



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 55

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

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

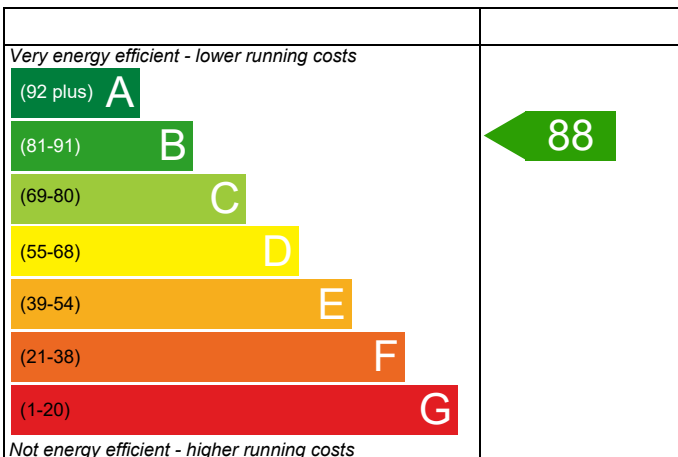
Plot 55

Dwelling type: House, Semi-Detached
Date of assessment: 08/02/2024
Produced by: Abacus Energy (UK) Ltd
Total floor area: 86 m²
DRRN: 2204-3223-8075

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

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

Energy Efficiency Rating

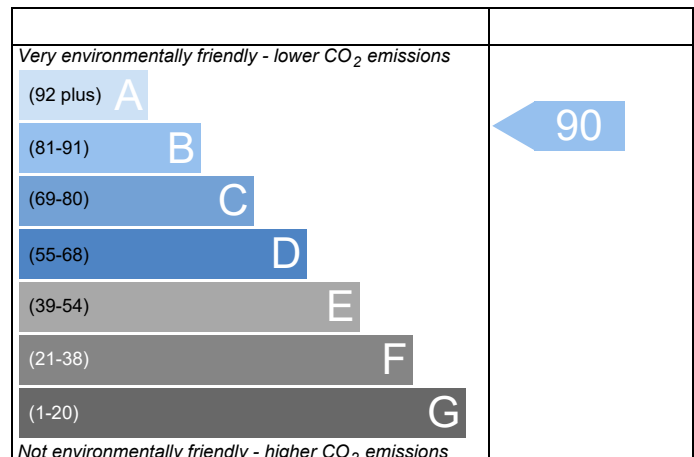


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 55				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H			
	Property					Plot 55
SAP Rating		88 B	DER	13.06	TER	18.00
Environmental		90 B	% DER<TER	27.44		
CO ₂ Emissions (t/year)		0.78	DFEE	43.15	TFEE	51.21
General Requirements Compliance		Pass	% DFEE<TFEE	15.74		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.00	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.06	kgCO ₂ /m ²	Pass
	-4.94 (-27.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.21	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.15	kWh/m ² /yr	
	-8.1 (-15.8%)	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)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

7.00 m², No overhang

Windows facing South

1.44 m², No overhang

Windows facing West

3.86 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

0.95

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£66	B 90	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£66	B 90	A 92	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 55				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H			
Property	Plot 55					
SAP Rating	88 B	DER	13.06	TER	18.00	
Environmental	90 B	% DER<TER	27.44			
CO ₂ Emissions (t/year)	0.78	DFEE	43.15	TFEE	51.21	
General Requirements Compliance	Pass	% DFEE<TFEE	15.74			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	10.45	0.45	Catnic Thermally Broken
External wall	E3 Sill	Independently assessed	0.021	7.84	0.16	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	26.40	0.42	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	19.05	3.05	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.48	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	12.01	0.72	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	2.55	0.61	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	9.46	0.42	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	12.30	0.48	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	2.30	-0.21	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	9.46	1.51	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	9.46	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	9.46	0.33	Knauf P29 Halved

Total: **8.31** W/mK:
Y-Value: **0.046** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	15.74		
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 86 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.00 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.06 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.1 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)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 7.00 m², No overhang
Windows facing South: 1.44 m², No overhang
Windows facing West: 3.86 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 0.95 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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1862 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4362 (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) =	0.3708 (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	0.4727	0.4634	0.4542	0.4078	0.3986	0.3522	0.3522	0.3429	0.3708	0.3986	0.4171	0.4356 (22b)
Effective ac	0.6117	0.6074	0.6031	0.5832	0.5794	0.5620	0.5620	0.5588	0.5687	0.5794	0.5870	0.5949 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			18.0000	761.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15756.5992 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 183.2163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3083 (36)
Total fabric heat loss (33) + (36) = 53.4079 (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	43.3706	43.0630	42.7615	41.3453	41.0804	39.8469	39.8469	39.6185	40.3220	41.0804	41.6164	42.1768 (38)
Heat transfer coeff	96.7785	96.4709	96.1694	94.7532	94.4883	93.2548	93.2548	93.0264	93.7299	94.4883	95.0243	95.5847 (39)
Average = Sum(39)m / 12 =												94.7520 (39)
HLP	1.1253	1.1218	1.1182	1.1018	1.0987	1.0844	1.0844	1.0817	1.0899	1.0987	1.1049	1.1114 (40)
HLP (average)												1.1018 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6707	0.6073	0.6120	0.5126	0.4718	0.3898	0.3612	0.4329	0.4567	0.5540	0.6193	0.6496 (61)
Total heat required for water heating calculated for each month	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (64)
Heat gains from water heating, kWh/month	51.7845	45.2962	46.7380	40.7421	39.0880	33.7256	31.2517	35.8664	36.2994	42.3089	46.1871	50.1505 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1503.6433 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0412	19.5768	15.9209	12.0532	9.0099	7.6065	8.2191	10.6835	14.3394	18.2072	21.2504	22.6538 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	69.6028	67.4051	62.8198	56.5862	52.5376	46.8411	42.0050	48.2076	50.4159	56.8668	64.1488	67.4066 (72)
Total internal gains	387.6712	385.4116	371.1163	348.1262	324.7647	302.3737	287.9348	294.1992	306.1176	329.3250	355.9199	375.8722 (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	
East	7.0000				19.6403		0.6300		0.7000		0.7700		42.0162 (76)	
South	1.4400				46.7521		0.6300		0.7000		0.7700		20.5748 (78)	
West	3.8600				19.6403		0.6300		0.7000		0.7700		23.1690 (80)	
Solar gains	85.7600	161.2122	252.9238	354.7859	425.9026	432.8875	413.3438	360.3873	289.0777	187.6531	105.6664	71.3836	(83)	
Total gains	473.4312	546.6238	624.0400	702.9121	750.6673	735.2612	701.2786	654.5866	595.1953	516.9781	461.5863	447.2558	(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	45.2253	45.3695	45.5117	46.1919	46.3214	46.9341	46.9341	47.0494	46.6962	46.3214	46.0602	45.7901
alpha	4.0150	4.0246	4.0341	4.0795	4.0881	4.1289	4.1289	4.1366	4.1131	4.0881	4.0707	4.0527
util living area	0.9949	0.9903	0.9781	0.9426	0.8612	0.7134	0.5567	0.6098	0.8363	0.9643	0.9909	0.9959 (86)
MIT	19.4055	19.5899	19.9065	20.3225	20.6746	20.8984	20.9720	20.9595	20.7909	20.3217	19.7921	19.3791 (87)
Th 2	19.9802	19.9831	19.9860	19.9994	20.0019	20.0136	20.0136	20.0158	20.0091	20.0019	19.9968	19.9915 (88)
util rest of house	0.9936	0.9978	0.9722	0.9264	0.8207	0.6333	0.4443	0.4974	0.7744	0.9512	0.9882	0.9949 (89)
MIT 2	18.5223	18.7079	19.0233	19.4386	19.7661	19.9585	20.0041	20.0007	19.8787	19.4462	18.9205	18.5046 (90)
Living area fraction									fLA = Living area / (4) =			0.2112 (91)
MIT	18.7088	18.8941	19.2098	19.6253	19.9579	20.1570	20.2085	20.2031	20.0713	19.6311	19.1045	18.6893 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7088	18.8941	19.2098	19.6253	19.9579	20.1570	20.2085	20.2031	20.0713	19.6311	19.1045	18.6893 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	469.3252	537.9813	603.0463	645.9899	614.5608	474.9378	327.8670	340.4732	463.6142	488.4873	454.6041	444.1423 (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	1394.4589	1350.0259	1222.2927	1016.2558	780.2742	518.2160	336.5086	353.7926	559.6884	853.3321	1140.7228	1384.9538 (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	688.2995	545.6940	460.7193	266.5915	123.2908	0.0000	0.0000	0.0000	0.0000	271.4446	494.0055	699.9637 (98)
Space heating												3550.0088 (98)
Space heating per m2										(98) / (4) =		41.2792 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3935.7082 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	688.2995	545.6940	460.7193	266.5915	123.2908	0.0000	0.0000	0.0000	0.0000	271.4446	494.0055	699.9637	(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)	763.0814	604.9822	510.7753	295.5559	136.6860	0.0000	0.0000	0.0000	0.0000	300.9363	547.6779	776.0130	(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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898	(64)
Efficiency of water heater (217)m	87.2882	87.0559	86.5426	85.3424	82.8885	76.4000	76.4000	76.4000	76.4000	85.2801	86.7577	76.4000	(216)
Fuel for water heating, kWh/month	178.6144	156.6580	162.5987	143.7266	141.9677	132.8889	123.1411	141.3303	143.0426	149.3694	160.2883	172.7595	(219)
Water heating fuel used												1806.3855	(219)
Annual totals kWh/year													
Space heating fuel - main system												3935.7082	(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)												389.2545	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.95 * 908 * 1.00) =										-689.9692		-689.9692	(233)
Total delivered energy for all uses												5516.3790	(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	3935.7082	0.2160	850.1130 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1806.3855	0.2160	390.1793 (264)
Space and water heating			1240.2922 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.2545	0.5190	202.0231 (268)
Energy saving/generation technologies			
PV Unit	-689.9692	0.5190	-358.0940 (269)
Total CO2, kg/year			1123.1463 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0600 (273)

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

DER			13.0600 ZC1
Total Floor Area		TFA	86.0000
Assumed number of occupants		N	2.5669
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.9530 ZC2
CO2 emissions from cooking, equation (L16)			2.1001 ZC3
Total CO2 emissions			31.1131 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			31.1131 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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (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) = 0.1396 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3896 (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) =	0.3312 (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	0.4223	0.4140	0.4057	0.3643	0.3560	0.3146	0.3146	0.3064	0.3312	0.3560	0.3726	0.3891 (22b)
Effective ac	0.5892	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5548	0.5634	0.5694	0.5757 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			12.3000	1.3258	16.3068		(27)
Ground Floor			43.7100	0.1300	5.6823		(28a)
Brick and Block	93.7600	14.4500	79.3100	0.1800	14.2758		(29a)
Pitched Roof	43.7100		43.7100	0.1300	5.6823		(30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0972		(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)							10.5747 (36)
Total fabric heat loss						(33) + (36) =	54.6719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.7702	41.5247	41.2842	40.1541	39.9427	38.9584	38.9584	38.7762	39.3376	39.9427	40.3704	40.8176 (38)
Heat transfer coeff	96.4421	96.1967	95.9561	94.8260	94.6146	93.6304	93.6304	93.4481	94.0095	94.6146	95.0423	95.4895 (39)
Average = Sum(39)m / 12 =												94.8250 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1214	1.1186	1.1158	1.1026	1.1002	1.0887	1.0887	1.0866	1.0931	1.1002	1.1051	1.1103 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (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)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.4646	45.9917	45.5850	42.2373	43.6452	45.5850	45.9917	49.4646	49.3151	50.9589 (61)
Solar input	206.1974	181.8000	189.5698	168.1388	162.7881	143.3746	137.3638	153.1285	154.8196	176.2930	187.7582	201.2991 (62)
	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	206.1974	181.8000	189.5698	168.1388	162.7881	143.3746	137.3638	153.1285	154.8196	176.2930	187.7582	201.2991 (64)
Heat gains from water heating, kWh/month	64.3565	56.6512	58.9511	52.1118	50.3663	44.1875	42.0727	47.1544	47.6832	54.5366	58.3611	62.7279 (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	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0412	19.5768	15.9209	12.0532	9.0099	7.6065	8.2191	10.6835	14.3394	18.2072	21.2504	22.6538	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	86.5007	84.3024	79.2354	72.3776	67.6966	61.3715	56.5494	63.3796	66.2267	73.3019	81.0571	84.3116	(72)
Total internal gains	404.5691	402.3089	387.5318	363.9176	339.9237	316.9041	302.4791	309.3713	321.9284	345.7600	372.8281	392.7772	(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		
East				7.0000	19.6403	0.6300	0.7000	0.7700		42.0162 (76)		
South				1.4400	46.7521	0.6300	0.7000	0.7700		20.5748 (78)		
West				3.8600	19.6403	0.6300	0.7000	0.7700		23.1690 (80)		
Solar gains	85.7600	161.2122	252.9238	354.7859	425.9026	432.8875	413.3438	360.3873	289.0777	187.6531	105.6664	71.3836 (83)
Total gains	490.3291	563.5212	640.4556	718.7035	765.8263	749.7916	715.8229	669.7586	611.0061	533.4131	478.4945	464.1608 (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	61.9255	62.0835	62.2391	62.9808	63.1216	63.7851	63.7851	63.9095	63.5279	63.1216	62.8375	62.5433	
alpha	5.1284	5.1389	5.1493	5.1987	5.2081	5.2523	5.2523	5.2606	5.2352	5.2081	5.1892	5.1696	
util living area	0.9984	0.9965	0.9900	0.9653	0.8911	0.7336	0.5617	0.6180	0.8636	0.9807	0.9967	0.9988	(86)
MIT	19.7694	19.9157	20.1678	20.5003	20.7824	20.9457	20.9890	20.9824	20.8665	20.4921	20.0705	19.7453	(87)
Th 2	19.9834	19.9857	19.9880	19.9987	20.0007	20.0101	20.0101	20.0118	20.0064	20.0007	19.9966	19.9924	(88)
util rest of house	0.9979	0.9952	0.9863	0.9518	0.8493	0.6450	0.4425	0.4970	0.7969	0.9709	0.9954	0.9984	(89)
MIT 2	18.3382	18.5534	18.9216	19.4044	19.7829	19.9730	20.0059	20.0043	19.8960	19.4009	18.7880	18.3095	(90)
Living area fraction									fLA = Living area / (4) =			0.2112	(91)
MIT	18.6404	18.8411	19.1847	19.6358	19.9939	20.1784	20.2135	20.2109	20.1009	19.6313	19.0589	18.6127	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6404	18.8411	19.1847	19.6358	19.9939	20.1784	20.2135	20.2109	20.1009	19.6313	19.0589	18.6127	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	488.7745	559.7080	629.1158	679.6063	650.1630	495.8158	334.8181	349.9881	491.4551	515.2121	475.3692	463.0431	(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	1383.0188	1341.0853	1217.1780	1018.0311	784.7265	522.3053	338.3341	356.1171	564.1449	854.4974	1136.5974	1376.2596	(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	665.3177	525.0855	437.5183	243.6658	100.1153	0.0000	0.0000	0.0000	0.0000	252.4282	476.0843	679.4331	(98)
Space heating												3379.6483	(98)
Space heating per m2												39.2982	(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													3618.4671 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	665.3177	525.0855	437.5183	243.6658	100.1153	0.0000	0.0000	0.0000	0.0000	252.4282	476.0843	679.4331	(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)	712.3316	562.1901	468.4350	260.8842	107.1898	0.0000	0.0000	0.0000	0.0000	270.2658	509.7263	727.4444	(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	206.1974	181.8000	189.5698	168.1388	162.7881	143.3746	137.3638	153.1285	154.8196	176.2930	187.7582	201.2991	(64)
Efficiency of water heater (217)m	87.7876	87.5674	87.0886	85.9843	83.8682	80.3000	80.3000	80.3000	80.3000	85.9544	87.2945	80.3000	(216)
Fuel for water heating, kWh/month	234.8823	207.6116	217.6745	195.5460	194.0997	178.5487	171.0633	190.6955	192.8015	205.1007	215.0858	229.0775	(219)
Water heating fuel used												2432.1872	(219)
Annual totals kWh/year													
Space heating fuel - main system												3618.4671	(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)												389.2545	(232)
Total delivered energy for all uses												6514.9088	(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	3618.4671	0.2160	781.5889 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2432.1872	0.2160	525.3524 (264)
Space and water heating			1306.9413 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.2545	0.5190	202.0231 (268)
Total CO2, kg/m2/year			1547.8894 (272)
Emissions per m2 for space and water heating			15.1970 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3491 (272b)
Emissions per m2 for pumps and fans			0.4526 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1970 * 1.00) + 2.3491 + 0.4526, rounded to 2 d.p.			18.0000 (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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (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) = 0.1396 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3896 (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) =				0.3312 (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	0.4223	0.4140	0.4057	0.3643	0.3560	0.3146	0.3146	0.3064	0.3312	0.3560	0.3726	0.3891 (22b)
Effective ac	0.5892	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5548	0.5634	0.5694	0.5757 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			9.0000	380.6100 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 15375.9892 (34)
178.7906 (35)
8.3083 (36)
(33) + (36) = 53.4079 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.7702	41.5247	41.2842	40.1541	39.9427	38.9584	38.9584	38.7762	39.3376	39.9427	40.3704	40.8176 (38)
Heat transfer coeff	95.1781	94.9326	94.6921	93.5620	93.3506	92.3663	92.3663	92.1841	92.7455	93.3506	93.7783	94.2255 (39)
Average = Sum(39)m / 12 =												93.5610 (39)
HLP	1.1067	1.1039	1.1011	1.0879	1.0855	1.0740	1.0740	1.0719	1.0784	1.0855	1.0904	1.0956 (40)
HLP (average)												1.0879 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.9882	28.8517	29.7723	25.9563	24.9056	21.4917	19.9152	22.8530	23.1259	26.9510	29.4192	31.9473 (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	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0412	19.5768	15.9209	12.0532	9.0099	7.6065	8.2191	10.6835	14.3394	18.2072	21.2504	22.6538	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	44.3390	42.9340	40.0166	36.0504	33.4753	29.8496	26.7677	30.7164	32.1193	36.2245	40.8599	42.9399	(72)
Total internal gains	359.4074	357.9405	345.3130	324.5904	302.7024	282.3821	269.6975	273.7080	284.8211	305.6827	329.6310	348.4055	(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	
East					7.0000	19.6403	0.6300	0.7000	0.7700		42.0162 (76)	
South					1.4400	46.7521	0.6300	0.7000	0.7700		20.5748 (78)	
West					3.8600	19.6403	0.6300	0.7000	0.7700		23.1690 (80)	
Solar gains	85.7600	161.2122	252.9238	354.7859	425.9026	432.8875	413.3438	360.3873	289.0777	187.6531	105.6664	71.3836 (83)
Total gains	445.1673	519.1528	598.2368	679.3763	728.6051	715.2697	683.0413	634.0954	573.8988	493.3357	435.2974	419.7891 (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	44.8749	44.9909	45.1052	45.6500	45.7534	46.2410	46.2410	46.3324	46.0519	45.7534	45.5447	45.3286	
alpha	3.9917	3.9994	4.0070	4.0433	4.0502	4.0827	4.0827	4.0888	4.0701	4.0502	4.0363	4.0219	
util living area	0.9955	0.9912	0.9795	0.9451	0.8654	0.7203	0.5638	0.6197	0.8439	0.9672	0.9920	0.9965	(86)
MIT	19.3678	19.5554	19.8778	20.2991	20.6599	20.8910	20.9695	20.9553	20.7769	20.2935	19.7540	19.3372	(87)
Th 2	19.9953	19.9977	20.0000	20.0107	20.0127	20.0221	20.0221	20.0238	20.0185	20.0127	20.0086	20.0044	(88)
util rest of house	0.9944	0.9889	0.9740	0.9297	0.8264	0.6416	0.4518	0.5080	0.7845	0.9552	0.9896	0.9956	(89)
MIT 2	18.4986	18.6870	19.0081	19.4273	19.7639	19.9620	20.0114	20.0067	19.8770	19.4296	18.8940	18.4750	(90)
Living area fraction	18.6821	18.8704	19.1918	19.6114	19.9531	20.1582	20.2137	20.2070	20.0670	19.6121	19.0756	18.6571	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6821	18.8704	19.1918	19.6114	19.9531	20.1582	20.2137	20.2070	20.0670	19.6121	19.0756	18.6571	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9924	0.9856	0.9684	0.9222	0.8237	0.6535	0.4749	0.5303	0.7879	0.9489	0.9865	0.9939	(94)
Ext temp.	441.7632	511.6618	579.3044	626.4907	600.1630	467.4594	324.3645	336.2693	452.1828	468.1455	429.4346	417.2297	(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	1368.8626	1326.2460	1201.8084	1002.1786	770.4320	513.3881	333.7850	350.9435	553.4154	841.2802	1123.0525	1362.2265	(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 per m2	689.7620	547.4005	463.1430	270.4953	126.6802	0.0000	0.0000	0.0000	0.0000	277.6123	499.4049	703.0776	(98)
												3577.5758	(98)
												41.5997	(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	868.2437	683.5110	700.5990	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8310	0.8941	0.8681	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	721.5060	611.1214	608.2072	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	932.9097	893.2692	837.8958	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	152.2107	209.9179	170.8883	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												533.0169 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.0527	52.4795	42.7221	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.2542 (107)
Space cooling per m2												1.5495 (108)
Energy for space heating												41.5997 (99)
Energy for space cooling												1.5495 (108)
Total												43.1492 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.1 (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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1396 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3896 (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) =	0.3312 (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	0.4223	0.4140	0.4057	0.3643	0.3560	0.3146	0.3146	0.3064	0.3312	0.3560	0.3726	0.3891 (22b)		
Effective ac	0.5892	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5548	0.5634	0.5694	0.5757 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.3000	1.3258	16.3068		(27)					
Ground Floor			43.7100	0.1300	5.6823		(28a)					
Brick and Block	93.7600	14.4500	79.3100	0.1800	14.2758		(29a)					
Pitched Roof	43.7100		43.7100	0.1300	5.6823		(30)					
Total net area of external elements Aum(A, m2)			181.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0972		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5747 (36)					
Total fabric heat loss						(33) + (36) =	54.6719 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.7702	Feb 41.5247	Mar 41.2842	Apr 40.1541	May 39.9427	Jun 38.9584	Jul 38.9584	Aug 38.7762	Sep 39.3376	Oct 39.9427	Nov 40.3704	Dec 40.8176 (38)
Heat transfer coeff	96.4421	96.1967	95.9561	94.8260	94.6146	93.6304	93.6304	93.4481	94.0095	94.6146	95.0423	95.4895 (39)
Average = Sum(39)m / 12 =												94.8250 (39)
HLP	Jan 1.1214	Feb 1.1186	Mar 1.1158	Apr 1.1026	May 1.1002	Jun 1.0887	Jul 1.0887	Aug 1.0866	Sep 1.0931	Oct 1.1002	Nov 1.1051	Dec 1.1103 (40)
HLP (average)												1.1026 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	Jan 104.6808	Feb 100.8742	Mar 97.0676	Apr 93.2610	May 89.4545	Jun 85.6479	Jul 85.6479	Aug 89.4545	Sep 93.2610	Oct 97.0676	Nov 100.8742	Dec 104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	32.9882	28.8517	29.7723	25.9563	24.9056	21.4917	19.9152	22.8530	23.1259	26.9510	29.4192	31.9473 (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	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0412	19.5768	15.9209	12.0532	9.0099	7.6065	8.2191	10.6835	14.3394	18.2072	21.2504	22.6538	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	44.3390	42.9340	40.0166	36.0504	33.4753	29.8496	26.7677	30.7164	32.1193	36.2245	40.8599	42.9399	(72)
Total internal gains	359.4074	357.9405	345.3130	324.5904	302.7024	282.3821	269.6975	273.7080	284.8211	305.6827	329.6310	348.4055	(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
East				7.0000	19.6403	0.6300	0.7000			0.7700			42.0162 (76)
South				1.4400	46.7521	0.6300	0.7000			0.7700			20.5748 (78)
West				3.8600	19.6403	0.6300	0.7000			0.7700			23.1690 (80)
Solar gains	85.7600	161.2122	252.9238	354.7859	425.9026	432.8875	413.3438	360.3873	289.0777	187.6531	105.6664	71.3836	(83)
Total gains	445.1673	519.1528	598.2368	679.3763	728.6051	715.2697	683.0413	634.0954	573.8988	493.3357	435.2974	419.7891	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9255	62.0835	62.2391	62.9808	63.1216	63.7851	63.7851	63.9095	63.5279	63.1216	62.8375	62.5433	
alpha	5.1284	5.1389	5.1493	5.1987	5.2081	5.2523	5.2523	5.2606	5.2352	5.2081	5.1892	5.1696	
util living area	0.9990	0.9976	0.9926	0.9722	0.9067	0.7576	0.5856	0.6469	0.8863	0.9861	0.9979	0.9993	(86)
MIT	19.7202	19.8678	20.1236	20.4636	20.7584	20.9367	20.9868	20.9783	20.8455	20.4517	20.0237	19.6968	(87)
Th 2	19.9834	19.9857	19.9880	19.9987	20.0007	20.0101	20.0101	20.0118	20.0064	20.0007	19.9966	19.9924	(88)
util rest of house	0.9987	0.9967	0.9898	0.9610	0.8687	0.6700	0.4628	0.5231	0.8254	0.9788	0.9970	0.9990	(89)
MIT 2	18.8110	18.9601	19.2164	19.5585	19.8327	19.9799	20.0066	20.0053	19.9165	19.5526	19.1249	18.7949	(90)
Living area fraction									fLA = Living area / (4) =			0.2112	(91)
MIT	19.0030	19.1518	19.4080	19.7497	20.0282	20.1820	20.2135	20.2108	20.1126	19.7425	19.3147	18.9854	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0030	19.1518	19.4080	19.7497	20.0282	20.1820	20.2135	20.2108	20.1126	19.7425	19.3147	18.9854	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	444.3640	516.9525	590.8598	650.4918	633.8072	491.1231	334.0193	348.3992	478.1577	481.5965	433.6184	419.2307	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1417.9874	1370.9754	1238.5984	1028.8302	787.9647	522.6400	338.3373	356.1115	565.2456	865.0123	1160.9128	1411.8462	(96)
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	724.3759	573.9034	481.9174	272.4037	114.6932	0.0000	0.0000	0.0000	0.0000	285.2614	523.6519	738.5059	(98)
Space heating												3714.7128	(98)
Space heating per m2										(98) / (4) =		43.1943	(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	880.1254	692.8647	710.2056	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8635	0.9258	0.9010	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.9717	641.4267	639.8710	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	932.9097	893.2692	837.8958	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	124.5154	187.3708	147.3305	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												459.2166	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.1288	46.8427	36.8326	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												114.8041 (107)
Space cooling per m2												1.3349 (108)
Energy for space heating												43.1943 (99)
Energy for space cooling												1.3349 (108)
Total												44.5293 (109)
Target Fabric Energy Efficiency (TFEE)												51.2 (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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1862 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4362 (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) =		0.3708 (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	0.4727	0.4356	0.4264	0.3986	0.3986	0.3708	0.3708	0.3615	0.3708	0.4171	0.4078	0.4356 (22b)
Effective ac	0.6117	0.5949	0.5909	0.5794	0.5794	0.5687	0.5687	0.5653	0.5687	0.5870	0.5832	0.5949 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			18.0000	761.2200 (32e)

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

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.3706	42.1768	41.8935	41.0804	41.0804	40.3220	40.3220	40.0814	40.3220	41.6164	41.3453	42.1768 (38)
Average = Sum(39)m / 12 =	96.7785	95.5847	95.3014	94.4883	94.4883	93.7299	93.7299	93.4893	93.7299	95.0243	94.7532	95.5847 (39)
												94.7235 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1253	1.1114	1.1082	1.0987	1.0987	1.0899	1.0899	1.0871	1.0899	1.1049	1.1018	1.1114 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy content (annual)	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6707	0.6073	0.6120	0.5126	0.4718	0.3898	0.3612	0.4329	0.4567	0.5540	0.6193	0.6496 (61)
Total heat required for water heating calculated for each month	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	51.7845	45.2962	46.7380	40.7421	39.0880	33.7256	31.2517	35.8664	36.2994	42.3089	46.1871	50.1505 (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	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1030	48.9420	39.8023	30.1329	22.5247	19.0163	20.5478	26.7088	35.8485	45.5179	53.1261	56.6345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	69.6028	67.4051	62.8198	56.5862	52.5376	46.8411	42.0050	48.2076	50.4159	56.8668	64.1488	67.4066	(72)
Total internal gains	577.5700	572.7970	550.0360	514.8961	478.9563	446.9288	428.3773	437.1550	457.5392	492.8963	532.0695	561.6583	(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
East				7.0000	25.9136	0.6300	0.7000			0.7700			55.4368 (76)
South				1.4400	58.2505	0.6300	0.7000			0.7700			25.6350 (78)
West				3.8600	25.9136	0.6300	0.7000			0.7700			30.5695 (80)
Solar gains	111.6413	179.4061	279.6595	398.6349	456.5690	502.0777	467.9796	417.0253	338.6314	220.8131	136.3219	88.7121	(83)
Total gains	689.2113	752.2032	829.6955	913.5311	935.5253	949.0065	896.3569	854.1803	796.1706	713.7094	668.3914	650.3705	(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	45.2253	45.7901	45.9262	46.3214	46.3214	46.6962	46.6962	46.8164	46.6962	46.0602	46.1919	45.7901	
alpha	4.0150	4.0527	4.0617	4.0881	4.0881	4.1131	4.1131	4.1211	4.1131	4.0707	4.0795	4.0527	
util living area	0.9762	0.9660	0.9357	0.8635	0.7325	0.5304	0.3821	0.3991	0.6466	0.8749	0.9564	0.9797	(86)
MIT	19.8347	19.9722	20.2601	20.5961	20.8481	20.9697	20.9939	20.9930	20.9332	20.6505	20.2235	19.8205	(87)
Th 2	19.9802	19.9915	19.9942	20.0019	20.0019	20.0091	20.0091	20.0114	20.0091	19.9968	19.9994	19.9915	(88)
util rest of house	0.9704	0.9579	0.9203	0.8317	0.6732	0.4453	0.2821	0.2954	0.5602	0.8362	0.9440	0.9747	(89)
MIT 2	18.9467	19.0898	19.3704	19.6894	19.9044	19.9959	20.0077	20.0097	19.9761	19.7421	19.3440	18.9421	(90)
Living area fraction	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(91)
MIT	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	664.5427	715.1624	756.9283	755.7958	635.9047	438.7991	271.8717	271.0547	458.4684	594.8124	626.1325	630.2582	(94)
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	1329.1791	1297.6706	1168.2308	971.4175	709.0100	450.0464	273.3107	272.7401	485.3515	772.9188	1054.5787	1302.5884	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	494.4895	391.4456	306.0090	155.2477	54.3903	0.0000	0.0000	0.0000	0.0000	132.5112	308.4813	500.2137	(98)
Space heating												2342.7882	(98)
RHI space heating demand												2343	(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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1862 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4362 (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) =	0.3708 (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	0.4727	0.4634	0.4542	0.4078	0.3986	0.3522	0.3522	0.3429	0.3708	0.3986	0.4171	0.4356 (22b)
Effective ac	0.6117	0.6074	0.6031	0.5832	0.5794	0.5620	0.5620	0.5588	0.5687	0.5794	0.5870	0.5949 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			18.0000	761.2200 (32e)

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

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.3706	Feb 43.0630	Mar 42.7615	Apr 41.3453	May 41.0804	Jun 39.8469	Jul 39.8469	Aug 39.6185	Sep 40.3220	Oct 41.0804	Nov 41.6164	Dec 42.1768 (38)
Heat transfer coeff	96.7785	96.4709	96.1694	94.7532	94.4883	93.2548	93.2548	93.0264	93.7299	94.4883	95.0243	95.5847 (39)
Average = Sum(39)m / 12 =												94.7520 (39)

HLP	Jan 1.1253	Feb 1.1218	Mar 1.1182	Apr 1.1018	May 1.0987	Jun 1.0844	Jul 1.0844	Aug 1.0817	Sep 1.0899	Oct 1.0987	Nov 1.1049	Dec 1.1114 (40)
HLP (average)												1.1018 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	Jan 104.6808	Feb 100.8742	Mar 97.0676	Apr 93.2610	May 89.4545	Jun 85.6479	Jul 85.6479	Aug 89.4545	Sep 93.2610	Oct 97.0676	Nov 100.8742	Dec 104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6707	0.6073	0.6120	0.5126	0.4718	0.3898	0.3612	0.4329	0.4567	0.5540	0.6193	0.6496 (61)
Total heat required for water heating calculated for each month	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (64)
Heat gains from water heating, kWh/month	51.7845	45.2962	46.7380	40.7421	39.0880	33.7256	31.2517	35.8664	36.2994	42.3089	46.1871	50.1505 (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	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1030	48.9420	39.8023	30.1329	22.5247	19.0163	20.5478	26.7088	35.8485	45.5179	53.1261	56.6345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	69.6028	67.4051	62.8198	56.5862	52.5376	46.8411	42.0050	48.2076	50.4159	56.8668	64.1488	67.4066	(72)
Total internal gains	577.5700	572.7970	550.0360	514.8961	478.9563	446.9288	428.3773	437.1550	457.5392	492.8963	532.0695	561.6583	(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
East			7.0000		19.6403		0.6300		0.7000		0.7700		42.0162 (76)
South			1.4400		46.7521		0.6300		0.7000		0.7700		20.5748 (78)
West			3.8600		19.6403		0.6300		0.7000		0.7700		23.1690 (80)
Solar gains	85.7600	161.2122	252.9238	354.7859	425.9026	432.8875	413.3438	360.3873	289.0777	187.6531	105.6664		71.3836 (83)
Total gains	663.3299	734.0093	802.9598	869.6820	904.8589	879.8164	841.7211	797.5424	746.6169	680.5494	637.7359		633.0420 (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	45.2253	45.3695	45.5117	46.1919	46.3214	46.9341	46.9341	47.0494	46.6962	46.3214	46.0602	45.7901	
alpha	4.0150	4.0246	4.0341	4.0795	4.0881	4.1289	4.1289	4.1366	4.1131	4.0881	4.0707	4.0527	
util living area	0.9833	0.9736	0.9512	0.8963	0.7915	0.6275	0.4743	0.5168	0.7428	0.9190	0.9726	0.9859	(86)
MIT	19.6579	19.8314	20.1204	20.4862	20.7723	20.9370	20.9844	20.9779	20.8706	20.4995	20.0199	19.6288	(87)
Th 2	19.9802	19.9831	19.9860	19.9994	20.0019	20.0136	20.0136	20.0158	20.0091	20.0019	19.9968	19.9915	(88)
util rest of house	0.9794	0.9674	0.9395	0.8712	0.7423	0.5476	0.3739	0.4148	0.6702	0.8940	0.9651	0.9826	(89)
MIT 2	18.7719	18.9450	19.2293	19.5878	19.8439	19.9812	20.0086	20.0080	19.9340	19.6097	19.1434	18.7520	(90)
Living area fraction									fLA = Living area / (4) =			0.2112	(91)
MIT	18.9589	19.1321	19.4175	19.7775	20.0400	20.1831	20.2146	20.2128	20.1318	19.7976	19.3285	18.9371	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9589	19.1321	19.4175	19.7775	20.0400	20.1831	20.2146	20.2128	20.1318	19.7976	19.3285	18.9371	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	646.2641	705.2982	748.0221	752.1319	673.5591	494.5150	332.4197	347.6862	507.7263	604.2238	611.4612	619.1680	(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	1418.6706	1372.9881	1242.2682	1030.6783	788.0305	520.6475	337.0816	354.6924	565.3605	869.0617	1162.0064	1408.6414	(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	574.6704	448.6876	367.7191	200.5534	85.1667	0.0000	0.0000	0.0000	0.0000	197.0394	396.3925	587.3682	(98)
Space heating												2857.5974	(98)
Space heating per m2												33.2279	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3168.0680	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	574.6704	448.6876	367.7191	200.5534	85.1667	0.0000	0.0000	0.0000	0.0000	197.0394	396.3925	587.3682	(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)	637.1069	497.4364	407.6708	222.3430	94.4198	0.0000	0.0000	0.0000	0.0000	218.4472	439.4596	651.1843	(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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898	(64)
Efficiency of water heater (217)m	86.8521	86.5556	85.9055	84.4136	81.6446	76.4000	76.4000	76.4000	76.4000	84.2264	86.1583	76.4000	(216)
Fuel for water heating, kWh/month	179.5112	157.5634	163.8047	145.3080	144.1306	132.8889	123.1411	141.3303	143.0426	151.2380	161.4034	173.5776	(219)
Water heating fuel used												1816.9398	(219)
Annual totals kWh/year													
Space heating fuel - main system												3168.0680	(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)												389.2545	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.95 * 908 * 1.00) =										-689.9692		-689.9692	(233)
Total delivered energy for all uses												4759.2931	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3168.0680	3.4800	110.2488 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1816.9398	3.4800	63.2295 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	389.2545	13.1900	51.3427 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-689.9692	13.1900	-91.0069 (252)
Total energy cost			263.7065 (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] =	0.8455 (257)
SAP value	88.2057	
SAP rating (Section 12)	88	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3168.0680	0.2160	684.3027 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.9398	0.2160	392.4590 (264)
Space and water heating			1076.7617 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.2545	0.5190	202.0231 (268)
Energy saving/generation technologies			
PV Unit	-689.9692	0.5190	-358.0940 (269)
Total kg/year			959.6158 (272)
CO2 emissions per m2			11.1600 (273)
EI value			90.1841
EI rating			90
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	$3.48 / 0.8236 = 4.225$, stars = 4
Water heating environmental impact	$0.216 / 0.8236 = 0.2623$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1862 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4362 (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) =	0.3708 (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	0.4727	0.4356	0.4264	0.3986	0.3986	0.3708	0.3708	0.3615	0.3708	0.4171	0.4078	0.4356 (22b)
Effective ac	0.6117	0.5949	0.5909	0.5794	0.5794	0.5687	0.5687	0.5653	0.5687	0.5870	0.5832	0.5949 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			18.0000	761.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15756.5992 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 183.2163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3083 (36)
Total fabric heat loss (33) + (36) = 53.4079 (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	43.3706	42.1768	41.8935	41.0804	41.0804	40.3220	40.3220	40.0814	40.3220	41.6164	41.3453	42.1768 (38)
Heat transfer coeff	96.7785	95.5847	95.3014	94.4883	94.4883	93.7299	93.7299	93.4893	93.7299	95.0243	94.7532	95.5847 (39)
Average = Sum(39)m / 12 =												94.7235 (39)
HLP	1.1253	1.1114	1.1082	1.0987	1.0987	1.0899	1.0899	1.0871	1.0899	1.1049	1.1018	1.1114 (40)
HLP (average)												1.1014 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6707	0.6073	0.6120	0.5126	0.4718	0.3898	0.3612	0.4329	0.4567	0.5540	0.6193	0.6496 (61)
Total heat required for water heating calculated for each month	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (64)
Heat gains from water heating, kWh/month	51.7845	45.2962	46.7380	40.7421	39.0880	33.7256	31.2517	35.8664	36.2994	42.3089	46.1871	50.1505 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1503.6433 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1030	48.9420	39.8023	30.1329	22.5247	19.0163	20.5478	26.7088	35.8485	45.5179	53.1261	56.6345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	69.6028	67.4051	62.8198	56.5862	52.5376	46.8411	42.0050	48.2076	50.4159	56.8668	64.1488	67.4066	(72)
Total internal gains	577.5700	572.7970	550.0360	514.8961	478.9563	446.9288	428.3773	437.1550	457.5392	492.8963	532.0695	561.6583	(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			
East				7.0000	25.9136	0.6300	0.7000	0.7700	55.4368 (76)			
South				1.4400	58.2505	0.6300	0.7000	0.7700	25.6350 (78)			
West				3.8600	25.9136	0.6300	0.7000	0.7700	30.5695 (80)			
Solar gains	111.6413	179.4061	279.6595	398.6349	456.5690	502.0777	467.9796	417.0253	338.6314	220.8131	136.3219	88.7121 (83)
Total gains	689.2113	752.2032	829.6955	913.5311	935.5253	949.0065	896.3569	854.1803	796.1706	713.7094	668.3914	650.3705 (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	45.2253	45.7901	45.9262	46.3214	46.3214	46.6962	46.6962	46.8164	46.6962	46.0602	46.1919	45.7901	
alpha	4.0150	4.0527	4.0617	4.0881	4.0881	4.1131	4.1131	4.1211	4.1131	4.0707	4.0795	4.0527	
util living area	0.9762	0.9660	0.9357	0.8635	0.7325	0.5304	0.3821	0.3991	0.6466	0.8749	0.9564	0.9797	(86)
MIT	19.8347	19.9722	20.2601	20.5961	20.8481	20.9697	20.9939	20.9930	20.9332	20.6505	20.2235	19.8205	(87)
Th 2	19.9802	19.9915	19.9942	20.0019	20.0019	20.0091	20.0091	20.0114	20.0091	19.9968	19.9994	19.9915	(88)
util rest of house	0.9704	0.9579	0.9203	0.8317	0.6732	0.4453	0.2821	0.2954	0.5602	0.8362	0.9440	0.9747	(89)
MIT 2	18.9467	19.0898	19.3704	19.6894	19.9044	19.9959	20.0077	20.0097	19.9761	19.7421	19.3440	18.9421	(90)
Living area fraction									fLA = Living area / (4) =			0.2112	(91)
MIT	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9642	0.9508	0.9123	0.8273	0.6797	0.4624	0.3033	0.3173	0.5758	0.8334	0.9368	0.9691	(94)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.0000	(96)
Heat loss rate W	1329.1791	1297.6706	1168.2308	971.4175	709.0100	450.0464	273.3107	272.7401	485.3515	772.9188	1054.5787	1302.5884	(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	494.4895	391.4456	306.0090	155.2477	54.3903	0.0000	0.0000	0.0000	0.0000	132.5112	308.4813	500.2137	(98)
Space heating												2342.7882	(98)
Space heating per m2												(98) / (4) =	27.2417 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2597.3262 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	494.4895	391.4456	306.0090	155.2477	54.3903	0.0000	0.0000	0.0000	0.0000	132.5112	308.4813	500.2137	(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)	548.2145	433.9751	339.2561	172.1149	60.2997	0.0000	0.0000	0.0000	0.0000	146.9082	341.9970	554.5606	(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	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898	(64)
Efficiency of water heater (217)m	86.4565	86.1780	85.3442	83.5399	80.2826	76.4000	76.4000	76.4000	76.4000	82.8639	85.4065	76.4000	(216)
Fuel for water heating, kWh/month	180.3326	158.2538	164.8820	146.8277	146.5758	132.8889	123.1411	141.3303	143.0426	153.7248	162.8240	174.4051	(219)
Water heating fuel used												1828.2288	(219)
Annual totals kWh/year													
Space heating fuel - main system												2597.3262	(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)												389.2545	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.95 * 1054 * 1.00) =										-801.3765		-801.3765	(233)
Total delivered energy for all uses												4088.4330	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2597.3262	7.6100	197.6565 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.2288	7.6100	139.1282 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	389.2545	31.0800	120.9803 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-801.3765	31.0800	-249.0678 (252)
Total energy cost			337.0072 (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	2597.3262	0.2160	561.0225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.2288	0.2160	394.8974 (264)
Space and water heating			955.9199 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.2545	0.5190	202.0231 (268)
Energy saving/generation technologies			
PV Unit	-801.3765	0.5190	-415.9144 (269)
Total kg/year			780.9536 (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	2597.3262	1.2200	3168.7380 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.2288	1.2200	2230.4391 (264)
Space and water heating			5399.1771 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	389.2545	3.0700	1195.0114 (268)
Energy saving/generation technologies			
PV Unit	-801.3765	3.0700	-2460.2257 (269)
Primary energy kWh/year			4364.2128 (272)
Primary energy kWh/m2/year			50.7467 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 66	-205 kg (26.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£66 2.39 kg/m²	B 90	A 92
Total Savings	£66 2.39 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

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

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

	Current	Potential	Saving
Electricity	£144	£160	-£16
Mains gas	£442	£360	£81
Space heating	£326	£326	£0
Water heating	£139	£73	£66
Lighting	£121	£121	£0
Generated (PV)	-£249	-£249	£0
Total cost of fuels	£337	£271	£65
Total cost of uses	£337	£271	£66
Delivered energy	48 kWh/m²	36 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	37 kWh/m²	13 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	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1862 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4362 (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) =	0.3708 (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	0.4727	0.4634	0.4542	0.4078	0.3986	0.3522	0.3522	0.3429	0.3708	0.3986	0.4171	0.4356 (22b)
Effective ac	0.6117	0.6074	0.6031	0.5832	0.5794	0.5620	0.5620	0.5588	0.5687	0.5794	0.5870	0.5949 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			18.0000	761.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15756.5992 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 183.2163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3083 (36)
Total fabric heat loss (33) + (36) = 53.4079 (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	43.3706	43.0630	42.7615	41.3453	41.0804	39.8469	39.8469	39.6185	40.3220	41.0804	41.6164	42.1768 (38)
Heat transfer coeff	96.7785	96.4709	96.1694	94.7532	94.4883	93.2548	93.2548	93.0264	93.7299	94.4883	95.0243	95.5847 (39)
Average = Sum(39)m / 12 =												94.7520 (39)
HLP	1.1253	1.1218	1.1182	1.1018	1.0987	1.0844	1.0844	1.0817	1.0899	1.0987	1.1049	1.1114 (40)
HLP (average)												1.1018 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6707	0.6073	0.6120	0.5126	0.4718	0.3898	0.3612	0.4329	0.4567	0.5540	0.6193	0.6496 (61)
Total heat required for water heating calculated for each month	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (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												1.2112 (H8)
Utilisation factor												0.5620 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.1643 (H14)
Volume ratio Veff/V												0.7881 (H15)
Solar storage volume factor												0.9524 (H16)
Solar input	-24.7520	-41.3039	-70.3453	-94.2766	-116.4707	-114.5093	-112.9960	-98.7252	-77.3216	-52.8016	-29.3594	-853.5746 (H17)
Solar input (sum of months) = Sum (63)m =												-853.5746 (63)
Output from w/h	131.1573	95.0760	70.3719	28.3832	1.2041	0.0000	0.0000	9.2512	31.9630	74.5808	109.7030	130.2767 (64)
Total per year (kWh/year) = Sum (64)m =												681.9670 (64)
Heat gains from water heating, kWh/month	51.7845	45.2962	46.7380	40.7421	39.0880	33.7256	31.2517	35.8664	36.2994	42.3089	46.1871	50.1505 (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)
(66)m	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1030	48.9420	39.8023	30.1329	22.5247	19.0163	20.5478	26.7088	35.8485	45.5179	53.1261	56.6345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	69.6028	67.4051	62.8198	56.5862	52.5376	46.8411	42.0050	48.2076	50.4159	56.8668	64.1488	67.4066	(72)
Total internal gains	577.5700	572.7970	550.0360	514.8961	478.9563	446.9288	428.3773	437.1550	457.5392	492.8963	532.0695	561.6583	(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			
East				7.0000	19.6403	0.6300	0.7000	0.7700	42.0162 (76)			
South				1.4400	46.7521	0.6300	0.7000	0.7700	20.5748 (78)			
West				3.8600	19.6403	0.6300	0.7000	0.7700	23.1690 (80)			
Solar gains	85.7600	161.2122	252.9238	354.7859	425.9026	432.8875	413.3438	360.3873	289.0777	187.6531	105.6664	71.3836 (83)
Total gains	663.3299	734.0093	802.9598	869.6820	904.8589	879.8164	841.7211	797.5424	746.6169	680.5494	637.7359	633.0420 (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	45.2253	45.3695	45.5117	46.1919	46.3214	46.9341	46.9341	47.0494	46.6962	46.3214	46.0602	45.7901	
alpha	4.0150	4.0246	4.0341	4.0795	4.0881	4.1289	4.1289	4.1366	4.1131	4.0881	4.0707	4.0527	
util living area	0.9833	0.9736	0.9512	0.8963	0.7915	0.6275	0.4743	0.5168	0.7428	0.9190	0.9726	0.9859	(86)
MIT	19.6579	19.8314	20.1204	20.4862	20.7723	20.9370	20.9844	20.9779	20.8706	20.4995	20.0199	19.6288	(87)
Th 2	19.9802	19.9831	19.9860	19.9994	20.0019	20.0136	20.0136	20.0158	20.0091	20.0019	19.9968	19.9915	(88)
util rest of house	0.9794	0.9674	0.9395	0.8712	0.7423	0.5476	0.3739	0.4148	0.6702	0.8940	0.9651	0.9826	(89)
MIT 2	18.7719	18.9450	19.2293	19.5878	19.8439	19.9812	20.0086	20.0080	19.9340	19.6097	19.1434	18.7520	(90)
Living area fraction													0.2112 (91)
MIT	18.9589	19.1321	19.4175	19.7775	20.0400	20.1831	20.2146	20.2128	20.1318	19.7976	19.3285	18.9371	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9589	19.1321	19.4175	19.7775	20.0400	20.1831	20.2146	20.2128	20.1318	19.7976	19.3285	18.9371	(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	0.9743	0.9609	0.9316	0.8648	0.7444	0.5621	0.3949	0.4359	0.6800	0.8878	0.9588	0.9781	(94)
Useful gains	646.2641	705.2982	748.0221	752.1319	673.5591	494.5150	332.4197	347.6862	507.7263	604.2238	611.4612	619.1680	(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	1418.6706	1372.9881	1242.2682	1030.6783	788.0305	520.6475	337.0816	354.6924	565.3605	869.0617	1162.0064	1408.6414	(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	574.6704	448.6876	367.7191	200.5534	85.1667	0.0000	0.0000	0.0000	0.0000	197.0394	396.3925	587.3682	(98)
Space heating												2857.5974	(98)
Space heating per m2											(98) / (4) =	33.2279	(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													3168.0680	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	574.6704	448.6876	367.7191	200.5534	85.1667	0.0000	0.0000	0.0000	0.0000	197.0394	396.3925	587.3682	(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)	637.1069	497.4364	407.6708	222.3430	94.4198	0.0000	0.0000	0.0000	0.0000	218.4472	439.4596	651.1843	(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	131.1573	95.0760	70.3719	28.3832	1.2041	0.0000	0.0000	9.2512	31.9630	74.5808	109.7030	130.2767	(64)	
Efficiency of water heater	87.2708	87.4385	87.6567	88.2243	89.9734	76.4000	76.4000	76.4000	76.4000	85.9378	86.8014	87.3362	(217)	
Fuel for water heating, kWh/month	150.2877	108.7348	80.2813	32.1716	1.3383	0.0000	0.0000	12.1089	41.8364	86.7846	126.3838	149.1668	(219)	
Water heating fuel used												789.0941	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3168.0680	(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)												389.2545	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.95 * 908 * 1.00) =										-689.9692		-689.9692	(233)	
Total delivered energy for all uses												3781.4475	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3168.0680	3.4800	110.2488	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	789.0941	3.4800	27.4605	(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	389.2545	13.1900	51.3427	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-689.9692	13.1900	-91.0069	(252)
Total energy cost			234.5325	(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] =	0.7519	(257)
SAP value			89.5105	
SAP rating (Section 12)			90	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3168.0680	0.2160	684.3027 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	789.0941	0.2160	170.4443 (264)
Space and water heating			854.7470 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	389.2545	0.5190	202.0231 (268)
Energy saving/generation technologies			
PV Unit	-689.9692	0.5190	-358.0940 (269)
Total kg/year			763.5511 (272)
CO2 emissions per m2			8.8800 (273)
EI value			92.1896
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.7100 (1b)	x 2.3900 (2b)	= 104.4669 (1b) - (3b)
First floor	42.2900 (1c)	x 2.6100 (2c)	= 110.3769 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.8438 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1862 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4362 (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) =				0.3708 (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	0.4727	0.4356	0.4264	0.3986	0.3986	0.3708	0.3708	0.3615	0.3708	0.4171	0.4078	0.4356 (22b)
Effective ac	0.6117	0.5949	0.5909	0.5794	0.5794	0.5687	0.5687	0.5653	0.5687	0.5870	0.5832	0.5949 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			12.3000	1.1450	14.0840		(27)
Ground Floor			43.7100	0.1200	5.2452	90.0000	3933.9000 (28a)
Brick and Block	93.7600	14.4500	79.3100	0.2400	19.0344	42.2200	3348.4682 (29a)
Pitched Roof	43.7100		43.7100	0.1000	4.3710	9.1000	397.7610 (30)
Total net area of external elements Aum(A, m ²)			181.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0996		(33)
Party Wall 1			45.5200	0.0000	0.0000	110.0000	5007.2000 (32)
Ground Floor Stud			73.7000			9.0000	663.3000 (32c)
First Floor Stud			98.1700			9.0000	883.5300 (32c)
Internal Floor 1			42.2900			18.0000	761.2200 (32d)
Internal Ceiling 1			42.2900			18.0000	761.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15756.5992 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 183.2163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3083 (36)
Total fabric heat loss (33) + (36) = 53.4079 (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	43.3706	42.1768	41.8935	41.0804	41.0804	40.3220	40.3220	40.0814	40.3220	41.6164	41.3453	42.1768 (38)
Heat transfer coeff	96.7785	95.5847	95.3014	94.4883	94.4883	93.7299	93.7299	93.4893	93.7299	95.0243	94.7532	95.5847 (39)
Average = Sum(39)m / 12 =												94.7235 (39)
HLP	1.1253	1.1114	1.1082	1.0987	1.0987	1.0899	1.0899	1.0871	1.0899	1.1049	1.1018	1.1114 (40)
HLP (average)												1.1014 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)										Total = Sum(45)m =		1497.3054 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6707	0.6073	0.6120	0.5126	0.4718	0.3898	0.3612	0.4329	0.4567	0.5540	0.6193	0.6496 (61)
Total heat required for water heating calculated for each month	155.9093	136.3799	140.7172	122.6597	117.6748	101.5271	94.0798	107.9764	109.2846	127.3824	139.0624	150.9898 (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												1.3851 (H8)
Utilisation factor												0.5142 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.1643 (H14)
Volume ratio Veff/V												0.7881 (H15)
Solar storage volume factor												0.9524 (H16)
Solar input	-29.3066	-41.8360	-70.9049	-96.7542	-114.1911	-121.5209	-117.0344	-104.4101	-82.6345	-56.5796	-34.4557	-893.0374 (H17)
Solar input (sum of months) = Sum (63)m =												-893.0374 (63)
Output from w/h	126.6027	94.5439	69.8122	25.9055	3.4838	0.0000	0.0000	3.5663	26.6501	70.8027	104.6066	127.5804 (64)
Total per year (kWh/year) = Sum (64)m =												653.5543 (64)
Heat gains from water heating, kWh/month	51.7845	45.2962	46.7380	40.7421	39.0880	33.7256	31.2517	35.8664	36.2994	42.3089	46.1871	50.1505 (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)
(66)m	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1030	48.9420	39.8023	30.1329	22.5247	19.0163	20.5478	26.7088	35.8485	45.5179	53.1261	56.6345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	69.6028	67.4051	62.8198	56.5862	52.5376	46.8411	42.0050	48.2076	50.4159	56.8668	64.1488	67.4066	(72)
Total internal gains	577.5700	572.7970	550.0360	514.8961	478.9563	446.9288	428.3773	437.1550	457.5392	492.8963	532.0695	561.6583	(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			
East				7.0000	25.9136	0.6300	0.7000	0.7700	55.4368 (76)			
South				1.4400	58.2505	0.6300	0.7000	0.7700	25.6350 (78)			
West				3.8600	25.9136	0.6300	0.7000	0.7700	30.5695 (80)			
Solar gains	111.6413	179.4061	279.6595	398.6349	456.5690	502.0777	467.9796	417.0253	338.6314	220.8131	136.3219	88.7121 (83)
Total gains	689.2113	752.2032	829.6955	913.5311	935.5253	949.0065	896.3569	854.1803	796.1706	713.7094	668.3914	650.3705 (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	45.2253	45.7901	45.9262	46.3214	46.3214	46.6962	46.6962	46.8164	46.6962	46.0602	46.1919	45.7901	
alpha	4.0150	4.0527	4.0617	4.0881	4.0881	4.1131	4.1131	4.1211	4.1131	4.0707	4.0795	4.0527	
util living area	0.9762	0.9660	0.9357	0.8635	0.7325	0.5304	0.3821	0.3991	0.6466	0.8749	0.9564	0.9797	(86)
MIT	19.8347	19.9722	20.2601	20.5961	20.8481	20.9697	20.9939	20.9930	20.9332	20.6505	20.2235	19.8205	(87)
Th 2	19.9802	19.9915	19.9942	20.0019	20.0019	20.0091	20.0091	20.0114	20.0091	19.9968	19.9994	19.9915	(88)
util rest of house	0.9704	0.9579	0.9203	0.8317	0.6732	0.4453	0.2821	0.2954	0.5602	0.8362	0.9440	0.9747	(89)
MIT 2	18.9467	19.0898	19.3704	19.6894	19.9044	19.9959	20.0077	20.0097	19.9761	19.7421	19.3440	18.9421	(90)
Living area fraction													0.2112 (91)
MIT	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(92)
Temperature adjustment													0.0000
adjusted MIT	19.1342	19.2761	19.5583	19.8808	20.1037	20.2015	20.2159	20.2173	20.1782	19.9339	19.5297	19.1276	(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	0.9642	0.9508	0.9123	0.8273	0.6797	0.4624	0.3033	0.3173	0.5758	0.8334	0.9368	0.9691	(94)
Useful gains	664.5427	715.1624	756.9283	755.7958	635.9047	438.7991	271.8717	271.0547	458.4684	594.8124	626.1325	630.2582	(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	1329.1791	1297.6706	1168.2308	971.4175	709.0100	450.0464	273.3107	272.7401	485.3515	772.9188	1054.5787	1302.5884	(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	494.4895	391.4456	306.0090	155.2477	54.3903	0.0000	0.0000	0.0000	0.0000	132.5112	308.4813	500.2137	(98)
Space heating												2342.7882	(98)
Space heating per m2											(98) / (4) =	27.2417	(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													2597.3262	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	494.4895	391.4456	306.0090	155.2477	54.3903	0.0000	0.0000	0.0000	0.0000	132.5112	308.4813	500.2137	(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)	548.2145	433.9751	339.2561	172.1149	60.2997	0.0000	0.0000	0.0000	0.0000	146.9082	341.9970	554.5606	(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	126.6027	94.5439	69.8122	25.9055	3.4838	0.0000	0.0000	3.5663	26.6501	70.8027	104.6066	127.5804	(64)	
Efficiency of water heater	86.9969	87.1380	87.2717	87.9288	89.2298	76.4000	76.4000	76.4000	76.4000	84.8620	86.2547	87.0062	(217)	
Fuel for water heating, kWh/month	145.5256	108.4990	79.9941	29.4620	3.9043	0.0000	0.0000	4.6679	34.8823	83.4328	121.2765	146.6336	(219)	
Water heating fuel used												758.2781	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2597.3262	(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)													389.2545	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.95 * 1054 * 1.00) =										-801.3765			-801.3765	(233)
Total delivered energy for all uses													3068.4824	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2597.3262	7.6100	197.6565	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	758.2781	7.6100	57.7050	(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	389.2545	31.0800	120.9803	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-801.3765	31.0800	-249.0678	(252)
Total energy cost			271.1240	(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	2597.3262	0.2160	561.0225	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	758.2781	0.2160	163.7881	(264)
Space and water heating			724.8105	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	389.2545	0.5190	202.0231	(268)
Energy saving/generation technologies				
PV Unit	-801.3765	0.5190	-415.9144	(269)
Total kg/year			575.7943	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2597.3262	1.2200	3168.7380 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	758.2781	1.2200	925.0993 (264)
Space and water heating			4093.8373 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	389.2545	3.0700	1195.0114 (268)
Energy saving/generation technologies			
PV Unit	-801.3765	3.0700	-2460.2257 (269)
Primary energy kWh/year			3212.3730 (272)
Primary energy kWh/m2/year			37.3532 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 55	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Project	Plot 55		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.06	TER	18.00
Environmental	90 B	% DER<TER	27.44		
CO ₂ Emissions (t/year)	0.78	DFEE	43.15	TFEE	51.21
General Requirements Compliance	Pass	% DFEE<TFEE	15.74		

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 55	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Project	Plot 55		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.06	TER	18.00
Environmental	90 B	% DER<TER	27.44		
CO ₂ Emissions (t/year)	0.78	DFEE	43.15	TFEE	51.21
General Requirements Compliance	Pass	% DFEE<TFEE	15.74		

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 55	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Project	Plot 55		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.06	TER	18.00
Environmental	90 B	% DER<TER	27.44		
CO ₂ Emissions (t/year)	0.78	DFEE	43.15	TFEE	51.21
General Requirements Compliance	Pass	% DFEE<TFEE	15.74		

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

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 55			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H		
Property	Plot 55				
SAP Rating	88 B	DER	13.06	TER	18.00
Environmental	90 B	% DER<TER	27.44		
CO ₂ Emissions (t/year)	0.78	DFEE	43.15	TFEE	51.21
General Requirements Compliance	Pass	% DFEE<TFEE	15.74		
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	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:	19.05 m	43.71 m ²	2.39 m
	1st Storey:	18.48 m	42.29 m ²	2.61 m

7.0 Living Area	18.16	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	183.22	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	93.76	79.31

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	45.52

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Stud	Plasterboard on timber frame		9.00	73.70
First Floor Stud	Plasterboard on timber frame		9.00	98.17

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	43.71	43.71

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.29

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	43.71

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.29

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	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 (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	West							2.15	
Windows	Window	[1] Brick and Block	West	None	0.00					3.86	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					7.00	
Side Elevation	Window	[1] Brick and Block	South	None	0.00					1.44	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	10.45	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	7.84	0.021	No	Knauf P5
Independently assessed	E4 Jamb	26.40	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	19.05	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.48	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	12.01	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	2.55	0.240	No	
Independently assessed	E12 Gable (insulation at ceiling level)	9.46	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	12.30	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	2.30	-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	9.46	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.46	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.46	0.035	No	Knauf P29 Halved
Y-value	0.046	W/m ² K			

18.0 Pressure Testing

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17960	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.2	
In Summer	76.4	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£66	B 90	