



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 50

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

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

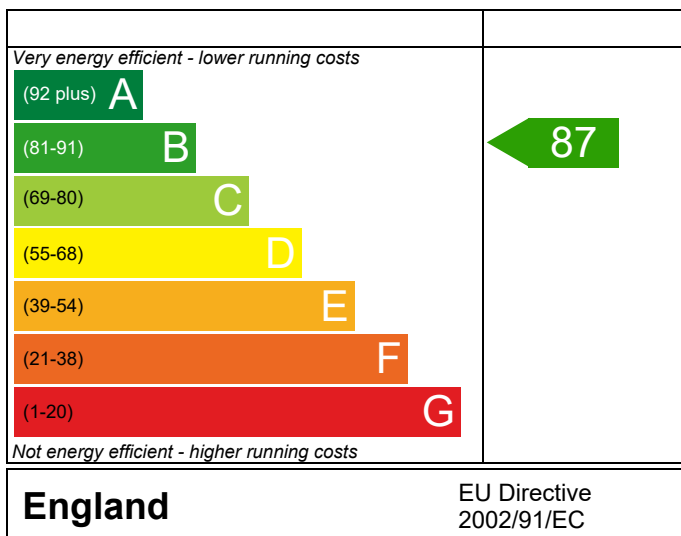
Plot 50

Dwelling type: House, Semi-Detached
Date of assessment: 08/02/2024
Produced by: Abacus Energy (UK) Ltd
Total floor area: 72.03 m²
DRRN: 3608-2202-0140

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.

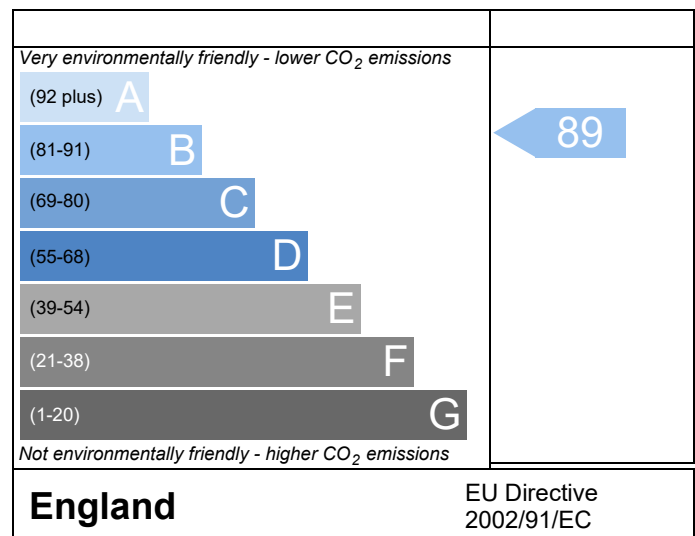
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

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 50				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C			
Property	Plot 50					
SAP Rating	87 B	DER	15.05	TER	19.69	
Environmental	89 B	% DER<TER	23.57			
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99	
General Requirements Compliance	Pass	% DFEE<TFEE	15.83			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.69	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.05	kgCO ₂ /m ²	Pass
	-4.64 (-23.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.99	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.13	kWh/m ² /yr	
	-8.9 (-15.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 830 VUW 306/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

7.82 m², No overhang

Windows facing South West

3.14 m², No overhang

Windows facing North West

0.72 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.60

kW

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RECOMMENDATIONS

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

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 50	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Property	Plot 50		

SAP Rating	87 B	DER	15.05	TER	19.69
Environmental	89 B	% DER<TER	23.57		
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99
General Requirements Compliance	Pass	% DFEE<TFEE	15.83		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	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	17.74	2.84	
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	1.01	0.32	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	2.24	0.72	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	14.79	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.40	0.50	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.72	0.38	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	14.20	0.55	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	4.20	-0.38	Knauf P24
External wall	E18 Party wall between dwellings	Independently assessed	0.036	10.00	0.36	Knauf P25 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.72	1.40	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.72	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.72	0.31	Knauf P29 Halved

Total: **7.96** W/mK:
Y-Value: **0.050** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 72 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.69 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.05 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 830 VUW 306/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing North East: 7.82 m², No overhang
Windows facing South West: 3.14 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 0.60 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13857.7150 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.3881 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9622 (36)
Total fabric heat loss (33) + (36) = 49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	85.0153	84.7802	84.5496	83.4669	83.2644	82.3214	82.3214	82.1467	82.6846	83.2644	83.6742	84.1026 (39)
Average = Sum(39)m / 12 =												83.4660 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1770	1.1738	1.1588	1.1560	1.1429	1.1429	1.1405	1.1479	1.1560	1.1617	1.1676 (40)
HLP (average)												1.1588 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1395.4639 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950 (61)
Total heat required for water heating calculated for each month											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (64)
Heat gains from water heating, kWh/month											
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7376	16.6426	13.5346	10.2466	7.6595	6.4664	6.9872	9.0822	12.1902	15.4782	18.0654	19.2584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467 (72)
Total internal gains	346.3452	344.2609	331.5642	311.1865	290.6069	270.7346	257.8180	263.6287	274.0935	294.6737	318.2858	335.8963 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.8200	11.2829	0.6300	0.7000	0.7700	26.9650 (75)			
Southwest				3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)			
Northwest				0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (81)			
Solar gains	64.7560	120.0848	190.2863	279.3221	352.6128	367.5470	347.0784	289.7273	220.6978	139.7244	79.3441	54.2650 (83)
Total gains	411.1012	464.3457	521.8505	590.5085	643.2197	638.2816	604.8964	553.3560	494.7913	434.3981	397.6299	390.1614 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.2785	45.4041	45.5279	46.1184	46.2306	46.7602	46.7602	46.8596	46.5548	46.2306	46.0042	45.7699
alpha	4.0186	4.0269	4.0352	4.0746	4.0820	4.1173	4.1173	4.1240	4.1037	4.0820	4.0669	4.0513
util living area	0.9951	0.9914	0.9815	0.9501	0.8699	0.7208	0.5674	0.6306	0.8568	0.9693	0.9916	0.9961 (86)
MIT	19.3995	19.5664	19.8680	20.2857	20.6580	20.8934	20.9697	20.9537	20.7662	20.2916	19.7775	19.3733 (87)
Th 2	19.9358	19.9384	19.9410	19.9531	19.9554	19.9660	19.9660	19.9679	19.9619	19.9554	19.9508	19.9460 (88)
util rest of house	0.9938	0.9890	0.9761	0.9348	0.8289	0.6369	0.4479	0.5108	0.7957	0.9570	0.9889	0.9950 (89)
MIT 2	18.4777	18.6457	18.9466	19.3635	19.7099	19.9097	19.9562	19.9513	19.8168	19.3770	18.8662	18.4595 (90)
Living area fraction									fLA = Living area / (4) =		0.2446 (91)	
MIT	18.7032	18.8710	19.1720	19.5891	19.9418	20.1503	20.2041	20.1965	20.0490	19.6008	19.0891	18.6830 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7032	18.8710	19.1720	19.5891	19.9418	20.1503	20.2041	20.1965	20.0490	19.6008	19.0891	18.6830 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9917	0.9859	0.9711	0.9282	0.8283	0.6532	0.4768	0.5392	0.8017	0.9516	0.9859	0.9932 (94)
Useful gains	407.6871	457.7844	506.7589	548.1327	532.8021	416.8973	288.4305	298.3647	396.6697	413.3727	392.0096	387.5198 (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	1224.4939	1184.4599	1071.4125	892.1840	686.2506	456.9107	296.6939	311.8697	491.8906	749.4431	1003.1806	1218.0594 (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	607.7043	488.3259	420.1023	247.7169	114.1657	0.0000	0.0000	0.0000	0.0000	250.0364	440.0431	617.9215 (98)
Space heating												
Space heating per m2	(98) / (4) = 44.2318 (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													3532.1687	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	607.7043	488.3259	420.1023	247.7169	114.1657	0.0000	0.0000	0.0000	0.0000	250.0364	440.0431	617.9215	(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)	673.7298	541.3813	465.7453	274.6307	126.5695	0.0000	0.0000	0.0000	0.0000	277.2022	487.8527	685.0571	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)	
Efficiency of water heater (217)m	87.0951	86.8866	86.4059	85.2356	82.7316	76.2000	76.2000	76.2000	76.2000	85.1433	86.5639	87.2113	(216)	
Fuel for water heating, kWh/month	167.9807	147.2101	152.6911	134.8931	133.2968	124.8341	115.6771	132.7948	134.4351	140.2714	150.6651	162.4637	(219)	
Water heating fuel used												1697.2131	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3532.1687	(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)													330.9118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096			-494.0096	(233)
Total delivered energy for all uses													5141.2839	(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	3532.1687	0.2160	762.9484	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1697.2131	0.2160	366.5980	(264)
Space and water heating			1129.5465	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	330.9118	0.5190	171.7432	(268)
Energy saving/generation technologies				
PV Unit	-494.0096	0.5190	-256.3910	(269)
Total CO2, kg/year			1083.8237	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0500	(273)

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

DER			15.0500	ZC1
Total Floor Area		TFA	72.0300	
Assumed number of occupants		N	2.2944	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.6172	ZC2
CO2 emissions from cooking, equation (L16)			2.4166	ZC3
Total CO2 emissions			34.0838	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			34.0838	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 180.0084 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			11.6800	1.3258	15.4848		(27)
Ground Floor			35.8300	0.1300	4.6579		(28a)
Exposed above Door			0.6000	0.1300	0.0780		(28b)
Brick and Block	87.0500	13.8000	73.2500	0.1800	13.1850		(29a)
Pitched Roof	36.2000		36.2000	0.1300	4.7060		(30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.2317	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2261 (36)
Total fabric heat loss						(33) + (36) =	50.4578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	86.2154	85.9802	85.7497	84.6670	84.4644	83.5214	83.5214	83.3468	83.8847	84.4644	84.8742	85.3026 (39)
Average = Sum(39)m / 12 =												84.6660 (39)
HLP	1.1969	1.1937	1.1905	1.1754	1.1726	1.1595	1.1595	1.1571	1.1646	1.1726	1.1783	1.1843 (40)
HLP (average)												1.1754 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)
Energy content (annual)										Total = Sum(45)m =		1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.7159	43.2718	46.1002	42.8635	42.4845	39.3645	40.6766	42.4845	42.8635	46.1002	46.3626	49.7159 (61)
Total heat required for water heating calculated for each month	194.3956	169.8096	176.6759	156.7026	151.7158	133.6228	128.0208	142.7132	144.2893	164.3021	175.3893	189.8305 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	194.3956	169.8096	176.6759	156.7026	151.7158	133.6228	128.0208	142.7132	144.2893	164.3021	175.3893	189.8305 (64)
Heat gains from water heating, kWh/month	60.5350	52.8918	54.9415	48.5674	46.9405	41.1820	39.2111	43.9472	44.4400	50.8272	54.4920	59.0171 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7376	16.6426	13.5346	10.2466	7.6595	6.4664	6.9872	9.0822	12.1902	15.4782	18.0654	19.2584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Water heating gains (Table 5)	81.3642	78.7080	73.8461	67.4547	63.0921	57.1972	52.7031	59.0688	61.7222	68.3161	75.6834	79.3240 (72)
Total internal gains	362.5054	359.8501	346.5984	325.6745	304.5307	284.1024	271.2168	277.5815	288.6246	309.7511	333.8996	352.0737 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W					
Northeast					7.8200	11.2829	0.6300	0.7000	0.7700		26.9650 (75)					
Southwest					3.1400	36.7938	0.6300	0.7000	0.7700		35.3083 (79)					
Northwest					0.7200	11.2829	0.6300	0.7000	0.7700		2.4827 (81)					
Solar gains					64.7560	120.0848	190.2863	279.3221	352.6128	367.5470	347.0784	289.7273	220.6978	139.7244	79.3441	54.2650 (83)
Total gains					427.2614	479.9349	536.8847	604.9966	657.1435	651.6494	618.2952	567.3088	509.3224	449.4755	413.2436	406.3387 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.0185	58.1771	58.3335	59.0795	59.2212	59.8898	59.8898	60.0153	59.6305	59.2212	58.9352	58.6392
alpha	4.8679	4.8785	4.8889	4.9386	4.9481	4.9927	4.9927	5.0010	4.9754	4.9481	4.9290	4.9093
util living area	0.9981	0.9963	0.9906	0.9682	0.8967	0.7414	0.5756	0.6417	0.8811	0.9819	0.9963	0.9985 (86)
MIT	19.6900	19.8279	20.0790	20.4307	20.7451	20.9331	20.9849	20.9748	20.8309	20.4325	20.0037	19.6688 (87)
Th 2	19.9225	19.9251	19.9276	19.9397	19.9420	19.9525	19.9525	19.9545	19.9484	19.9420	19.9374	19.9326 (88)
util rest of house	0.9974	0.9950	0.9871	0.9555	0.8549	0.6494	0.4481	0.5123	0.8167	0.9725	0.9948	0.9980 (89)
MIT 2	18.1791	18.3822	18.7495	19.2618	19.6865	19.9070	19.9469	19.9438	19.8063	19.2726	18.6484	18.1553 (90)
Living area fraction	18.5487	18.7359	19.0747	19.5477	19.9454	20.1580	20.2008	20.1960	20.0569	19.5563	18.9799	18.5255 (92)
Temperature adjustment	18.5487	18.7359	19.0747	19.5477	19.9454	20.1580	20.2008	20.1960	20.0569	19.5563	18.9799	18.5255 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9962	0.9928	0.9831	0.9494	0.8551	0.6690	0.4795	0.5440	0.8246	0.9677	0.9927	0.9970 (94)
Ext temp.	425.6275	476.5014	527.8217	574.3732	561.9134	435.9533	296.4578	308.6040	419.9877	434.9408	410.2240	405.1185 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1228.4538	1189.6095	1078.2786	901.5097	696.4455	464.2106	300.7426	316.3827	499.6935	756.4892	1008.2980	1222.0058 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	597.3028	479.2086	409.5399	235.5383	100.0919	0.0000	0.0000	0.0000	0.0000	239.2319	430.6133	607.7641 (98)
												3099.2907 (98)
												43.0278 (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													3318.2984 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.3028	479.2086	409.5399	235.5383	100.0919	0.0000	0.0000	0.0000	0.0000	239.2319	430.6133	607.7641	(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)	639.5104	513.0713	438.4795	252.1823	107.1647	0.0000	0.0000	0.0000	0.0000	256.1370	461.0420	650.7110	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	194.3956	169.8096	176.6759	156.7026	151.7158	133.6228	128.0208	142.7132	144.2893	164.3021	175.3893	189.8305	(64)
Efficiency of water heater (217)m	87.6917	87.5198	87.0983	86.0748	84.0319	80.3000	80.3000	80.3000	80.3000	85.9960	87.2248	87.7725	(216)
Fuel for water heating, kWh/month	221.6807	194.0241	202.8465	182.0540	180.5455	166.4045	159.4282	177.7250	179.6878	191.0579	201.0774	216.2757	(219)
Water heating fuel used												2272.8073	(219)
Annual totals kWh/year													
Space heating fuel - main system												3318.2984	(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)												330.9118	(232)
Total delivered energy for all uses												5997.0174	(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	3318.2984	0.2160	716.7525 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2272.8073	0.2160	490.9264 (264)
Space and water heating			1207.6788 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.9118	0.5190	171.7432 (268)
Total CO2, kg/m2/year			1418.3470 (272)
Emissions per m2 for space and water heating			16.7663 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3843 (272b)
Emissions per m2 for pumps and fans			0.5404 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7663 * 1.00) + 2.3843 + 0.5404, rounded to 2 d.p.			19.6900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			9.0000	322.4700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13535.2450 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							187.9112 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9622 (36)
Total fabric heat loss						(33) + (36) =	49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	85.0153	84.7802	84.5496	83.4669	83.2644	82.3214	82.3214	82.1467	82.6846	83.2644	83.6742	84.1026 (39)
Average = Sum(39)m / 12 =												83.4660 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1770	1.1738	1.1588	1.1560	1.1429	1.1429	1.1405	1.1479	1.1560	1.1617	1.1676 (40)
HLP (average)												1.1588 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1395.4639 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.7444	26.8893	27.7473	24.1908	23.2117	20.0299	18.5606	21.2986	21.5530	25.1179	27.4182	29.7744 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7376	16.6426	13.5346	10.2466	7.6595	6.4664	6.9872	9.0822	12.1902	15.4782	18.0654	19.2584	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	41.3232	40.0138	37.2948	33.5983	31.1985	27.8193	24.9471	28.6272	29.9347	33.7606	38.0808	40.0193	(72)
Total internal gains	319.4643	318.1559	307.0471	288.8182	269.6371	251.7244	240.4608	244.1399	253.8372	272.1956	293.2970	309.7690	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					7.8200	11.2829	0.6300	0.7000			0.7700			26.9650 (75)
Southwest					3.1400	36.7938	0.6300	0.7000			0.7700			35.3083 (79)
Northwest					0.7200	11.2829	0.6300	0.7000			0.7700			2.4827 (81)
Solar gains	64.7560	120.0848	190.2863	279.3221	352.6128	367.5470	347.0784	289.7273	220.6978	139.7244	79.3441	54.2650	(83)	
Total gains	384.2203	438.2407	497.3334	568.1403	622.2498	619.2714	587.5392	533.8671	474.5350	411.9200	372.6411	364.0340	(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	44.2249	44.3475	44.4684	45.0453	45.1548	45.6721	45.6721	45.7692	45.4715	45.1548	44.9337	44.7048	
alpha	3.9483	3.9565	3.9646	4.0030	4.0103	4.0448	4.0448	4.0513	4.0314	4.0103	3.9956	3.9803	
util living area	0.9958	0.9924	0.9832	0.9537	0.8772	0.7323	0.5799	0.6460	0.8675	0.9727	0.9928	0.9966	(86)
MIT	19.3288	19.5003	19.8107	20.2420	20.6298	20.8808	20.9650	20.9464	20.7421	20.2462	19.7167	19.3031	(87)
Th 2	19.9358	19.9384	19.9410	19.9531	19.9554	19.9660	19.9660	19.9679	19.9619	19.9554	19.9508	19.9460	(88)
util rest of house	0.9947	0.9904	0.9784	0.9395	0.8381	0.6496	0.4594	0.5261	0.8096	0.9618	0.9905	0.9957	(89)
MIT 2	18.4097	18.5824	18.8924	19.3236	19.6867	19.9018	19.9543	19.9480	19.7988	19.3352	18.8081	18.3918	(90)
Living area fraction	18.6346	18.8069	19.1170	19.5482	19.9174	20.1413	20.2016	20.1923	20.0296	19.5581	19.0304	18.6147	(91)
MIT	18.6346	18.8069	19.1170	19.5482	19.9174	20.1413	20.2016	20.1923	20.0296	19.5581	19.0304	18.6147	(92)
Temperature adjustment	18.6346	18.8069	19.1170	19.5482	19.9174	20.1413	20.2016	20.1923	20.0296	19.5581	19.0304	18.6147	(93)
adjusted MIT	18.6346	18.8069	19.1170	19.5482	19.9174	20.1413	20.2016	20.1923	20.0296	19.5581	19.0304	18.6147	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9928	0.9874	0.9735	0.9327	0.8365	0.6649	0.4884	0.5542	0.8141	0.9564	0.9877	0.9942	(94)
Ext temp.	381.4519	432.7129	484.1503	529.8849	520.5064	411.7792	286.9471	295.8584	386.3228	393.9521	368.0533	361.9081	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1218.6574	1179.0324	1066.7655	888.7758	684.2159	456.1678	296.4862	311.5212	490.2826	745.8873	998.2634	1212.3164	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	622.8809	501.5267	433.4658	258.4015	121.7999	0.0000	0.0000	0.0000	0.0000	261.8398	453.7513	632.7038	(98)
Space heating per m2												3286.3696	(98)
												45.6250	(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	773.8210	609.1782	624.3153	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8194	0.8834	0.8497	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	634.0398	538.1681	530.4547	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	809.3743	770.5779	709.3334	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	126.2409	172.9129	133.0857	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												432.2394 (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	31.5602	43.2282	33.2714	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												108.0599 (107)
Space cooling per m2												1.5002 (108)
Energy for space heating												45.6250 (99)
Energy for space cooling												1.5002 (108)
Total												47.1252 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 180.0084 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			11.6800	1.3258	15.4848		(27)
Ground Floor			35.8300	0.1300	4.6579		(28a)
Exposed above Door			0.6000	0.1300	0.0780		(28b)
Brick and Block	87.0500	13.8000	73.2500	0.1800	13.1850		(29a)
Pitched Roof	36.2000		36.2000	0.1300	4.7060		(30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2317		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2261 (36)
Total fabric heat loss						(33) + (36) =	50.4578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	86.2154	85.9802	85.7497	84.6670	84.4644	83.5214	83.5214	83.3468	83.8847	84.4644	84.8742	85.3026 (39)
Average = Sum(39)m / 12 =												84.6660 (39)
HLP	1.1969	1.1937	1.1905	1.1754	1.1726	1.1595	1.1595	1.1571	1.1646	1.1726	1.1783	1.1843 (40)
HLP (average)												1.1754 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy content (annual)	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.7444	26.8893	27.7473	24.1908	23.2117	20.0299	18.5606	21.2986	21.5530	25.1179	27.4182	29.7744 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	114.7191	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7376	16.6426	13.5346	10.2466	7.6595	6.4664	6.9872	9.0822	12.1902	15.4782	18.0654	19.2584	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9878	204.0838	198.8019	187.5575	173.3634	160.0230	151.1107	149.0147	154.2966	165.5410	179.7351	193.0756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	34.4719	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	41.3232	40.0138	37.2948	33.5983	31.1985	27.8193	24.9471	28.6272	29.9347	33.7606	38.0808	40.0193	(72)
Total internal gains	319.4643	318.1559	307.0471	288.8182	269.6371	251.7244	240.4608	244.1399	253.8372	272.1956	293.2970	309.7690	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast				7.8200	11.2829	0.6300	0.7000			0.7700			26.9650 (75)		
Southwest				3.1400	36.7938	0.6300	0.7000			0.7700			35.3083 (79)		
Northwest				0.7200	11.2829	0.6300	0.7000			0.7700			2.4827 (81)		
Solar gains				64.7560	120.0848	190.2863	279.3221	352.6128	367.5470	347.0784	289.7273	220.6978	139.7244	79.3441	54.2650 (83)
Total gains				384.2203	438.2407	497.3334	568.1403	622.2498	619.2714	587.5392	533.8671	474.5350	411.9200	372.6411	364.0340 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.0185	58.1771	58.3335	59.0795	59.2212	59.8898	59.8898	60.0153	59.6305	59.2212	58.9352	58.6392	
alpha	4.8679	4.8785	4.8889	4.9386	4.9481	4.9927	4.9927	5.0010	4.9754	4.9481	4.9290	4.9093	
util living area	0.9988	0.9975	0.9932	0.9750	0.9125	0.7665	0.6015	0.6734	0.9035	0.9873	0.9977	0.9991	(86)
MIT	19.6348	19.7748	20.0300	20.3893	20.7173	20.9221	20.9817	20.9689	20.8049	20.3875	19.9519	19.6143	(87)
Th 2	19.9225	19.9251	19.9276	19.9397	19.9420	19.9525	19.9525	19.9545	19.9484	19.9420	19.9374	19.9326	(88)
util rest of house	0.9984	0.9966	0.9906	0.9646	0.8749	0.6759	0.4703	0.5415	0.8462	0.9804	0.9967	0.9988	(89)
MIT 2	18.6771	18.8189	19.0750	19.4379	19.7449	19.9154	19.9477	19.9452	19.8326	19.4418	19.0058	18.6648	(90)
Living area fraction	18.9114	19.0528	19.3086	19.6706	19.9828	20.1617	20.2007	20.1956	20.0705	19.6731	19.2373	18.8971	(92)
MIT	18.9114	19.0528	19.3086	19.6706	19.9828	20.1617	20.2007	20.1956	20.0705	19.6731	19.2373	18.8971	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.9114	19.0528	19.3086	19.6706	19.9828	20.1617	20.2007	20.1956	20.0705	19.6731	19.2373	18.8971	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	383.3959	436.3126	491.6227	546.1183	545.4801	430.8930	295.4540	306.5121	405.3820	402.8672	371.0538	363.4371	(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	1259.7257	1216.8581	1098.3328	911.9163	699.6007	464.5201	300.7324	316.3495	500.8306	766.3548	1030.1400	1253.6990	(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	651.9900	524.5266	451.3923	263.3745	114.6657	0.0000	0.0000	0.0000	0.0000	270.4348	474.5421	662.3549	(98)
Space heating												3413.2809	(98)
Space heating per m2												47.3869	(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	785.1015	618.0586	633.4357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8456	0.9103	0.8767	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	663.8434	562.5947	555.3627	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	809.3743	770.5779	709.3334	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	104.7822	154.7395	114.5542	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												374.0759 (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	26.1956	38.6849	28.6385	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.5190 (107)
Space cooling per m2												1.2983 (108)
Energy for space heating												47.3869 (99)
Energy for space cooling												1.2983 (108)
Total												48.6853 (109)
Target Fabric Energy Efficiency (TFEE)												56.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4516	0.4161	0.4073	0.3807	0.3807	0.3542	0.3542	0.3453	0.3542	0.3984	0.3896	0.4161 (22b)
Effective ac	0.6020	0.5866	0.5829	0.5725	0.5725	0.5627	0.5627	0.5596	0.5627	0.5794	0.5759	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13857.7150 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.3881 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9622 (36)
Total fabric heat loss (33) + (36) = 49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	34.8448	34.6283	34.0066	34.0066	33.4268	33.4268	33.2429	33.4268	34.4164	34.2092	34.8448 (38)
Heat transfer coeff	85.0153	84.1026	83.8861	83.2644	83.2644	82.6846	82.6846	82.5007	82.6846	83.6742	83.4669	84.1026 (39)
Average = Sum(39)m / 12 =												83.4442 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1676	1.1646	1.1560	1.1560	1.1479	1.1479	1.1454	1.1479	1.1617	1.1588	1.1676 (40)
HLP (average)												1.1585 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	1.5720 (61)
Total heat required for water heating calculated for each month	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8440	41.6064	33.8366	25.6165	19.1486	16.1661	17.4680	22.7056	30.4754	38.6955	45.1634	48.1459 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467 (72)
Total internal gains	513.4707	509.2763	489.3161	458.4680	427.0166	398.7841	382.2590	390.1799	407.9081	438.9587	473.4427	499.4134 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.8200	15.0428	0.6300	0.7000	0.7700	35.9508 (75)			
Southwest				3.1400	46.3896	0.6300	0.7000	0.7700	44.5166 (79)			
Northwest				0.7200	15.0428	0.6300	0.7000	0.7700	3.3100 (81)			
Solar gains	83.7774	133.5283	211.9629	318.1840	383.8242	432.6922	398.9558	261.2446	164.7904	101.8779	66.9319 (83)	
Total gains	597.2481	642.8046	701.2790	776.6520	810.8408	831.4763	781.2148	730.4410	669.1527	603.7491	575.3205	566.3453 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.2785	45.7699	45.8880	46.2306	46.2306	46.5548	46.5548	46.6586	46.5548	46.0042	46.1184	45.7699
alpha	4.0186	4.0513	4.0592	4.0820	4.0820	4.1037	4.1037	4.1106	4.1037	4.0669	4.0746	4.0513
util living area	0.9773	0.9690	0.9428	0.8746	0.7399	0.5334	0.3865	0.4111	0.6697	0.8866	0.9593	0.9804 (86)
MIT	19.8241	19.9457	20.2244	20.5702	20.8415	20.9688	20.9936	20.9921	20.9234	20.6271	20.2048	19.8116 (87)
Th 2	19.9358	19.9460	19.9484	19.9554	19.9554	19.9619	19.9619	19.9640	19.9619	19.9508	19.9531	19.9460 (88)
util rest of house	0.9714	0.9611	0.9280	0.8428	0.6779	0.4438	0.2806	0.2994	0.5784	0.8483	0.9470	0.9752 (89)
MIT 2	18.8976	19.0244	19.2965	19.6248	19.8555	19.9488	19.9605	19.9622	19.9248	19.6807	19.2856	18.8937 (90)
Living area fraction	fLA = Living area / (4) =											0.2446 (91)
MIT	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9657	0.9546	0.9208	0.8394	0.6870	0.4649	0.3066	0.3268	0.5979	0.8466	0.9405	0.9700 (94)
Useful gains	576.7697	613.6403	645.7347	651.9036	557.0450	386.5558	239.5418	238.7369	400.1015	511.1618	541.0615	549.3517 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	1166.7733	1139.5732	1025.3803	853.9627	624.2088	396.7488	240.8782	240.4167	427.4058	678.7818	927.3568	1145.3296 (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	438.9626	353.4269	282.4564	145.4826	49.9699	0.0000	0.0000	0.0000	0.0000	124.7093	278.1326	443.4076 (98)
Space heating												2116.5479 (98)
RHI space heating demand												2117 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13857.7150 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.3881 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9622 (36)
Total fabric heat loss (33) + (36) = 49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	85.0153	84.7802	84.5496	83.4669	83.2644	82.3214	82.3214	82.1467	82.6846	83.2644	83.6742	84.1026 (39)
Average = Sum(39)m / 12 =												83.4660 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1770	1.1738	1.1588	1.1560	1.1429	1.1429	1.1405	1.1479	1.1560	1.1617	1.1676 (40)
HLP (average)												1.1588 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1395.4639 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950 (61)
Total heat required for water heating calculated for each month											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (64)
Heat gains from water heating, kWh/month											
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8440	41.6064	33.8366	25.6165	19.1486	16.1661	17.4680	22.7056	30.4754	38.6955	45.1634	48.1459	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	513.4707	509.2763	489.3161	458.4680	427.0166	398.7841	382.2590	390.1799	407.9081	438.9587	473.4427	499.4134	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8200	11.2829	0.6300	0.7000	0.7700	26.9650	(75)
Southwest	3.1400	36.7938	0.6300	0.7000	0.7700	35.3083	(79)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827	(81)

Solar gains	64.7560	120.0848	190.2863	279.3221	352.6128	367.5470	347.0784	289.7273	220.6978	139.7244	79.3441	54.2650	(83)
Total gains	578.2267	629.3610	679.6024	737.7901	779.6294	766.3311	729.3374	679.9072	628.6059	578.6831	552.7867	553.6784	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.2785	45.4041	45.5279	46.1184	46.2306	46.7602	46.7602	46.8596	46.5548	46.2306	46.0042	45.7699
alpha	4.0186	4.0269	4.0352	4.0746	4.0820	4.1173	4.1173	4.1240	4.1037	4.0820	4.0669	4.0513
util living area	0.9838	0.9756	0.9566	0.9059	0.8005	0.6337	0.4822	0.5327	0.7633	0.9265	0.9739	0.9862 (86)
MIT	19.6525	19.8100	20.0867	20.4565	20.7607	20.9341	20.9832	20.9750	20.8553	20.4749	20.0066	19.6233 (87)
Th 2	19.9358	19.9384	19.9410	19.9531	19.9554	19.9660	19.9660	19.9679	19.9619	19.9554	19.9508	19.9460 (88)
util rest of house	0.9798	0.9696	0.9454	0.8812	0.7497	0.5496	0.3755	0.4233	0.6884	0.9019	0.9664	0.9828 (89)
MIT 2	18.7279	18.8850	19.1577	19.5197	19.7915	19.9331	19.9608	19.9595	19.8790	19.5461	19.0904	18.7071 (90)
Living area fraction	18.9541	19.1113	19.3849	19.7488	20.0286	20.1780	20.2109	20.2079	20.1178	19.7733	19.3145	18.9312 (91)
MIT	18.9541	19.1113	19.3849	19.7488	20.0286	20.1780	20.2109	20.2079	20.1178	19.7733	19.3145	18.9312 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9541	19.1113	19.3849	19.7488	20.0286	20.1780	20.2109	20.2079	20.1178	19.7733	19.3145	18.9312 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9637	0.9382	0.8756	0.7536	0.5678	0.4015	0.4498	0.7008	0.8967	0.9605	0.9785	(94)
Useful gains	563.7438	606.4938	637.6236	646.0273	587.5392	435.0918	292.8383	305.8053	440.5350	518.9339	530.9736	541.7540	(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	1245.8213	1204.8348	1089.4180	905.5187	693.4783	459.1852	297.2566	312.8091	497.5813	763.8116	1022.0405	1238.9351	(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	507.4657	402.0851	336.1350	186.8338	78.8187	0.0000	0.0000	0.0000	0.0000	182.1890	353.5682	518.7027	(98)
Space heating												2565.7982	(98)
Space heating per m2												35.6212	(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													2844.5656 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	507.4657	402.0851	336.1350	186.8338	78.8187	0.0000	0.0000	0.0000	0.0000	182.1890	353.5682	518.7027	(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)	562.6005	445.7706	372.6552	207.1328	87.3821	0.0000	0.0000	0.0000	0.0000	201.9834	391.9825	575.0584	(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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)
Efficiency of water heater (217)m	86.6379	86.3703	85.7588	84.2997	81.4707	76.2000	76.2000	76.2000	76.2000	84.0830	85.9449	86.7793	(216)
Fuel for water heating, kWh/month	168.8673	148.0901	153.8433	136.3907	135.3598	124.8341	115.6771	132.7948	134.4351	142.0402	151.7503	163.2724	(219)
Water heating fuel used													1707.3552 (219)
Annual totals kWh/year													
Space heating fuel - main system													2844.5656 (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)													330.9118 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096			-494.0096 (233)
Total delivered energy for all uses													4463.8230 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2844.5656	3.4800	98.9909 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1707.3552	3.4800	59.4160 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	330.9118	13.1900	43.6473 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.0096	13.1900	-65.1599 (252)
Total energy cost			266.7867 (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] =	0.9575 (257)
SAP value		86.6436
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2844.5656	0.2160	614.4262 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1707.3552	0.2160	368.7887 (264)
Space and water heating			983.2149 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.9118	0.5190	171.7432 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total kg/year			937.4921 (272)
CO2 emissions per m2			13.0200 (273)
EI value			89.2657
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8218 = 4.235$, stars = 4
Water heating environmental impact	$0.216 / 0.8218 = 0.2628$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4516	0.4161	0.4073	0.3807	0.3807	0.3542	0.3542	0.3453	0.3542	0.3984	0.3896	0.4161 (22b)
Effective ac	0.6020	0.5866	0.5829	0.5725	0.5725	0.5627	0.5627	0.5596	0.5627	0.5794	0.5759	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13857.7150 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.3881 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9622 (36)
Total fabric heat loss (33) + (36) = 49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	34.8448	34.6283	34.0066	34.0066	33.4268	33.4268	33.2429	33.4268	34.4164	34.2092	34.8448 (38)
Heat transfer coeff	85.0153	84.1026	83.8861	83.2644	83.2644	82.6846	82.6846	82.5007	82.6846	83.6742	83.4669	84.1026 (39)
Average = Sum(39)m / 12 =												83.4442 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1676	1.1646	1.1560	1.1560	1.1479	1.1479	1.1454	1.1479	1.1617	1.1588	1.1676 (40)
HLP (average)												1.1585 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1395.4639 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950 (61)
Total heat required for water heating calculated for each month											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (64)
Heat gains from water heating, kWh/month											
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8440	41.6064	33.8366	25.6165	19.1486	16.1661	17.4680	22.7056	30.4754	38.6955	45.1634	48.1459	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	513.4707	509.2763	489.3161	458.4680	427.0166	398.7841	382.2590	390.1799	407.9081	438.9587	473.4427	499.4134	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				7.8200	15.0428		0.6300	0.7000		0.7700		35.9508 (75)
Southwest				3.1400	46.3896		0.6300	0.7000		0.7700		44.5166 (79)
Northwest				0.7200	15.0428		0.6300	0.7000		0.7700		3.3100 (81)
Solar gains	83.7774	133.5283	211.9629	318.1840	383.8242	432.6922	398.9558	340.2611	261.2446	164.7904	101.8779	66.9319 (83)
Total gains	597.2481	642.8046	701.2790	776.6520	810.8408	831.4763	781.2148	730.4410	669.1527	603.7491	575.3205	566.3453 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.2785	45.7699	45.8880	46.2306	46.2306	46.5548	46.5548	46.6586	46.5548	46.0042	46.1184	45.7699
alpha	4.0186	4.0513	4.0592	4.0820	4.0820	4.1037	4.1037	4.1106	4.1037	4.0669	4.0746	4.0513
util living area	0.9773	0.9690	0.9428	0.8746	0.7399	0.5334	0.3865	0.4111	0.6697	0.8866	0.9593	0.9804 (86)
MIT	19.8241	19.9457	20.2244	20.5702	20.8415	20.9688	20.9936	20.9921	20.9234	20.6271	20.2048	19.8116 (87)
Th 2	19.9358	19.9460	19.9484	19.9554	19.9554	19.9619	19.9619	19.9640	19.9619	19.9508	19.9531	19.9460 (88)
util rest of house	0.9714	0.9611	0.9280	0.8428	0.6779	0.4438	0.2806	0.2994	0.5784	0.8483	0.9470	0.9752 (89)
MIT 2	18.8976	19.0244	19.2965	19.6248	19.8555	19.9488	19.9605	19.9622	19.9248	19.6807	19.2856	18.8937 (90)
Living area fraction	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (91)
MIT	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	576.7697	613.6403	645.7347	651.9036	557.0450	386.5558	239.5418	238.7369	400.1015	511.1618	541.0615	549.3517	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1166.7733	1139.5732	1025.3803	853.9627	624.2088	396.7488	240.8782	240.4167	427.4058	678.7818	927.3568	1145.3296	(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	438.9626	353.4269	282.4564	145.4826	49.9699	0.0000	0.0000	0.0000	0.0000	124.7093	278.1326	443.4076	(98)
Space heating												2116.5479	(98)
Space heating per m2												29.3843	(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													2346.5054	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	438.9626	353.4269	282.4564	145.4826	49.9699	0.0000	0.0000	0.0000	0.0000	124.7093	278.1326	443.4076	(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)	486.6548	391.8259	313.1445	161.2889	55.3990	0.0000	0.0000	0.0000	0.0000	138.2586	308.3510	491.5827	(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	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(64)	
Efficiency of water heater (217)m	86.2392	86.0012	85.2153	83.4332	80.0756	76.2000	76.2000	76.2000	76.2000	82.7616	85.2028	86.3578	(216)	
Fuel for water heating, kWh/month	169.6478	148.7257	154.8245	137.8072	137.7181	124.8341	115.6771	132.7948	134.4351	144.3081	153.0720	164.0693	(219)	
Water heating fuel used												1717.9138	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2346.5054	(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)													330.9118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1182 * 1.00) =										-567.2191			-567.2191	(233)
Total delivered energy for all uses													3903.1119	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2346.5054	7.6100	178.5691 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1717.9138	7.6100	130.7332 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	330.9118	31.0800	102.8474 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-567.2191	31.0800	-176.2917 (252)
Total energy cost			364.1680 (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	2346.5054	0.2160	506.8452 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1717.9138	0.2160	371.0694 (264)
Space and water heating			877.9146 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.9118	0.5190	171.7432 (268)
Energy saving/generation technologies			
PV Unit	-567.2191	0.5190	-294.3867 (269)
Total kg/year			794.1960 (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	2346.5054	1.2200	2862.7366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1717.9138	1.2200	2095.8548 (264)
Space and water heating			4958.5915 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	330.9118	3.0700	1015.8992 (268)
Energy saving/generation technologies			
PV Unit	-567.2191	3.0700	-1741.3628 (269)
Primary energy kWh/year			4463.3779 (272)
Primary energy kWh/m2/year			61.9655 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 63	-196 kg (24.7%)

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

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

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

	Current	Potential	Saving
Electricity	£126	£142	-£16
Mains gas	£414	£336	£78
Space heating	£307	£307	£0
Water heating	£131	£68	£63
Lighting	£103	£103	£0
Generated (PV)	-£176	-£176	£0
Total cost of fuels	£364	£302	£62
Total cost of uses	£365	£302	£63
Delivered energy	54 kWh/m²	41 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	62 kWh/m²	47 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.0084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4516	0.4427	0.4338	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13857.7150 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.3881 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9622 (36)
Total fabric heat loss (33) + (36) = 49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	35.5224	35.2919	34.2092	34.0066	33.0636	33.0636	32.8890	33.4268	34.0066	34.4164	34.8448 (38)
Heat transfer coeff	85.0153	84.7802	84.5496	83.4669	83.2644	82.3214	82.3214	82.1467	82.6846	83.2644	83.6742	84.1026 (39)
Average = Sum(39)m / 12 =												83.4660 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1770	1.1738	1.1588	1.1560	1.1429	1.1429	1.1405	1.1479	1.1560	1.1617	1.1676 (40)
HLP (average)												1.1588 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2944 (42)
Average daily hot water use (litres/day) 88.6916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	1.5720 (61)
Total heat required for water heating calculated for each month	146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2996 (H8)
Utilisation factor												0.5367 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.6916 (H14)
Volume ratio Veff/V												0.8456 (H15)
Solar storage volume factor												0.9665 (H16)
Solar input												-827.2121 (H17)
Solar input	-23.9875	-40.0282	-68.1727	-91.3648	-112.8736	-110.9727	-109.5061	-95.6761	-74.9335	-51.1708	-28.4526	-20.0734 (63)
												Solar input (sum of months) = Sum(63)m = -827.2121 (63)
Output from w/h	122.3155	87.8777	63.7615	23.6121	0.0000	0.0000	0.0000	5.5136	27.5060	68.2609	101.9690	121.6132 (64)
												Total per year (kWh/year) = Sum(64)m = 622.4295 (64)
Heat gains from water heating, kWh/month	48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8440	41.6064	33.8366	25.6165	19.1486	16.1661	17.4680	22.7056	30.4754	38.6955	45.1634	48.1459	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	(71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467	(72)
Total internal gains	513.4707	509.2763	489.3161	458.4680	427.0166	398.7841	382.2590	390.1799	407.9081	438.9587	473.4427	499.4134	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.8200	11.2829	0.6300	0.7000	0.7700	26.9650 (75)			
Southwest				3.1400	36.7938	0.6300	0.7000	0.7700	35.3083 (79)			
Northwest				0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (81)			
Solar gains	64.7560	120.0848	190.2863	279.3221	352.6128	367.5470	347.0784	289.7273	220.6978	139.7244	79.3441	54.2650 (83)
Total gains	578.2267	629.3610	679.6024	737.7901	779.6294	766.3311	729.3374	679.9072	628.6059	578.6831	552.7867	553.6784 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.2785	45.4041	45.5279	46.1184	46.2306	46.7602	46.7602	46.8596	46.5548	46.2306	46.0042	45.7699
alpha	4.0186	4.0269	4.0352	4.0746	4.0820	4.1173	4.1173	4.1240	4.1037	4.0820	4.0669	4.0513
util living area	0.9838	0.9756	0.9566	0.9059	0.8005	0.6337	0.4822	0.5327	0.7633	0.9265	0.9739	0.9862 (86)
MIT	19.6525	19.8100	20.0867	20.4565	20.7607	20.9341	20.9832	20.9750	20.8553	20.4749	20.0066	19.6233 (87)
Th 2	19.9358	19.9384	19.9410	19.9531	19.9554	19.9660	19.9660	19.9679	19.9619	19.9554	19.9508	19.9460 (88)
util rest of house	0.9798	0.9696	0.9454	0.8812	0.7497	0.5496	0.3755	0.4233	0.6884	0.9019	0.9664	0.9828 (89)
MIT 2	18.7279	18.8850	19.1577	19.5197	19.7915	19.9331	19.9608	19.9595	19.8790	19.5461	19.0904	18.7071 (90)
Living area fraction	fLA = Living area / (4) = 0.2446 (91)											
MIT	18.9541	19.1113	19.3849	19.7488	20.0286	20.1780	20.2109	20.2079	20.1178	19.7733	19.3145	18.9312 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9541	19.1113	19.3849	19.7488	20.0286	20.1780	20.2109	20.2079	20.1178	19.7733	19.3145	18.9312 (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	0.9750	0.9637	0.9382	0.8756	0.7536	0.5678	0.4015	0.4498	0.7008	0.8967	0.9605	0.9785	(94)
Useful gains	563.7438	606.4938	637.6236	646.0273	587.5392	435.0918	292.8383	305.8053	440.5350	518.9339	530.9736	541.7540	(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	1245.8213	1204.8348	1089.4180	905.5187	693.4783	459.1852	297.2566	312.8091	497.5813	763.8116	1022.0405	1238.9351	(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	507.4657	402.0851	336.1350	186.8338	78.8187	0.0000	0.0000	0.0000	0.0000	182.1890	353.5682	518.7027	(98)
Space heating												2565.7982	(98)
Space heating per m2											(98) / (4) =	35.6212	(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													2844.5656	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	507.4657	402.0851	336.1350	186.8338	78.8187	0.0000	0.0000	0.0000	0.0000	182.1890	353.5682	518.7027	(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)	562.6005	445.7706	372.6552	207.1328	87.3821	0.0000	0.0000	0.0000	0.0000	201.9834	391.9825	575.0584	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	122.3155	87.8777	63.7615	23.6121	0.0000	0.0000	0.0000	5.5136	27.5060	68.2609	101.9690	121.6132	(64)	
Efficiency of water heater	87.0923	87.3225	87.6329	88.3782	90.2000	76.2000	76.2000	76.2000	76.2000	85.8986	86.6370	87.1586	(216)	
(217)m	140.4436	100.6358	72.7598	26.7172	0.0000	0.0000	0.0000	7.2357	36.0972	79.4668	117.6969	139.5309	(219)	
Fuel for water heating, kWh/month												720.5837	(219)	
Water heating fuel used														
Annual totals kWh/year														
Space heating fuel - main system													2844.5656	(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)													330.9118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096			-494.0096	(233)
Total delivered energy for all uses													3527.0515	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2844.5656	3.4800	98.9909 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	720.5837	3.4800	25.0763 (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	330.9118	13.1900	43.6473 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.0096	13.1900	-65.1599 (252)
Total energy cost			239.0421 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8579 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.0326
SAP rating (Section 12)		88 (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	2844.5656	0.2160	614.4262 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	720.5837	0.2160	155.6461 (264)
Space and water heating			770.0723 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	330.9118	0.5190	171.7432 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total kg/year			750.2995 (272)
CO2 emissions per m2			10.4200 (273)
EI value			91.4090
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8300 (1b)	x 2.6800 (2b)	= 96.0244 (1b) - (3b)
First floor	36.2000 (1c)	x 2.3200 (2c)	= 83.9840 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 180.0084 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4516	0.4161	0.4073	0.3807	0.3807	0.3542	0.3542	0.3453	0.3542	0.3984	0.3896	0.4161 (22b)
Effective ac	0.6020	0.5866	0.5829	0.5725	0.5725	0.5627	0.5627	0.5596	0.5627	0.5794	0.5759	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			11.6800	1.1450	13.3740		(27)
Ground Floor			35.8300	0.1200	4.2996	90.0000	3224.7000 (28a)
Exposed above Door			0.6000	0.1500	0.0900	20.0000	12.0000 (28b)
Brick and Block	87.0500	13.8000	73.2500	0.2400	17.5800	42.2200	3092.6150 (29a)
Pitched Roof	36.2000		36.2000	0.1000	3.6200	9.1000	329.4200 (30)
Total net area of external elements Aum(A, m ²)			159.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2956		(33)
Party Wall 1			43.5000	0.0000	0.0000	110.0000	4785.0000 (32)
Ground Floor Stud			59.6700			9.0000	537.0300 (32c)
First Floor Stud			65.2300			9.0000	587.0700 (32c)
Internal Floor 1			35.8300			18.0000	644.9400 (32d)
Internal Ceiling 1			35.8300			18.0000	644.9400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13857.7150 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							192.3881 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9622 (36)
Total fabric heat loss						(33) + (36) =	49.2578 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7575	34.8448	34.6283	34.0066	34.0066	33.4268	33.4268	33.2429	33.4268	34.4164	34.2092	34.8448 (38)
Heat transfer coeff	85.0153	84.1026	83.8861	83.2644	83.2644	82.6846	82.6846	82.5007	82.6846	83.6742	83.4669	84.1026 (39)
Average = Sum(39)m / 12 =												83.4442 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1803	1.1676	1.1646	1.1560	1.1560	1.1479	1.1479	1.1454	1.1479	1.1617	1.1588	1.1676 (40)
HLP (average)												1.1585 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2944 (42)
Average daily hot water use (litres/day)												88.6916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5607	94.0131	90.4654	86.9177	83.3701	79.8224	79.8224	83.3701	86.9177	90.4654	94.0131	97.5607 (44)
Energy conte	144.6798	126.5378	130.5757	113.8391	109.2313	94.2583	87.3442	100.2287	101.4258	118.2020	129.0267	140.1146 (45)

Energy content (annual)											Total = Sum(45)m =		1395.4639 (45)
Distribution loss (46)m = 0.15 x (45)m													
21.7020	18.9807	19.5864	17.0759	16.3847	14.1387	13.1016	15.0343	15.2139	17.7303	19.3540	21.0172	(46)	
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	1.6232	1.3681	1.3584	1.1379	1.0473	0.8653	0.8018	0.9609	1.0138	1.2297	1.3950	1.5720 (61)	
Total heat required for water heating calculated for each month													
146.3030	127.9059	131.9342	114.9770	110.2786	95.1236	88.1460	101.1897	102.4396	119.4317	130.4217	141.6866	(62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												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												1.4862 (H8)	
Utilisation factor												0.4898 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												88.6916 (H14)	
Volume ratio Veff/V												0.8456 (H15)	
Solar storage volume factor												0.9665 (H16)	
Solar input												-863.1552 (H17)	
Solar input	-28.3259	-40.4361	-68.5324	-93.5167	-110.3701	-117.4546	-113.1183	-100.9164	-79.8694	-54.6864	-33.3028	-22.6261 (63)	
												-863.1552 (63)	
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
117.9770	87.4698	63.4018	21.4603	0.0000	0.0000	0.0000	0.2733	22.5702	64.7453	97.1189	119.0605	(64)	
												594.0770 (64)	
Total per year (kWh/year) = Sum(64)m =													
Heat gains from water heating, kWh/month													
48.5118	42.4158	43.7560	38.1360	36.5812	31.5572	29.2424	33.5663	33.9775	39.6096	43.2501	46.9811	(65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629	137.6629 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8440	41.6064	33.8366	25.6165	19.1486	16.1661	17.4680	22.7056	30.4754	38.6955	45.1634	48.1459 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.4743	304.6027	296.7193	279.9366	258.7514	238.8402	225.5384	222.4100	230.2934	247.0762	268.2614	288.1725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607	51.0607 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753	-91.7753 (71)
Water heating gains (Table 5)	65.2041	63.1188	58.8119	52.9666	49.1683	43.8294	39.3043	45.1160	47.1910	53.2387	60.0696	63.1467 (72)
Total internal gains	513.4707	509.2763	489.3161	458.4680	427.0166	398.7841	382.2590	390.1799	407.9081	438.9587	473.4427	499.4134 (73)

[Jan	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	7.8200	15.0428	0.6300	0.7000	0.7700	35.9508 (75)
Southwest	3.1400	46.3896	0.6300	0.7000	0.7700	44.5166 (79)
Northwest	0.7200	15.0428	0.6300	0.7000	0.7700	3.3100 (81)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.2785	45.7699	45.8880	46.2306	46.2306	46.5548	46.5548	46.6586	46.5548	46.0042	46.1184	45.7699
alpha	4.0186	4.0513	4.0592	4.0820	4.0820	4.1037	4.1037	4.1106	4.1037	4.0669	4.0746	4.0513
util living area	0.9773	0.9690	0.9428	0.8746	0.7399	0.5334	0.3865	0.4111	0.6697	0.8866	0.9593	0.9804 (86)
MIT	19.8241	19.9457	20.2244	20.5702	20.8415	20.9688	20.9936	20.9921	20.9234	20.6271	20.2048	19.8116 (87)
Th 2	19.9358	19.9460	19.9484	19.9554	19.9554	19.9619	19.9619	19.9640	19.9619	19.9508	19.9531	19.9460 (88)
util rest of house	0.9714	0.9611	0.9280	0.8428	0.6779	0.4438	0.2806	0.2994	0.5784	0.8483	0.9470	0.9752 (89)
MIT 2	18.8976	19.0244	19.2965	19.6248	19.8555	19.9488	19.9605	19.9622	19.9248	19.6807	19.2856	18.8937 (90)
Living area fraction									fLA = Living area / (4) =			0.2446 (91)
MIT	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1243	19.2498	19.5235	19.8560	20.0967	20.1983	20.2132	20.2141	20.1691	19.9122	19.5105	19.1182 (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	0.9657	0.9546	0.9208	0.8394	0.6870	0.4649	0.3066	0.3268	0.5979	0.8466	0.9405	0.9700	(94)
Useful gains	576.7697	613.6403	645.7347	651.9036	557.0450	386.5558	239.5418	238.7369	400.1015	511.1618	541.0615	549.3517	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W													
	1166.7733	1139.5732	1025.3803	853.9627	624.2088	396.7488	240.8782	240.4167	427.4058	678.7818	927.3568	1145.3296	(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													
	438.9626	353.4269	282.4564	145.4826	49.9699	0.0000	0.0000	0.0000	0.0000	124.7093	278.1326	443.4076	(98)
Space heating													
Space heating per m2													(98) / (4) = 29.3843 (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													2346.5054 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	438.9626	353.4269	282.4564	145.4826	49.9699	0.0000	0.0000	0.0000	0.0000	124.7093	278.1326	443.4076	(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)	486.6548	391.8259	313.1445	161.2889	55.3990	0.0000	0.0000	0.0000	0.0000	138.2586	308.3510	491.5827	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	117.9770	87.4698	63.4018	21.4603	0.0000	0.0000	0.0000	0.2733	22.5702	64.7453	97.1189	119.0605	(64)
Efficiency of water heater	86.8210	87.0279	87.2610	88.1188	90.2000	76.2000	76.2000	76.2000	76.2000	84.8711	86.1056	86.8234	(216)
(217)m	135.8854	100.5078	72.6576	24.3538	0.0000	0.0000	0.0000	0.3586	29.6196	76.2866	112.7904	137.1296	(219)
Fuel for water heating, kWh/month													(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													2346.5054 (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)													330.9118 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1182 * 1.00) =									-567.2191				-567.2191 (233)
Total delivered energy for all uses													2924.7874 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2346.5054	7.6100	178.5691	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	689.5894	7.6100	52.4778	(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	330.9118	31.0800	102.8474	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-567.2191	31.0800	-176.2917	(252)
Total energy cost			301.4525	(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	2346.5054	0.2160	506.8452	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	689.5894	0.2160	148.9513	(264)
Space and water heating			655.7965	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	330.9118	0.5190	171.7432	(268)
Energy saving/generation technologies				
PV Unit	-567.2191	0.5190	-294.3867	(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

598.0280 (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	2346.5054	1.2200	2862.7366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	689.5894	1.2200	841.2990 (264)
Space and water heating			3704.0356 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	330.9118	3.0700	1015.8992 (268)
Energy saving/generation technologies			
PV Unit	-567.2191	3.0700	-1741.3628 (269)
Primary energy kWh/year			3362.3221 (272)
Primary energy kWh/m2/year			46.6795 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 50	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 50		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.05	TER	19.69
Environmental	89 B	% DER<TER	23.57		
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99
General Requirements Compliance	Pass	% DFEE<TFEE	15.83		

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 50	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 50		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.05	TER	19.69
Environmental	89 B	% DER<TER	23.57		
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99
General Requirements Compliance	Pass	% DFEE<TFEE	15.83		

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 50	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 50		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.05	TER	19.69
Environmental	89 B	% DER<TER	23.57		
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99
General Requirements Compliance	Pass	% DFEE<TFEE	15.83		

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

Floor 000003

Floor Type: Suspended Floor

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

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 50	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C
Project	Plot 50		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.05	TER	19.69
Environmental	89 B	% DER<TER	23.57		
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99
General Requirements Compliance	Pass	% DFEE<TFEE	15.83		

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

Floor 000004 - New exposed above Garage

Floor Type: Exposed Floor

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

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

Unheated space: None

Total thickness: 375 mm

U-value: 0.15 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 50			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block C		
Property	Plot 50				
SAP Rating	87 B	DER	15.05	TER	19.69
Environmental	89 B	% DER<TER	23.57		
CO ₂ Emissions (t/year)	0.79	DFEE	47.13	TFEE	55.99
General Requirements Compliance	Pass	% DFEE<TFEE	15.83		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

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

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

6.0 Measurements				
		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	17.74 m	35.83 m ²	2.68 m
	1st Storey:	17.03 m	36.20 m ²	2.32 m

7.0 Living Area	17.62	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	192.39	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	87.05	73.25

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

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.83

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	35.83
Exposed above Door	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.15	20.00	0.60

11.2 Internal Floors

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

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South West							2.12	
Windows	Window	[1] Brick and Block	South West	None	0.00					3.14	
Side Elevation	Window	[1] Brick and Block	North West	None	0.00					0.72	
Rear Elevation	Window	[1] Brick and Block	North East	None	0.00					7.82	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	9.77	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)	17.74	0.160	No	
Table K1 - Default	E20 Exposed floor (normal)	1.01	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	2.24	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	14.79	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.40	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.72	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	14.20	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.20	-0.091	No	Knauf P24
Independently assessed	E18 Party wall between dwellings	10.00	0.036	No	Knauf P25 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.72	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.72	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.72	0.035	No	Knauf P29 Halved

Y-value 0.050 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted
Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Database	
Description	Gas Combi
Percentage of Heat	100 %
Database Ref. No.	17959
Fuel Type	Mains gas
Main Heating	BGW
SAP Code	104
In Winter	90.2
In Summer	76.2
Controls	CBE Programmer, room thermostat and TRVs
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2106
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£63	B 88	