288	19.9891	19.7446	19.3543	18.9574 (90)
Living area fraction	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	fLA = Living area / (4) =	19.1950	19.9404	19.5442
MIT	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	20.1950	19.9404	19.5442	19.1472 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	20.1950	19.9404	19.5442	19.1472 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9621	0.9504	0.9170	0.8402	0.6966	0.4787	0.3171	0.3340	0.5972	0.8394	0.9349	0.9666	(94)	
Useful gains	643.3190	682.0713	710.0961	707.2787	602.9105	421.2366	262.8284	261.8900	437.0643	563.4856	601.9910	612.8500	(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	1279.1443	1247.1106	1121.2575	932.0593	681.7747	434.0132	264.5663	263.9715	467.5026	743.0777	1014.2598	1253.3800	(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	473.0540	379.7064	305.9041	161.8420	58.6750	0.0000	0.0000	0.0000	0.0000	133.6165	296.8335	476.5543	(98)	
Space heating												2286.1859	(98)	
Space heating per m2												(98) / (4) =	27.0811	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2534.5742 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.0540	379.7064	305.9041	161.8420	58.6750	0.0000	0.0000	0.0000	0.0000	133.6165	296.8335	476.5543	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	524.4501	420.9606	339.1398	179.4258	65.0499	0.0000	0.0000	0.0000	0.0000	148.1336	329.0837	528.3308	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(64)
Efficiency of water heater (217)m	86.3521	86.1090	85.3633	83.7052	80.5161	76.4000	76.4000	76.4000	76.4000	82.9145	85.3055	86.4606	(216)
Fuel for water heating, kWh/month	179.4055	157.3758	163.7907	145.6006	145.2161	132.0393	122.3538	140.4266	142.1278	152.6482	161.9827	173.5267	(219)
Water heating fuel used												1816.4937	(219)
Annual totals kWh/year													
Space heating fuel - main system												2534.5742	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.5584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1182 * 1.00) =									-756.2922			-756.2922	(233)
Total delivered energy for all uses												4057.3341	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2534.5742	7.6100	192.8811 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1816.4937	7.6100	138.2352 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	387.5584	31.0800	120.4531 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-756.2922	31.0800	-235.0556 (252)
Total energy cost			344.8238 (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	2534.5742	0.2160	547.4680 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.4937	0.2160	392.3626 (264)
Space and water heating			939.8307 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Energy saving/generation technologies			
PV Unit	-756.2922	0.5190	-392.5157 (269)
Total kg/year			787.3828 (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	2534.5742	1.2200	3092.1805 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.4937	1.2200	2216.1223 (264)
Space and water heating			5308.3029 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	387.5584	3.0700	1189.8042 (268)
Energy saving/generation technologies			
PV Unit	-756.2922	3.0700	-2321.8170 (269)
Primary energy kWh/year			4406.5400 (272)
Primary energy kWh/m2/year			52.1978 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 66	-204 kg (25.9%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£66	2.42 kg/m²	B 89	A 92
Total Savings	£66	2.42 kg/m²		
Potential energy efficiency rating:			B 89	
Potential environmental impact rating:				A 92

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£144	£159	-£16
Mains gas	£436	£355	£81
Space heating	£321	£321	£0
Water heating	£138	£73	£66
Lighting	£120	£120	£0
Generated (PV)	-£235	-£235	£0
Total cost of fuels	£345	£279	£65
Total cost of uses	£344	£279	£66
Delivered energy	48 kWh/m²	36 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	52 kWh/m²	39 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3736 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4763	0.4670	0.4577	0.4110	0.4016	0.3549	0.3549	0.3456	0.3736	0.4016	0.4203	0.4390 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5964 (25)

3. Heat losses and heat loss parameter

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

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9875 (36)
Total fabric heat loss (33) + (36) = 50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	42.4178	42.1170	40.7045	40.4402	39.2099	39.2099	38.9820	39.6838	40.4402	40.9748	41.5338 (38)
Heat transfer coeff	93.0322	92.7254	92.4247	91.0121	90.7478	89.5175	89.5175	89.2896	89.9914	90.7478	91.2824	91.8414 (39)
Average = Sum(39)m / 12 =												91.0108 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1020	1.0984	1.0948	1.0781	1.0750	1.0604	1.0604	1.0577	1.0660	1.0750	1.0813	1.0879 (40)
HLP (average)												1.0781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5414 (42)
Average daily hot water use (litres/day) 94.5582 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
Energy conte	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	(61)
Total heat required for water heating calculated for each month												
154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321	(62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2190 (H8)
Utilisation factor												0.5597 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.5582 (H14)
Volume ratio Veff/V												0.7932 (H15)
Solar storage volume factor												0.9537 (H16)
Solar input												-851.2084 (H17)
Solar input	-24.6833	-41.1894	-70.1503	-94.0152	-116.1479	-114.1918	-112.6828	-98.4515	-77.1073	-52.6552	-29.2780	-20.6557 (63)
Solar input (sum of months) = Sum(63)m =												-851.2084 (63)
Output from w/h												
130.2370	94.3254	69.6668	27.8600	0.7745	0.0000	0.0000	8.8344	31.4784	73.9124	108.9022	129.3764	(64)
Total per year (kWh/year) = Sum(64)m =												675.3675 (64)
Heat gains from water heating, kWh/month												
51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				7.0000	11.2829	0.6300	0.7000		0.7700	24.1375	(75)	
Southeast				1.4400	36.7938	0.6300	0.7000		0.7700	16.1923	(77)	
Southwest				3.1400	36.7938	0.6300	0.7000		0.7700	35.3083	(79)	
Solar gains	75.6381	136.8572	208.5499	294.0986	361.9959	373.7094	354.3317	301.4863	237.8301	156.9982	92.0571	63.7857 (83)
Total gains	647.2199	703.6589	752.7777	803.5256	835.8666	815.9093	778.2080	734.1217	690.6750	644.8599	618.6903	619.6669 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.4921	44.6393	44.7846	45.4797	45.6121	46.2390	46.2390	46.3570	45.9955	45.6121	45.3450	45.0690
alpha	3.9661	3.9760	3.9856	4.0320	4.0408	4.0826	4.0826	4.0905	4.0664	4.0408	4.0230	4.0046
util living area	0.9817	0.9728	0.9534	0.9046	0.8055	0.6430	0.4901	0.5353	0.7578	0.9204	0.9707	0.9843 (86)
MIT	19.6538	19.8139	20.0859	20.4480	20.7481	20.9285	20.9816	20.9737	20.8557	20.4831	20.0155	19.6276 (87)
Th 2	19.9992	20.0022	20.0051	20.0188	20.0213	20.0333	20.0333	20.0355	20.0287	20.0213	20.0161	20.0107 (88)
util rest of house	0.9775	0.9667	0.9425	0.8816	0.7590	0.5647	0.3895	0.4333	0.6882	0.8964	0.9630	0.9808 (89)
MIT 2	18.7856	18.9455	19.2140	19.5712	19.8432	19.9954	20.0271	20.0259	19.9426	19.6127	19.1569	18.7688 (90)
Living area fraction												fLA = Living area / (4) = 0.2206 (91)
MIT	18.9771	19.1371	19.4063	19.7646	20.0428	20.2012	20.2376	20.2349	20.1440	19.8047	19.3463	18.9582 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9771	19.1371	19.4063	19.7646	20.0428	20.2012	20.2376	20.2349	20.1440	19.8047	19.3463	18.9582 (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	0.9721	0.9600	0.9345	0.8747	0.7601	0.5791	0.4114	0.4552	0.6972	0.8900	0.9564	0.9759	(94)
Useful gains	629.1515	675.5010	703.4701	702.8744	635.3382	472.4922	320.1600	334.1777	481.5724	573.9414	591.7381	604.7277	(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	1365.4425	1320.1374	1192.8584	988.8127	757.0883	501.4050	325.6274	342.4188	543.9066	835.3059	1117.8719	1355.4154	(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	547.8005	433.1956	364.1049	205.8755	90.5821	0.0000	0.0000	0.0000	0.0000	194.4552	378.8163	558.5116	(98)
Space heating												2773.3417	(98)
Space heating per m2											(98) / (4) =	32.8517	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3074.6582	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	547.8005	433.1956	364.1049	205.8755	90.5821	0.0000	0.0000	0.0000	0.0000	194.4552	378.8163	558.5116	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	607.3176	480.2612	403.6640	228.2434	100.4236	0.0000	0.0000	0.0000	0.0000	215.5822	419.9737	619.1925	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	130.2370	94.3254	69.6668	27.8600	0.7745	0.0000	0.0000	8.8344	31.4784	73.9124	108.9022	129.3764	(64)	
Efficiency of water heater	87.1755	87.3779	87.6571	88.2989	90.0621	76.4000	76.4000	76.4000	76.4000	85.9254	86.7031	87.2364	(217)	
Fuel for water heating, kWh/month	149.3965	107.9511	79.4765	31.5519	0.8600	0.0000	0.0000	11.5634	41.2021	86.0192	125.6036	148.3055	(219)	
Water heating fuel used												781.9298	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3074.6582	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													387.5584	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.80 * 1029 * 1.00) =										-658.6795			-658.6795	(233)
Total delivered energy for all uses													3710.4669	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3074.6582	3.4800	106.9981	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	781.9298	3.4800	27.2112	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	387.5584	13.1900	51.1190	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-658.6795	13.1900	-86.8798	(252)
Total energy cost			234.9359	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.7624	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	89.3642	
SAP rating (Section 12)		89	(258)
SAP band		B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3074.6582	0.2160	664.1262 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	781.9298	0.2160	168.8968 (264)
Space and water heating			833.0230 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	387.5584	0.5190	201.1428 (268)
Energy saving/generation technologies			
PV Unit	-658.6795	0.5190	-341.8547 (269)
Total kg/year			757.1862 (272)
CO2 emissions per m2			8.9700 (273)
EI value			92.1602
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1895 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4395 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3736 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4763	0.4390	0.4296	0.4016	0.4016	0.3736	0.3736	0.3643	0.3736	0.4203	0.4110	0.4390 (22b)
Effective ac	0.6134	0.5964	0.5923	0.5806	0.5806	0.5698	0.5698	0.5663	0.5698	0.5883	0.5844	0.5964 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.5800	1.1450	13.2595		(27)
Ground Floor			42.2100	0.1200	5.0652	90.0000	3798.9000 (28a)
Brick and Block	91.8500	13.7000	78.1500	0.2400	18.7560	42.2200	3299.4930 (29a)
Step Party Wall	2.6400		2.6400	0.2600	0.6864	58.0600	153.2784 (29a)
Pitched Roof	42.2100		42.2100	0.1000	4.2210	9.1000	384.1110 (30)
Total net area of external elements Aum(A, m ²)			178.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3201		(33)
Party Wall 1			38.7000	0.0000	0.0000	110.0000	4257.0000 (32)
Ground Floor Stud			67.1100			9.0000	603.9900 (32c)
First Floor Stud			98.3100			9.0000	884.7900 (32c)
Internal Floor 1			42.2100			18.0000	759.7800 (32d)
Internal Ceiling 1			42.2100			18.0000	759.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14901.1224 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5118 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9875 (36)
Total fabric heat loss						(33) + (36) =	50.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7246	41.5338	41.2513	40.4402	40.4402	39.6838	39.6838	39.4438	39.6838	40.9748	40.7045	41.5338 (38)
Heat transfer coeff	93.0322	91.8414	91.5589	90.7478	90.7478	89.9914	89.9914	89.7514	89.9914	91.2824	91.0121	91.8414 (39)
Average = Sum(39)m / 12 =												90.9825 (39)
HLP	1.1020	1.0879	1.0846	1.0750	1.0750	1.0660	1.0660	1.0632	1.0660	1.0813	1.0781	1.0879 (40)
HLP (average)												1.0777 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5414 (42)
Average daily hot water use (litres/day)												94.5582 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0140	100.2317	96.4494	92.6670	88.8847	85.1024	85.1024	88.8847	92.6670	96.4494	100.2317	104.0140 (44)
	154.2498	134.9079	139.2128	121.3691	116.4566	100.4932	93.1217	106.8585	108.1347	126.0206	137.5613	149.3827 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum (45)m = 1487.7689 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.1375	20.2362	20.8819	18.2054	17.4685	15.0740	13.9683	16.0288	16.2202	18.9031	20.6342	22.4074 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6706	0.6069	0.6042	0.5061	0.4658	0.3848	0.3566	0.4274	0.4509	0.5470	0.6189	0.6494 (61)
Total heat required for water heating calculated for each month	154.9204	135.5148	139.8170	121.8752	116.9224	100.8780	93.4783	107.2859	108.5856	126.5676	138.1802	150.0321 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1234.4649 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2073.9010 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3940 (H8)
Utilisation factor												0.5120 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.5582 (H14)
Volume ratio Veff/V												0.7932 (H15)
Solar storage volume factor												0.9537 (H16)
Solar input												-890.3420 (H17)
Solar input	-29.2181	-41.7097	-70.6909	-96.4621	-113.8464	-121.1541	-116.6812	-104.0950	-82.3851	-56.4089	-34.3517	-23.3387 (63)
												Solar input (sum of months) = Sum (63)m = -890.3420 (63)
Output from w/h	125.7023	93.8050	69.1261	25.4131	3.0760	0.0000	0.0000	3.1909	26.2006	70.1587	103.8285	126.6934 (64)
												Total per year (kWh/year) = Sum (64)m = 647.1945 (64)
Heat gains from water heating, kWh/month	51.4557	45.0086	46.4393	40.4818	38.8383	33.5102	31.0521	35.6373	36.0675	42.0386	45.8939	49.8321 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	152.4839	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8629	48.7287	39.6289	30.0016	22.4266	18.9334	20.4583	26.5924	35.6923	45.3195	52.8946	56.3877	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.9403	344.4782	335.5628	316.5830	292.6244	270.1068	255.0636	251.5257	260.4411	279.4208	303.3794	325.8971	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	52.7898	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	-101.6559	(71)
Water heating gains (Table 5)	69.1609	66.9771	62.4184	56.2247	52.2020	46.5419	41.7367	47.8996	50.0938	56.5035	63.7415	66.9786	(72)
Total internal gains	571.5818	566.8017	544.2279	509.4270	473.8707	442.1999	423.8763	432.6354	452.8449	487.8616	526.6332	555.8812	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
Northeast				7.0000	15.0428	0.6300	0.7000			0.7700	32.1810 (75)	
Southeast				1.4400	46.3896	0.6300	0.7000			0.7700	20.4153 (77)	
Southwest				3.1400	46.3896	0.6300	0.7000			0.7700	44.5166 (79)	
Solar gains	97.1129	150.8290	230.1329	332.3562	391.6722	437.7366	405.0716	351.5410	278.9908	183.4485	117.2537	78.1129 (83)
Total gains	668.6947	717.6307	774.3608	841.7832	865.5429	879.9365	828.9479	784.1764	731.8357	671.3101	643.8869	633.9941 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.4921	45.0690	45.2081	45.6121	45.6121	45.9955	45.9955	46.1185	45.9955	45.3450	45.4797	45.0690
alpha	3.9661	4.0046	4.0139	4.0408	4.0408	4.0664	4.0664	4.0746	4.0664	4.0230	4.0320	4.0046
util living area	0.9745	0.9656	0.9394	0.8747	0.7477	0.5457	0.3957	0.4160	0.6663	0.8793	0.9547	0.9779 (86)
MIT	19.8277	19.9524	20.2243	20.5600	20.8302	20.9649	20.9927	20.9913	20.9226	20.6324	20.2156	19.8180 (87)
Th 2	19.9992	20.0107	20.0135	20.0213	20.0213	20.0287	20.0287	20.0310	20.0287	20.0161	20.0188	20.0107 (88)
util rest of house	0.9685	0.9577	0.9251	0.8453	0.6908	0.4612	0.2947	0.3107	0.5817	0.8427	0.9423	0.9726 (89)
MIT 2	18.9575	19.0884	19.3544	19.6759	19.9099	20.0128	20.0269	20.0288	19.9891	19.7446	19.3543	18.9574 (90)
Living area fraction	fLA = Living area / (4) =											0.2206 (91)
MIT	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	20.1950	19.9404	19.5442	19.1472 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1495	19.2790	19.5463	19.8709	20.1129	20.2228	20.2399	20.2411	20.1950	19.9404	19.5442	19.1472 (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	0.9621	0.9504	0.9170	0.8402	0.6966	0.4787	0.3171	0.3340	0.5972	0.8394	0.9349	0.9666	(94)
Useful gains	643.3190	682.0713	710.0961	707.2787	602.9105	421.2366	262.8284	261.8900	437.0643	563.4856	601.9910	612.8500	(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	1279.1443	1247.1106	1121.2575	932.0593	681.7747	434.0132	264.5663	263.9715	467.5026	743.0777	1014.2598	1253.3800	(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	473.0540	379.7064	305.9041	161.8420	58.6750	0.0000	0.0000	0.0000	0.0000	133.6165	296.8335	476.5543	(98)
Space heating												2286.1859	(98)
Space heating per m2												(98) / (4) =	27.0811 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2534.5742 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.0540	379.7064	305.9041	161.8420	58.6750	0.0000	0.0000	0.0000	0.0000	133.6165	296.8335	476.5543	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	524.4501	420.9606	339.1398	179.4258	65.0499	0.0000	0.0000	0.0000	0.0000	148.1336	329.0837	528.3308	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	125.7023	93.8050	69.1261	25.4131	3.0760	0.0000	0.0000	3.1909	26.2006	70.1587	103.8285	126.6934	(64)
Efficiency of water heater	86.9045	87.0838	87.2937	88.0418	89.3957	76.4000	76.4000	76.4000	76.4000	84.9189	86.1667	86.9033	(216)
(217)m	144.6441	107.7181	79.1880	28.8648	3.4408	0.0000	0.0000	4.1766	34.2940	82.6184	120.4972	145.7866	(219)
Fuel for water heating, kWh/month												751.2287	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													2534.5742 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													387.5584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1182 * 1.00) =									-756.2922				-756.2922 (233)
Total delivered energy for all uses													3042.0691 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2534.5742	7.6100	192.8811	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	751.2287	7.6100	57.1685	(247)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Pump for solar water heating	50.0000	31.0800	15.5400	(249)
Energy for lighting	387.5584	31.0800	120.4531	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-756.2922	31.0800	-235.0556	(252)
Total energy cost			279.2971	(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	2534.5742	0.2160	547.4680	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	751.2287	0.2160	162.2654	(264)
Space and water heating			709.7334	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	387.5584	0.5190	201.1428	(268)
Energy saving/generation technologies				
PV Unit	-756.2922	0.5190	-392.5157	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Total kg/year

583.2356 (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	2534.5742	1.2200	3092.1805 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	751.2287	1.2200	916.4990 (264)
Space and water heating			4008.6796 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	387.5584	3.0700	1189.8042 (268)
Energy saving/generation technologies			
PV Unit	-756.2922	3.0700	-2321.8170 (269)
Primary energy kWh/year			3260.4168 (272)
Primary energy kWh/m2/year			38.6214 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 52	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 52		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.21	TER	18.03
Environmental	90 B	% DER<TER	26.74		
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53
General Requirements Compliance	Pass	% DFEE<TFEE	15.51		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Mineral wool batt						
	Main construction	350	0.0380	9.2105	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Mineral wool batt						
	Main construction	100	0.0380	2.6316	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 52	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 52		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.21	TER	18.03
Environmental	90 B	% DER<TER	26.74		
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53
General Requirements Compliance	Pass	% DFEE<TFEE	15.51		

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 0931 Plot 52	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 52		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.21	TER	18.03
Environmental	90 B	% DER<TER	26.74		
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53
General Requirements Compliance	Pass	% DFEE<TFEE	15.51		

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 000006

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Supafil Party Wall						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	680	1000
	Main construction	100	0.8803	0.1136	5.96	680	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 3.898 m ² K/W	Lower limit = 3.765 m ² K/W	Average = 3.831 m ² K/W
	Total correction = 0.0003 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: None		
Total thickness: 328 mm	U-value: 0.26 W/m² K	Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 52	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G
Project	Plot 52		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.21	TER	18.03
Environmental	90 B	% DER<TER	26.74		
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53
General Requirements Compliance	Pass	% DFEE<TFEE	15.51		

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

Floor 000003

Floor Type: Suspended Floor

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

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 52			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block G		
Property	Plot 52				
SAP Rating	88 B	DER	13.21	TER	18.03
Environmental	90 B	% DER<TER	26.74		
CO ₂ Emissions (t/year)	0.79	DFEE	42.70	TFEE	50.53
General Requirements Compliance	Pass	% DFEE<TFEE	15.51		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

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

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	18.37 m	42.21 m ²	2.39 m
	1st Storey:	18.37 m	42.21 m ²	2.61 m

7.0 Living Area	18.62	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	176.51	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	91.85	78.15
Step Party Wall	Cavity Wall	Other	0.26	58.06	2.64	2.64

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	38.70

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

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Other	0.10	9.10	42.21	42.21

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.21

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	42.21

11.2 Internal Floors

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

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South West							2.12	
Windows	Window	[1] Brick and Block	South West	None	0.00					3.14	
Rear Elevation	Window	[1] Brick and Block	North East	None	0.00					7.00	
Side Elevation	Window	[1] Brick and Block	South East	None	0.00					1.44	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	9.77	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	7.16	0.021	No	Knauf P5
Independently assessed	E4 Jamb	24.60	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	18.37	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.37	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.66	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	17.60	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.60	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	8.80	0.036	No	Knauf P25 Halved
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.80	0.000	No	

Y-value 0.033 W/m²K

18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Description

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heat Emitter

Flow Temperature

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

Community Heating

28.0 Water Heating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
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32.0 Photovoltaic Unit	One Dwelling
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PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£66	B 89	