



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 54

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 08/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

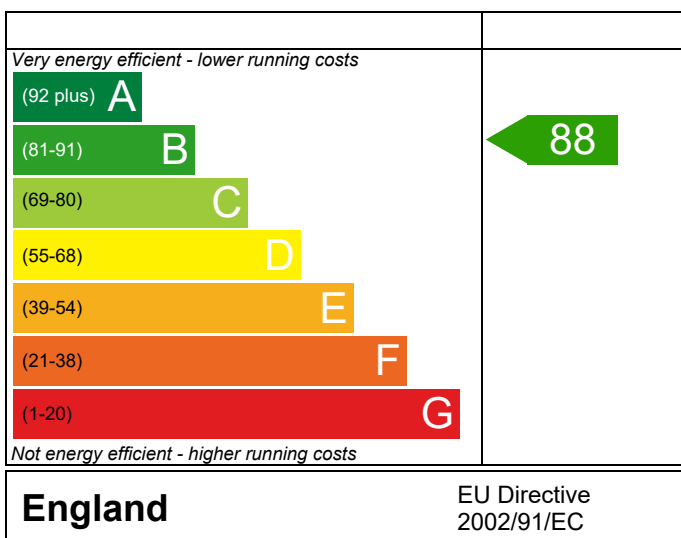
Plot 54

Dwelling type: House, Semi-Detached
Date of assessment: 08/02/2024
Produced by: Abacus Energy (UK) Ltd
Total floor area: 86 m²
DRRN: 6204-5521-8031

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

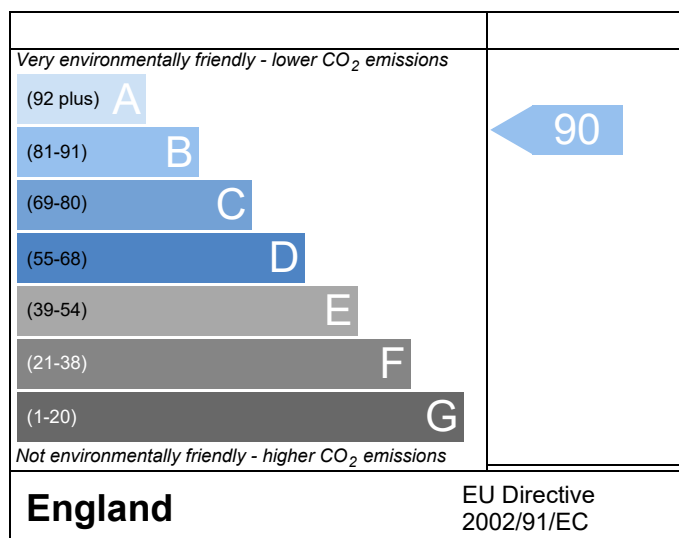
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 54			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H		
Property	Plot 54				
SAP Rating	88 B	DER	13.49	TER	18.34
Environmental	90 B	% DER<TER	26.43		
CO ₂ Emissions (t/year)	0.82	DFEE	44.36	TFEE	52.79
General Requirements Compliance	Pass	% DFEE<TFEE	15.97		
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)	18.34	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.49	kgCO ₂ /m ²	Pass
	-4.85 (-26.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.79	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.36	kWh/m ² /yr	
	-8.4 (-15.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (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 North East

7.00 m², No overhang

Windows facing South West

3.86 m², No overhang

Windows facing North West

1.44 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

0.82 kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£66	B 89	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£66	B 89	A 92	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 54	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Property	Plot 54		

SAP Rating	88 B	DER	13.49	TER	18.34
Environmental	90 B	% DER<TER	26.43		
CO ₂ Emissions (t/year)	0.82	DFEE	44.36	TFEE	52.79
General Requirements Compliance	Pass	% DFEE<TFEE	15.97		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	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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Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 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) 18.34 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.4 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 North East: 7.00 m², No overhang
Windows facing South West: 3.86 m², No overhang
Windows facing North West: 1.44 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 0.82 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	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) (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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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			
Northeast				7.0000	11.2829	0.6300	0.7000	0.7700	24.1375 (75)			
Southwest				3.8600	36.7938	0.6300	0.7000	0.7700	43.4044 (79)			
Northwest				1.4400	11.2829	0.6300	0.7000	0.7700	4.9654 (81)			
Solar gains	72.5074	133.1737	207.8908	300.6250	376.0084	390.5687	369.3590	310.4779	239.5881	154.1084	88.6075	60.9121 (83)
Total gains	460.1786	518.5852	579.0071	648.7512	700.7731	692.9424	657.2938	604.6771	545.7058	483.4334	444.5274	436.7843 (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	0.9954	0.9919	0.9829	0.9550	0.8826	0.7408	0.5875	0.6481	0.8662	0.9713	0.9921	0.9963 (86)
MIT	19.3875	19.5524	19.8490	20.2622	20.6354	20.8826	20.9660	20.9493	20.7556	20.2811	19.7692	19.3648 (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	0.9942	0.9989	0.9782	0.9416	0.8460	0.6619	0.4715	0.5333	0.8103	0.9603	0.9897	0.9953 (89)
MIT 2	18.5043	18.6707	18.9671	19.3822	19.7335	19.9487	20.0018	19.9963	19.8524	19.4077	18.8978	18.4903 (90)
Living area fraction									fLA = Living area / (4) =			0.2112 (91)
MIT	18.6908	18.8569	19.1533	19.5680	19.9239	20.1459	20.2054	20.1975	20.0431	19.5921	19.0818	18.6750 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6908	18.8569	19.1533	19.5680	19.9239	20.1459	20.2054	20.1975	20.0431	19.5921	19.0818	18.6750 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	456.5525	511.6745	563.4696	606.2173	590.4950	466.7340	325.5642	336.2972	443.4440	461.4034	438.5855	433.9822 (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	1392.7211	1346.4376	1216.8643	1010.8305	777.0633	517.1852	336.2194	353.2712	557.0459	849.6510	1138.5629	1383.5861 (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	696.5095	560.9608	486.1256	291.3215	138.8068	0.0000	0.0000	0.0000	0.0000	288.8562	503.9837	706.5053 (98)
Space heating												3673.0694 (98)
Space heating per m2												(98) / (4) = 42.7101 (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												4072.1390 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	696.5095	560.9608	486.1256	291.3215	138.8068	0.0000	0.0000	0.0000	0.0000	288.8562	503.9837	706.5053 (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)	772.1834	621.9078	538.9419	322.9728	153.8878	0.0000	0.0000	0.0000	0.0000	320.2397	558.7403	783.2653 (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	87.3153	87.1223	86.6851	85.6178	83.2969	76.4000	76.4000	76.4000	76.4000	85.4751	86.8091	76.4000 (216)
Fuel for water heating, kWh/month	178.5589	156.5384	162.3315	143.2642	141.2715	132.8889	123.1411	141.3303	143.0426	149.0286	160.1933	172.7185 (219)
Water heating fuel used												1804.3079 (219)
Annual totals kWh/year												
Space heating fuel - main system												4072.1390 (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 * 0.82 * 1029 * 1.00) =										-675.1465		-675.1465 (233)
Total delivered energy for all uses												5665.5550 (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	4072.1390	0.2160	879.5820 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1804.3079	0.2160	389.7305 (264)
Space and water heating			1269.3125 (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	-675.1465	0.5190	-350.4010 (269)
Total CO2, kg/year			1159.8596 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4900 (273)

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

DER			13.4900 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			31.5431 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			31.5431 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	=	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												
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	
Northeast	7.0000				11.2829		0.6300		0.7000		0.7700		24.1375 (75)	
Southwest	3.8600				36.7938		0.6300		0.7000		0.7700		43.4044 (79)	
Northwest	1.4400				11.2829		0.6300		0.7000		0.7700		4.9654 (81)	
Solar gains	72.5074	133.1737	207.8908	300.6250	376.0084	390.5687	369.3590	310.4779	239.5881	154.1084	88.6075	60.9121	(83)	
Total gains	477.0765	535.4826	595.4226	664.5426	715.9321	707.4728	671.8381	619.8492	561.5165	499.8684	461.4357	453.6893	(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	0.9986	0.9972	0.9927	0.9745	0.9118	0.7631	0.5941	0.6590	0.8936	0.9853	0.9972	0.9990	(86)
MIT	19.7550	19.8854	20.1206	20.4495	20.7497	20.9345	20.9858	20.9764	20.8379	20.4584	20.0521	19.7339	(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	0.9982	0.9962	0.9900	0.9642	0.8751	0.6759	0.4702	0.5341	0.8349	0.9776	0.9961	0.9986	(89)
MIT 2	18.3171	18.5094	18.8536	19.3344	19.7443	19.9641	20.0046	20.0014	19.8667	19.3538	18.7612	18.2928	(90)
Living area fraction	18.6207	18.7999	19.1212	19.5699	19.9566	20.1690	20.2118	20.2073	20.0718	19.5870	19.0338	18.5971	(91)
MIT	18.6207	18.7999	19.1212	19.5699	19.9566	20.1690	20.2118	20.2073	20.0718	19.5870	19.0338	18.5971	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6207	18.7999	19.1212	19.5699	19.9566	20.1690	20.2118	20.2073	20.0718	19.5870	19.0338	18.5971	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9945	0.9867	0.9583	0.8732	0.6912	0.4965	0.5604	0.8395	0.9731	0.9944	0.9978	(94)
Ext temp.	4.3000	4.9000	5.8750	6.3655	6.2513	4.8900	3.3344	3.4735	4.7143	4.8642	4.5852	4.5270	(95)
Heat loss rate W	1381.1220	1337.1286	1211.0775	1011.7828	781.1948	521.4293	338.1710	355.7827	561.4044	850.3058	1134.2137	1374.7688	(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	673.6082	540.6702	463.9405	269.9478	116.1120	0.0000	0.0000	0.0000	0.0000	270.7302	486.2600	686.0175	(98)
Space heating												3507.2865	(98)
Space heating per m2												40.7824	(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												3755.1247 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	673.6082	540.6702	463.9405	269.9478	116.1120	0.0000	0.0000	0.0000	0.0000	270.7302	486.2600	686.0175 (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)	721.2079	578.8760	496.7243	289.0234	124.3169	0.0000	0.0000	0.0000	0.0000	289.8610	520.6210	734.4941 (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	87.8115	87.6266	87.2178	86.2370	84.2173	80.3000	80.3000	80.3000	80.3000	86.1278	87.3398	80.3000 (216)
Fuel for water heating, kWh/month	234.8183	207.4713	217.3522	194.9730	193.2954	178.5487	171.0633	190.6955	192.8015	204.6877	214.9743	229.0300 (219)
Water heating fuel used												2429.7111 (219)
Annual totals kWh/year												
Space heating fuel - main system												3755.1247 (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												6649.0903 (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	3755.1247	0.2160	811.1069 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2429.7111	0.2160	524.8176 (264)
Space and water heating			1335.9245 (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			1576.8726 (272)
Emissions per m2 for space and water heating			15.5340 (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) = (15.5340 * 1.00) + 2.3491 + 0.4526, rounded to 2 d.p.			18.3400 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1396 (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)

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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	
Northeast	7.0000				11.2829		0.6300		0.7000		0.7700		24.1375 (75)	
Southwest	3.8600				36.7938		0.6300		0.7000		0.7700		43.4044 (79)	
Northwest	1.4400				11.2829		0.6300		0.7000		0.7700		4.9654 (81)	
Solar gains	72.5074	133.1737	207.8908	300.6250	376.0084	390.5687	369.3590	310.4779	239.5881	154.1084	88.6075	60.9121	(83)	
Total gains	431.9147	491.1142	553.2038	625.2154	678.7108	672.9508	639.0565	584.1860	524.4092	459.7911	418.2385	409.3176	(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	0.9960	0.9927	0.9842	0.9573	0.8869	0.7481	0.5954	0.6591	0.8737	0.9739	0.9931	0.9968	(86)
MIT	19.3493	19.5169	19.8186	20.2368	20.6190	20.8741	20.9628	20.9440	20.7394	20.2514	19.7304	19.3225	(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	0.9950	0.9909	0.9799	0.9447	0.8518	0.6709	0.4801	0.5454	0.8207	0.9640	0.9910	0.9960	(89)
MIT 2	18.4802	18.6489	18.9502	19.3687	19.7295	19.9513	20.0088	20.0017	19.8485	19.3896	18.8707	18.4604	(90)
Living area fraction	18.6637	18.8322	19.1336	19.5520	19.9173	20.1462	20.2102	20.2006	20.0367	19.5716	19.0522	18.6424	(91)
Temperature adjustment	18.6637	18.8322	19.1336	19.5520	19.9173	20.1462	20.2102	20.2006	20.0367	19.5716	19.0522	18.6424	(92)
adjusted MIT	18.6637	18.8322	19.1336	19.5520	19.9173	20.1462	20.2102	20.2006	20.0367	19.5716	19.0522	18.6424	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	428.9332	485.1993	539.3878	586.1289	575.4132	458.7420	321.8358	331.6330	430.9721	440.5824	413.3002	407.0304	(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	1367.1086	1322.6173	1196.3004	996.6221	767.0922	512.2784	333.4649	350.3587	550.5980	837.5006	1120.8612	1360.8444	(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	(98)
Space heating kWh	698.0024	562.7449	488.7430	295.5551	142.6092	0.0000	0.0000	0.0000	0.0000	295.3071	509.4439	709.6376	(98)
Space heating												3702.0431	(98)
Space heating per m2												43.0470	(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	0.8102	0.8770	0.8439	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	703.4197	599.4503	591.2268	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	883.4461	841.8583	779.5601	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	129.6191	180.3516	140.1200	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												450.0906 (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	32.4048	45.0879	35.0300	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												112.5227 (107)
Space cooling per m2												1.3084 (108)
Energy for space heating												43.0470 (99)
Energy for space cooling												1.3084 (108)
Total												44.3554 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												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	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												

FULL SAP CALCULATION PRINTOUT

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
Northeast			7.0000		11.2829		0.6300		0.7000		0.7700	24.1375 (75)
Southwest			3.8600		36.7938		0.6300		0.7000		0.7700	43.4044 (79)
Northwest			1.4400		11.2829		0.6300		0.7000		0.7700	4.9654 (81)

Solar gains	72.5074	133.1737	207.8908	300.6250	376.0084	390.5687	369.3590	310.4779	239.5881	154.1084	89.6075	60.9121 (83)
Total gains	431.9147	491.1142	553.2038	625.2154	678.7108	672.9508	639.0565	584.1860	524.4092	459.7911	418.2385	409.3176 (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	0.9991	0.9981	0.9948	0.9802	0.9261	0.7877	0.6203	0.6905	0.9143	0.9898	0.9983	0.9994 (86)
MIT	19.7057	19.8373	20.0758	20.4111	20.7230	20.9236	20.9828	20.9707	20.8133	20.4171	20.0051	19.6853 (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	0.9988	0.9975	0.9928	0.9718	0.8934	0.7023	0.4930	0.5637	0.8626	0.9842	0.9975	0.9991 (89)
MIT 2	18.7966	18.9298	19.1692	19.5087	19.8034	19.9726	20.0054	20.0027	19.8929	19.5192	19.1064	18.7835 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9885	19.1215	19.3607	19.6992	19.9976	20.1734	20.2118	20.2071	20.0873	19.7088	19.2962	18.9739 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9885	19.1215	19.3607	19.6992	19.9976	20.1734	20.2118	20.2071	20.0873	19.7088	19.2962	18.9739 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9984	0.9967	0.9911	0.9686	0.8933	0.7179	0.5202	0.5906	0.8678	0.9819	0.9968	0.9988 (94)
Ext temp.	431.2351	489.4832	548.2667	605.5660	606.3039	483.1332	332.4377	345.0477	455.0733	451.4886	416.8880	408.8330 (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	1416.5938	1368.0584	1234.0590	1024.0473	785.0762	521.8406	338.1714	355.7680	562.8589	861.8254	1159.1536	1410.7518 (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	733.1069	590.4025	510.2294	301.3066	133.0066	0.0000	0.0000	0.0000	0.0000	305.2905	534.4313	745.4276 (98)
Space heating per m2	(98) / (4) =											44.8047 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	880.1254	692.8647	710.2056	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8416	0.9096	0.8767	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	740.7465	630.2567	622.6376	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	883.4461	841.8583	779.5601	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	102.7437	157.4316	116.7504	0.0000	0.0000	0.0000	0.0000 (104)
												376.9257 (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	25.6859	39.3579	29.1876	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												94.2314 (107)
Space cooling per m2												1.0957 (108)
Energy for space heating												44.8047 (99)
Energy for space cooling												1.0957 (108)
Total												45.9004 (109)
Target Fabric Energy Efficiency (TFEE)												52.8 (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) (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 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				
Northeast				7.0000	15.0428	0.6300	0.7000	0.7700	32.1810 (75)				
Southwest				3.8600	46.3896	0.6300	0.7000	0.7700	54.7242 (79)				
Northwest				1.4400	15.0428	0.6300	0.7000	0.7700	6.6201 (81)				
Solar gains	93.5253	147.5735	230.7528	341.4474	408.3983	458.9606	423.7286	363.6766	282.6497	181.1081	113.4147	74.9186	(83)
Total gains	671.0953	720.3705	780.7888	856.3435	887.3546	905.8894	852.1059	800.8317	740.1889	674.0044	645.4842	636.5769	(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	0.9782	0.9704	0.9462	0.8835	0.7563	0.5519	0.4009	0.4241	0.6816	0.8916	0.9609	0.9811	(86)
MIT	19.8119	19.9336	20.2076	20.5508	20.8282	20.9650	20.9928	20.9912	20.9188	20.6176	20.1969	19.8029	(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	0.9728	0.9632	0.9328	0.8546	0.6983	0.4647	0.2966	0.3146	0.5948	0.8562	0.9496	0.9764	(89)
MIT 2	18.9245	19.0526	19.3211	19.6502	19.8902	19.9937	20.0074	20.0093	19.9680	19.7145	19.3188	18.9248	(90)
Living area fraction									fLA = Living area / (4) =			0.2112	(91)
MIT	19.1119	19.2386	19.5083	19.8404	20.0883	20.1988	20.2155	20.2166	20.1688	19.9052	19.5042	19.1103	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1119	19.2386	19.5083	19.8404	20.0883	20.1988	20.2155	20.2166	20.1688	19.9052	19.5042	19.1103	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9669	0.9565	0.9249	0.8492	0.7038	0.4821	0.3187	0.3378	0.6099	0.8524	0.9425	0.9710	(94)
Ext temp.	648.8929	689.0107	722.1868	727.2311	624.4985	436.7084	271.5340	270.5422	451.4053	574.5205	608.3889	618.1299	(95)
Heat loss rate W	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Month fracti	1327.0189	1294.0841	1163.4709	967.5953	707.5532	449.7889	273.2657	272.6721	484.4717	770.1899	1052.1583	1300.9325	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	504.5257	406.6093	328.3154	173.0622	61.7927	0.0000	0.0000	0.0000	0.0000	145.5780	319.5140	508.0051	(98)
RHI space heating demand												2447.4025	(98)
												2447	(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	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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 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	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			
Northeast				7.0000	11.2829	0.6300	0.7000	0.7700	24.1375 (75)			
Southwest				3.8600	36.7938	0.6300	0.7000	0.7700	43.4044 (79)			
Northwest				1.4400	11.2829	0.6300	0.7000	0.7700	4.9654 (81)			
Solar gains	72.5074	133.1737	207.8908	300.6250	376.0084	390.5687	369.3590	310.4779	239.5881	154.1084	88.6075	60.9121 (83)
Total gains	650.0773	705.9707	757.9268	815.5212	854.9647	837.4975	797.7363	747.6330	697.1273	647.0047	620.6771	622.5704 (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	0.9844	0.9767	0.9591	0.9126	0.8143	0.6513	0.4978	0.5466	0.7731	0.9297	0.9750	0.9867 (86)	
MIT	19.6407	19.7965	20.0690	20.4368	20.7443	20.9278	20.9814	20.9729	20.8487	20.4660	19.9988	19.6150 (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	0.9807	0.9712	0.9490	0.8903	0.7674	0.5708	0.3936	0.4407	0.7028	0.9072	0.9680	0.9836 (89)	
MIT 2	18.7550	18.9109	19.1803	19.5435	19.8221	19.9760	20.0075	20.0061	19.9194	19.5796	19.1229	18.7384 (90)	
Living area fraction									fLA = Living area / (4) =			0.2112 (91)	
MIT	18.9420	19.0979	19.3680	19.7321	20.0169	20.1769	20.2132	20.2102	20.1156	19.7668	19.3079	18.9235 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9420	19.0979	19.3680	19.7321	20.0169	20.1769	20.2132	20.2102	20.1156	19.7668	19.3079	18.9235 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	634.3584	681.3360	713.5193	720.3627	656.7977	489.8889	331.3344	345.7594	495.8184	582.7686	597.0582	609.6245 (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	1417.0331	1369.6857	1237.5060	1026.3769	785.8462	520.0766	336.9448	354.4520	563.8457	866.1528	1160.0429	1407.3433 (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	582.3100	462.5711	389.8461	220.3302	96.0121	0.0000	0.0000	0.0000	0.0000	210.8379	405.3490	593.5028 (98)	
Space heating												2960.7592 (98)	
Space heating per m2												(98) / (4) =	34.4274 (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													3282.4381 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	582.3100	462.5711	389.8461	220.3302	96.0121	0.0000	0.0000	0.0000	0.0000	210.8379	405.3490	593.5028	(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)	645.5765	512.8282	432.2019	244.2685	106.4436	0.0000	0.0000	0.0000	0.0000	233.7449	449.3891	657.9854	(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	86.8855	86.6367	86.0764	84.7270	82.0395	76.4000	76.4000	76.4000	76.4000	84.4546	86.2218	76.4000	(216)
Fuel for water heating, kWh/month	179.4423	157.4158	163.4794	144.7706	143.4367	132.8889	123.1411	141.3303	143.0426	150.8294	161.2844	173.5266	(219)
Water heating fuel used												1814.5882	(219)
Annual totals kWh/year													
Space heating fuel - main system												3282.4381	(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 * 0.82 * 1029 * 1.00) =										-675.1465		-675.1465	(233)
Total delivered energy for all uses												4886.1343	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3282.4381	3.4800	114.2288 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1814.5882	3.4800	63.1477 (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	-675.1465	13.1900	-89.0518 (252)
Total energy cost			269.5599 (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] =	0.8642 (257)
SAP value		87.9439
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	3282.4381	0.2160	709.0066 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1814.5882	0.2160	391.9510 (264)
Space and water heating			1100.9577 (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	-675.1465	0.5190	-350.4010 (269)
Total kg/year			991.5047 (272)
CO2 emissions per m2			11.5300 (273)
EI value			89.8579
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8247 = 4.220$, stars = 4
Water heating environmental impact	$0.216 / 0.8247 = 0.2619$, 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	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	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)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			
Northeast				7.0000	15.0428	0.6300	0.7000	0.7700	32.1810 (75)			
Southwest				3.8600	46.3896	0.6300	0.7000	0.7700	54.7242 (79)			
Northwest				1.4400	15.0428	0.6300	0.7000	0.7700	6.6201 (81)			
Solar gains	93.5253	147.5735	230.7528	341.4474	408.3983	458.9606	423.7286	363.6766	282.6497	181.1081	113.4147	74.9186 (83)
Total gains	671.0953	720.3705	780.7888	856.3435	887.3546	905.8894	852.1059	800.8317	740.1889	674.0044	645.4842	636.5769 (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	0.9782	0.9704	0.9462	0.8835	0.7563	0.5519	0.4009	0.4241	0.6816	0.8916	0.9609	0.9811	(86)
MIT	19.8119	19.9336	20.2076	20.5508	20.8282	20.9650	20.9928	20.9912	20.9188	20.6176	20.1969	19.8029	(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	0.9728	0.9632	0.9328	0.8546	0.6983	0.4647	0.2966	0.3146	0.5948	0.8562	0.9496	0.9764	(89)
MIT 2	18.9245	19.0526	19.3211	19.6502	19.8902	19.9937	20.0074	20.0093	19.9680	19.7145	19.3188	18.9248	(90)
Living area fraction									fLA = Living area / (4) =			0.2112	(91)
MIT	19.1119	19.2386	19.5083	19.8404	20.0883	20.1988	20.2155	20.2166	20.1688	19.9052	19.5042	19.1103	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1119	19.2386	19.5083	19.8404	20.0883	20.1988	20.2155	20.2166	20.1688	19.9052	19.5042	19.1103	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9669	0.9565	0.9249	0.8492	0.7038	0.4821	0.3187	0.3378	0.6099	0.8524	0.9425	0.9710	(94)
Useful gains	648.8929	689.0107	722.1868	727.2311	624.4985	436.7084	271.5340	270.5422	451.4053	574.5205	608.3889	618.1299	(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	1327.0189	1294.0841	1163.4709	967.5953	707.5532	449.7889	273.2657	272.6721	484.4717	770.1899	1052.1583	1300.9325	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	504.5257	406.6093	328.3154	173.0622	61.7927	0.0000	0.0000	0.0000	0.0000	145.5780	319.5140	508.0051	(98)
Space heating												2447.4025	(98)
Space heating per m2												28.4582	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2713.3065 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	504.5257	406.6093	328.3154	173.0622	61.7927	0.0000	0.0000	0.0000	0.0000	145.5780	319.5140	508.0051	(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)	559.3412	450.7864	363.9860	191.8650	68.5063	0.0000	0.0000	0.0000	0.0000	161.3947	354.2284	563.1985	(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	86.5111	86.2854	85.5632	83.9131	80.6483	76.4000	76.4000	76.4000	76.4000	83.1878	85.5159	76.4000	(216)
Fuel for water heating, kWh/month	180.2189	158.0567	164.4599	146.1746	145.9110	132.8889	123.1411	141.3303	143.0426	153.1263	162.6159	174.3222	(219)
Water heating fuel used												1825.2884	(219)
Annual totals kWh/year													
Space heating fuel - main system												2713.3065	(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 * 0.82 * 1182 * 1.00) =										-775.1995		-775.1995	(233)
Total delivered energy for all uses												4227.6499	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2713.3065	7.6100	206.4826 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1825.2884	7.6100	138.9044 (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	-775.1995	31.0800	-240.9320 (252)
Total energy cost			353.7454 (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	2713.3065	0.2160	586.0742 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1825.2884	0.2160	394.2623 (264)
Space and water heating			980.3365 (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	-775.1995	0.5190	-402.3285 (269)
Total kg/year			818.9561 (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	2713.3065	1.2200	3310.2339 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1825.2884	1.2200	2226.8519 (264)
Space and water heating			5537.0858 (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	-775.1995	3.0700	-2379.8625 (269)
Primary energy kWh/year			4582.4847 (272)
Primary energy kWh/m2/year			53.2847 (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 (25.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£66 2.38 kg/m²	B 89	A 92
Total Savings	£66 2.38 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

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

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

	Current	Potential	Saving
Electricity	£144	£160	-£16
Mains gas	£450	£369	£81
Space heating	£335	£335	£0
Water heating	£139	£73	£66
Lighting	£121	£121	£0
Generated (PV)	-£241	-£241	£0
Total cost of fuels	£353	£288	£65
Total cost of uses	£354	£288	£66
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 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	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) (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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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												-853.5746 (H17)
Solar input	-24.7520	-41.3039	-70.3453	-94.2766	-116.4707	-114.5093	-112.9960	-98.7252	-77.3216	-52.8016	-29.3594	-20.7132 (63)
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)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
Northeast				7.0000	11.2829		0.6300		0.7000		0.7700		24.1375 (75)
Southwest				3.8600	36.7938		0.6300		0.7000		0.7700		43.4044 (79)
Northwest				1.4400	11.2829		0.6300		0.7000		0.7700		4.9654 (81)
Solar gains	72.5074	133.1737	207.8908	300.6250	376.0084	390.5687	369.3590	310.4779	239.5881	154.1084	88.6075	60.9121	(83)
Total gains	650.0773	705.9707	757.9268	815.5212	854.9647	837.4975	797.7363	747.6330	697.1273	647.0047	620.6771	622.5704	(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	0.9844	0.9767	0.9591	0.9126	0.8143	0.6513	0.4978	0.5466	0.7731	0.9297	0.9750	0.9867 (86)
MIT	19.6407	19.7965	20.0690	20.4368	20.7443	20.9278	20.9814	20.9729	20.8487	20.4660	19.9988	19.6150 (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	0.9807	0.9712	0.9490	0.8903	0.7674	0.5708	0.3936	0.4407	0.7028	0.9072	0.9680	0.9836 (89)
MIT 2	18.7550	18.9109	19.1803	19.5435	19.8221	19.9760	20.0075	20.0061	19.9194	19.5796	19.1229	18.7384 (90)
Living area fraction										fLA = Living area / (4) =		0.2112 (91)
MIT	18.9420	19.0979	19.3680	19.7321	20.0169	20.1769	20.2132	20.2102	20.1156	19.7668	19.3079	18.9235 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9420	19.0979	19.3680	19.7321	20.0169	20.1769	20.2132	20.2102	20.1156	19.7668	19.3079	18.9235 (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	0.9758	0.9651	0.9414	0.8833	0.7682	0.5849	0.4153	0.4625	0.7112	0.9007	0.9619	0.9792	(94)
Useful gains	634.3584	681.3360	713.5193	720.3627	656.7977	489.8889	331.3344	345.7594	495.8184	582.7686	597.0582	609.6245	(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	1417.0331	1369.6857	1237.5060	1026.3769	785.8462	520.0766	336.9448	354.4520	563.8457	866.1528	1160.0429	1407.3433	(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	582.3100	462.5711	389.8461	220.3302	96.0121	0.0000	0.0000	0.0000	0.0000	210.8379	405.3490	593.5028	(98)
Space heating												2960.7592	(98)
Space heating per m2											(98) / (4) =	34.4274	(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													3282.4381	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	582.3100	462.5711	389.8461	220.3302	96.0121	0.0000	0.0000	0.0000	0.0000	210.8379	405.3490	593.5028	(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)	645.5765	512.8282	432.2019	244.2685	106.4436	0.0000	0.0000	0.0000	0.0000	233.7449	449.3891	657.9854	(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	87.3012	87.5052	87.7757	88.3782	89.9987	76.4000	76.4000	76.4000	76.4000	86.1346	86.8583	87.3597	(217)	
Fuel for water heating, kWh/month	150.2355	108.6519	80.1724	32.1156	1.3379	0.0000	0.0000	12.1089	41.8364	86.5864	126.3010	149.1266	(219)	
Water heating fuel used												788.4726	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3282.4381	(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 * 0.82 * 1029 * 1.00) =										-675.1465			-675.1465	(233)
Total delivered energy for all uses													3910.0187	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3282.4381	3.4800	114.2288	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	788.4726	3.4800	27.4388	(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	-675.1465	13.1900	-89.0518	(252)
Total energy cost			240.4460	(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] =	0.7709	(257)
SAP value			89.2460	
SAP rating (Section 12)			89	(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	3282.4381	0.2160	709.0066	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	788.4726	0.2160	170.3101	(264)
Space and water heating			879.3167	(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	-675.1465	0.5190	-350.4010	(269)
Total kg/year			795.8138	(272)
CO2 emissions per m2			9.2500	(273)
EI value			91.8596	
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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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												-893.0374 (H17)
Solar input	-29.3066	-41.8360	-70.9049	-96.7542	-114.1911	-121.5209	-117.0344	-104.4101	-82.6345	-56.5796	-34.4557	-23.4094 (63)
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)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
Northeast				7.0000	15.0428		0.6300	0.7000		0.7700		32.1810 (75)
Southwest				3.8600	46.3896		0.6300	0.7000		0.7700		54.7242 (79)
Northwest				1.4400	15.0428		0.6300	0.7000		0.7700		6.6201 (81)
Solar gains	93.5253	147.5735	230.7528	341.4474	408.3983	458.9606	423.7286	363.6766	282.6497	181.1081	113.4147	74.9186 (83)
Total gains	671.0953	720.3705	780.7888	856.3435	887.3546	905.8894	852.1059	800.8317	740.1889	674.0044	645.4842	636.5769 (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	0.9782	0.9704	0.9462	0.8835	0.7563	0.5519	0.4009	0.4241	0.6816	0.8916	0.9609	0.9811 (86)	
MIT	19.8119	19.9336	20.2076	20.5508	20.8282	20.9650	20.9928	20.9912	20.9188	20.6176	20.1969	19.8029 (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	0.9728	0.9632	0.9328	0.8546	0.6983	0.4647	0.2966	0.3146	0.5948	0.8562	0.9496	0.9764 (89)	
MIT 2	18.9245	19.0526	19.3211	19.6502	19.8902	19.9937	20.0074	20.0093	19.9680	19.7145	19.3188	18.9248 (90)	
Living area fraction												0.2112 (91)	
MIT	19.1119	19.2386	19.5083	19.8404	20.0883	20.1988	20.2155	20.2166	20.1688	19.9052	19.5042	19.1103 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1119	19.2386	19.5083	19.8404	20.0883	20.1988	20.2155	20.2166	20.1688	19.9052	19.5042	19.1103 (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	0.9669	0.9565	0.9249	0.8492	0.7038	0.4821	0.3187	0.3378	0.6099	0.8524	0.9425	0.9710	(94)
Useful gains	648.8929	689.0107	722.1868	727.2311	624.4985	436.7084	271.5340	270.5422	451.4053	574.5205	608.3889	618.1299	(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	1327.0189	1294.0841	1163.4709	967.5953	707.5532	449.7889	273.2657	272.6721	484.4717	770.1899	1052.1583	1300.9325	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	504.5257	406.6093	328.3154	173.0622	61.7927	0.0000	0.0000	0.0000	0.0000	145.5780	319.5140	508.0051	(98)
Space heating												2447.4025	(98)
Space heating per m2											(98) / (4) =	28.4582	(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													2713.3065	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	504.5257	406.6093	328.3154	173.0622	61.7927	0.0000	0.0000	0.0000	0.0000	145.5780	319.5140	508.0051	(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)	559.3412	450.7864	363.9860	191.8650	68.5063	0.0000	0.0000	0.0000	0.0000	161.3947	354.2284	563.1985	(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	87.0460	87.2276	87.4308	88.1274	89.3388	76.4000	76.4000	76.4000	76.4000	85.1663	86.3529	87.0440	(216)	
(217)m	87.0460	87.2276	87.4308	88.1274	89.3388	76.4000	76.4000	76.4000	76.4000	85.1663	86.3529	87.0440	(217)	
Fuel for water heating, kWh/month	145.4434	108.3876	79.8486	29.3955	3.8995	0.0000	0.0000	4.6679	34.8823	83.1347	121.1385	146.5700	(219)	
Water heating fuel used												757.3680	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2713.3065	(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 * 0.82 * 1182 * 1.00) =									-775.1995			-775.1995	(233)	
Total delivered energy for all uses												3209.7295	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2713.3065	7.6100	206.4826	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	757.3680	7.6100	57.6357	(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	-775.1995	31.0800	-240.9320	(252)
Total energy cost			288.0166	(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	2713.3065	0.2160	586.0742	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	757.3680	0.2160	163.5915	(264)
Space and water heating			749.6657	(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	-775.1995	0.5190	-402.3285	(269)
Total kg/year			614.2352	(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	2713.3065	1.2200	3310.2339 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	757.3680	1.2200	923.9890 (264)
Space and water heating			4234.2229 (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	-775.1995	3.0700	-2379.8625 (269)
Primary energy kWh/year			3433.1218 (272)
Primary energy kWh/m2/year			39.9200 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 54	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Project	Plot 54		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.49	TER	18.34
Environmental	90 B	% DER<TER	26.43		
CO ₂ Emissions (t/year)	0.82	DFEE	44.36	TFEE	52.79
General Requirements Compliance	Pass	% DFEE<TFEE	15.97		

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 54	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Project	Plot 54		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.49	TER	18.34
Environmental	90 B	% DER<TER	26.43		
CO ₂ Emissions (t/year)	0.82	DFEE	44.36	TFEE	52.79
General Requirements Compliance	Pass	% DFEE<TFEE	15.97		

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 54	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H
Project	Plot 54		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.49	TER	18.34
Environmental	90 B	% DER<TER	26.43		
CO ₂ Emissions (t/year)	0.82	DFEE	44.36	TFEE	52.79
General Requirements Compliance	Pass	% DFEE<TFEE	15.97		

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

Floor 000003

Floor Type: Suspended Floor

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

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 54				Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block H			
	Property					Plot 54
SAP Rating		88 B	DER	13.49	TER	18.34
Environmental		90 B	% DER<TER	26.43		
CO ₂ Emissions (t/year)		0.82	DFEE	44.36	TFEE	52.79
General Requirements Compliance		Pass	% DFEE<TFEE	15.97		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

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

Orientation	South West						
Property Tenure	Unknown						
Transaction Type	New dwelling						
Terrain Type	Suburban						
1.0 Property Type	House, Semi-Detached						
2.0 Number of Storeys	2						
3.0 Date Built	2023						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
		Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
			19.05 m	43.71 m²	2.39 m		
		1st Storey:	18.48 m	42.29 m²	2.61 m		
7.0 Living Area	18.16			m²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	183.22			kJ/m²K			
9.0 External Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Brick and Block	Cavity Wall	Other		0.24	42.22	93.76	79.31
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	
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/m²K)	Area (m²)	
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/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
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	South West							2.15	
Windows	Window	[1] Brick and Block	South West	None	0.00					3.86	
Rear Elevation	Window	[1] Brick and Block	North East	None	0.00					7.00	
Side Elevation	Window	[1] Brick and Block	North West	None	0.00					1.44	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	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
0.82	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

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