



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 16 Shaw Road
WEST END, SO30 3JZ

Contact: Tobias Whiting
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Report Issue Date: 09/08/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 23	Issued on Date	09/08/2022
Assessment Reference	As Built	Prop Type Ref	MhV
Property	16 Shaw Road, WEST END, SO30 3JZ		
SAP Rating	89 B	DER	12.23
Environmental	89 B	TER	16.24
CO ₂ Emissions (t/year)	1.25	% DER<TER	24.70
General Requirements Compliance	Pass	DfEE	45.25
		TfEE	56.66
		% DfEE<TfEE	20.13
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 Built)

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)	16.24	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.23	kgCO ₂ /m ²	Pass
	-4.01 (-24.7%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	56.66	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	45.25	kWh/m ² /yr	
	-11.4 (-20.1%)	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	4.14 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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 Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% 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

4.20 m², No overhang

Windows facing East

8.02 m², Overhang twice as wide as window, ratio 0.50

Windows facing West

11.41 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

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.14 (measured in this dwelling) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.019	W/m ² K
Photovoltaic array	1.36	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	89 B	DER	12.23	TER	16.24
Environmental	89 B	% DER<TER	24.70		
CO ₂ Emissions (t/year)	1.25	DFEE	45.25	TFEE	56.66
General Requirements Compliance	Pass	% DFEE<TFEE	20.13		

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	0.077	1.89	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.00	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.51	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.58	0.23	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	2.77	0.16	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	2.40	0.72	
External wall	E3 Sill	Independently assessed	0.021	13.83	0.29	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	38.40	0.61	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.022	37.64	0.83	Knauf P10
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	35.23	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.31	1.10	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	3.27	0.78	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	22.44	0.99	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	34.69	1.35	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	14.49	-1.32	Knauf P24

Total: **6.40** W/mK:
Y-Value: **0.019** W/m²K:

FULL SAP CALCULATION PRINTOUT

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CO ₂ Emissions (t/year)	1.25	DFEE	45.25	TFEE	56.66
General Requirements Compliance	Pass	% DFEE<TFEE	20.13		
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FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 148 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) 16.24 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.23 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.3 kWh/m²/yr OK

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: 4.14 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% 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: 4.20 m², No overhang
Windows facing East: 8.02 m², Overhang twice as wide as window, ratio 0.50
Windows facing West: 11.41 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging g-value 0.019 W/m²K
Photovoltaic array 1.36 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3407 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403 (22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			23.6300	1.1450	27.0573		(27)
Ground Floor			74.9000	0.1200	8.9880	84.0000	6291.6000 (28a)
Brick and Block	184.0200	25.7500	158.2700	0.2400	37.9848	42.2200	6682.1594 (29a)
Pitched Roof	74.9000		74.9000	0.1000	7.4900	9.1000	681.5900 (30)
Total net area of external elements Aum(A, m ²)			333.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8521		(33)
GF Block			84.6700			75.0000	6350.2500 (32c)
GF Stud			31.4800			9.0000	283.3200 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			73.0300			18.0000	1314.5400 (32d)
Internal Ceiling 1			73.0300			18.0000	1314.5400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24465.5494 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.3860 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3955 (36)
Total fabric heat loss (33) + (36) = 90.2475 (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	70.1228	69.7962	69.4759	67.9720	67.6906	66.3806	66.3806	66.1381	66.8852	67.6906	68.2598	68.8549 (38)
Heat transfer coeff	160.3703	160.0437	159.7235	158.2195	157.9381	156.6281	156.6281	156.3856	157.1327	157.9381	158.5073	159.1025 (39)
Average = Sum(39)m / 12 =												158.2181 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0841	1.0819	1.0797	1.0696	1.0677	1.0588	1.0588	1.0572	1.0622	1.0677	1.0715	1.0755 (40)
HLP (average)												1.0695 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1899	110.0376	105.8852	101.7329	97.5805	93.4281	93.4281	97.5805	101.7329	105.8852	110.0376	114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4011	22.2159	22.9248	19.9864	19.1775	16.5487	15.3348	17.5969	17.8071	20.7524	22.6529	24.5996 (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	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (64)
Heat gains from water heating, kWh/month	63.7707	55.9856	58.2658	51.4909	49.9151	43.8160	41.3424	46.3923	46.6329	53.4239	57.4220	61.9847 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.7733 (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	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6109	26.3001	21.3887	16.1926	12.1042	10.2188	11.0418	14.3526	19.2640	24.4601	28.5485	30.4338 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.2620	321.5645	313.2422	295.5249	273.1600	252.1401	238.0975	234.7950	243.1173	260.8346	283.1995	304.2194 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545 (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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363 (71)
Water heating gains (Table 5)	85.7132	83.3119	78.3142	71.5151	67.0902	60.8556	55.5677	62.3552	64.7679	71.8063	79.7528	83.3128 (72)
Total internal gains	503.5497	501.1402	482.9087	453.1962	422.3179	393.1781	374.6707	381.4663	397.1129	427.0646	461.4645	487.9297 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				4.2000	10.6334		0.6300	0.7000	0.7700		13.6488 (74)	
East				8.0200	19.6403		0.6300	0.7000	0.7700		48.1386 (76)	
West				11.4100	19.6403		0.6300	0.7000	0.7700		68.4865 (80)	

Solar gains	130.2738	254.2269	420.0418	619.1575	767.4546	790.1195	750.3356	638.2380	490.2671	301.7603	162.2553	107.2851 (83)
Total gains	633.8235	755.3670	902.9505	1072.3537	1189.7725	1183.2977	1125.0063	1019.7043	887.3800	728.8249	623.7197	595.2147 (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	42.3768	42.4633	42.5485	42.9529	43.0294	43.3893	43.3893	43.4566	43.2500	43.0294	42.8749	42.7145
alpha	3.8251	3.8309	3.8366	3.8635	3.8686	3.8926	3.8926	3.8971	3.8833	3.8686	3.8583	3.8476
util living area	0.9969	0.9936	0.9834	0.9502	0.8689	0.7250	0.5738	0.6403	0.8664	0.9755	0.9945	0.9976 (86)
MIT	19.1967	19.3898	19.7402	20.2079	20.6151	20.8718	20.9613	20.9411	20.7205	20.1757	19.6006	19.1638 (87)
Th 2	20.0138	20.0157	20.0174	20.0258	20.0273	20.0346	20.0346	20.0360	20.0318	20.0273	20.0242	20.0209 (88)
util rest of house	0.9962	0.9920	0.9792	0.9367	0.8324	0.6494	0.4637	0.5308	0.8143	0.9668	0.9929	0.9970 (89)
MIT 2	18.3495	18.5433	18.8927	19.3573	19.7399	19.9612	20.0201	20.0117	19.8462	19.3333	18.7606	18.3220 (90)
Living area fraction									fLA = Living area / (4) =			0.1439 (91)
MIT	18.4714	18.6651	19.0146	19.4796	19.8658	20.0922	20.1555	20.1454	19.9719	19.4545	18.8815	18.4431 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4714	18.6651	19.0146	19.4796	19.8658	20.0922	20.1555	20.1454	19.9719	19.4545	18.8815	18.4431 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	630.3594	747.0980	878.9633	994.4436	981.9711	774.2884	538.0830	554.9540	719.1610	699.5517	617.6521	592.6500 (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	2272.6714	2203.0155	1998.8762	1673.9051	1289.6877	860.2310	556.8965	585.7203	922.6745	1398.4566	1867.4467	2266.1077 (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	1221.8802	978.3766	833.2152	489.2123	228.9412	0.0000	0.0000	0.0000	0.0000	519.9852	899.8521	1245.0526 (98)
Space heating												6416.5153 (98)
Space heating per m2												(98) / (4) = 43.3753 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7097.9151 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1221.8802	978.3766	833.2152	489.2123	228.9412	0.0000	0.0000	0.0000	0.0000	519.9852	899.8521	1245.0526	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1351.6374	1082.2750	921.6982	541.1640	253.2535	0.0000	0.0000	0.0000	0.0000	575.2049	995.4116	1377.2705	(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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199	(64)
Efficiency of water heater (217)m	90.0850	90.0591	89.9964	89.8425	89.4903	88.2000	88.2000	88.2000	88.2000	89.8526	90.0259	88.2000	(216)
Fuel for water heating, kWh/month	221.1248	194.3918	202.9285	180.3081	175.9632	157.4342	149.2437	166.5032	167.0705	187.0176	199.7777	215.1230	(219)
Water heating fuel used												2216.8861	(219)
Annual totals kWh/year													
Space heating fuel - main system												7097.9151	(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)												522.9372	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.36 * 908 * 1.00) =										-987.7454		-987.7454	(233)
Total delivered energy for all uses												8924.9931	(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	7097.9151	0.2160	1533.1497 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2216.8861	0.2160	478.8474 (264)
Space and water heating			2011.9971 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.9372	0.5190	271.4044 (268)
Energy saving/generation technologies			
PV Unit	-987.7454	0.5190	-512.6399 (269)
Total CO2, kg/year			1809.6866 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2300 (273)

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

DER		12.2300	ZC1
Total Floor Area	TFA	147.9300	
Assumed number of occupants	N	2.9309	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.7490	ZC2
CO2 emissions from cooking, equation (L16)		1.2799	ZC3
Total CO2 emissions		26.2589	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		26.2589	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1070 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3570	(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) =	0.3034 (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	0.3868	0.3793	0.3717	0.3337	0.3262	0.2882	0.2882	0.2807	0.3034	0.3262	0.3413	0.3565 (22b)
Effective ac	0.5748	0.5719	0.5691	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5583	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			23.6300	1.3258	31.3277		(27)					
Ground Floor			74.9000	0.1300	9.7370		(28a)					
Brick and Block	184.0200	25.7500	158.2700	0.1800	28.4886		(29a)					
Pitched Roof	74.9000		74.9000	0.1300	9.7370		(30)					
Total net area of external elements Aum(A, m2)			333.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	81.4103		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5892 (36)					
Total fabric heat loss						(33) + (36) =	95.9995 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.9451	Feb 70.5865	Mar 70.2350	Apr 68.5840	May 68.2751	Jun 66.8371	Jul 66.8371	Aug 66.5709	Sep 67.3910	Oct 68.2751	Nov 68.9000	Dec 69.5533 (38)
Heat transfer coeff	166.9446	166.5860	166.2345	164.5835	164.2746	162.8366	162.8366	162.5703	163.3905	164.2746	164.8995	165.5528 (39)
Average = Sum(39)m / 12 =												164.5820 (39)
HLP	Jan 1.1285	Feb 1.1261	Mar 1.1237	Apr 1.1126	May 1.1105	Jun 1.1008	Jul 1.1008	Aug 1.0990	Sep 1.1045	Oct 1.1105	Nov 1.1147	Dec 1.1191 (40)
HLP (average)												1.1126 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
Daily hot water use	Jan 114.1899	Feb 110.0376	Mar 105.8852	Apr 101.7329	May 97.5805	Jun 93.4281	Jul 93.4281	Aug 97.5805	Sep 101.7329	Oct 105.8852	Nov 110.0376	Dec 114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4011	22.2159	22.9248	19.9864	19.1775	16.5487	15.3348	17.5969	17.8071	20.7524	22.6529	24.5996	(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 Built)

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	50.9589	49.3151	49.7260	46.0741	47.6100	49.7260	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	220.2993	194.1336	203.7912	182.5580	177.5757	156.3988	149.8419	167.0386	168.0288	189.3084	200.3343	214.9560 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	220.2993	194.1336	203.7912	182.5580	177.5757	156.3988	149.8419	167.0386	168.0288	189.3084	200.3343	214.9560 (64)
	69.0454	60.7522	63.5565	56.6320	54.9415	48.2015	45.8946	51.4380	51.8011	58.7409	62.5427	67.2688 (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	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6109	26.3001	21.3887	16.1926	12.1042	10.2188	11.0418	14.3526	19.2640	24.4601	28.5485	30.4338	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.2620	321.5645	313.2422	295.5249	273.1600	252.1401	238.0975	234.7950	243.1173	260.8346	283.1995	304.2194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	(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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	(71)
Water heating gains (Table 5)	92.8030	90.4050	85.4254	78.6556	73.8461	66.9465	61.6863	69.1370	71.9460	78.9528	86.8648	90.4150	(72)
Total internal gains	510.6394	508.2332	490.0198	460.3367	429.0739	399.2690	380.7893	388.2482	404.2909	434.2112	468.5765	495.0319	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					4.2000	10.6334	0.6300	0.7000			0.7700			13.6488 (74)
East					8.0200	19.6403	0.6300	0.7000			0.7700			48.1386 (76)
West					11.4100	19.6403	0.6300	0.7000			0.7700			68.4865 (80)
Solar gains	130.2738	254.2269	420.0418	619.1575	767.4546	790.1195	750.3356	638.2380	490.2671	301.7603	162.2553	107.2851	(83)	
Total gains	640.9132	762.4601	910.0617	1079.4942	1196.5284	1189.3886	1131.1249	1026.4862	894.5580	735.9715	630.8317	602.3169	(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	61.5349	61.6674	61.7978	62.4177	62.5350	63.0873	63.0873	63.1906	62.8734	62.5350	62.2981	62.0522	
alpha	5.1023	5.1112	5.1199	5.1612	5.1690	5.2058	5.2058	5.2127	5.1916	5.1690	5.1532	5.1368	
util living area	0.9996	0.9988	0.9957	0.9801	0.9213	0.7788	0.6105	0.6844	0.9184	0.9926	0.9991	0.9997	(86)
MIT	19.6314	19.7754	20.0404	20.4033	20.7279	20.9258	20.9834	20.9710	20.8042	20.3747	19.9381	19.6087	(87)
Th 2	19.9776	19.9796	19.9815	19.9906	19.9923	20.0002	20.0002	20.0017	19.9972	19.9923	19.9888	19.9852	(88)
util rest of house	0.9994	0.9984	0.9941	0.9717	0.8870	0.6921	0.4834	0.5569	0.8680	0.9885	0.9987	0.9996	(89)
MIT 2	18.1323	18.3445	18.7329	19.2637	19.7105	19.9475	19.9937	19.9886	19.8217	19.2286	18.5894	18.1045	(90)
Living area fraction	18.3479	18.5503	18.9210	19.4277	19.8568	20.0882	20.1361	20.1299	19.9630	19.3934	18.7834	18.3209	(91)
MIT	18.3479	18.5503	18.9210	19.4277	19.8568	20.0882	20.1361	20.1299	19.9630	19.3934	18.7834	18.3209	(92)
Temperature adjustment	18.3479	18.5503	18.9210	19.4277	19.8568	20.0882	20.1361	20.1299	19.9630	19.3934	18.7834	18.3209	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	640.2913	760.5554	902.3366	1042.0726	1054.6001	833.2554	567.2624	589.7855	774.4859	724.7381	629.4845	601.8951	(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	2345.2268	2273.9516	2064.7903	1732.6789	1339.9628	893.6795	575.8011	606.3774	957.9659	1444.5367	1926.5820	2337.7538	(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	1268.4720	1017.0022	864.8655	497.2365	212.3098	0.0000	0.0000	0.0000	0.0000	535.5301	933.9102	1291.4788	(98)
Space heating													(98)
Space heating per m2													(98) / (4) =

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													7088.6566 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1268.4720	1017.0022	864.8655	497.2365	212.3098	0.0000	0.0000	0.0000	0.0000	535.5301	933.9102	1291.4788	(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)	1358.1071	1088.8675	925.9802	532.3732	227.3124	0.0000	0.0000	0.0000	0.0000	573.3727	999.9038	1382.7396	(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	220.2993	194.1336	203.7912	182.5580	177.5757	156.3988	149.8419	167.0386	168.0288	189.3084	200.3343	214.9560	(64)
Efficiency of water heater (217)m	88.7482	88.6135	88.2825	87.4463	85.5019	80.3000	80.3000	80.3000	80.3000	87.5248	88.4354	88.8061	(216)
Fuel for water heating, kWh/month	248.2295	219.0791	230.8399	208.7659	207.6863	194.7681	186.6026	208.0182	209.2514	216.2911	226.5319	242.0508	(219)
Water heating fuel used												2598.1148	(219)
Annual totals kWh/year													
Space heating fuel - main system												7088.6566	(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)												522.9372	(232)
Total delivered energy for all uses												10284.7086	(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	7088.6566	0.2160	1531.1498 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2598.1148	0.2160	561.1928 (264)
Space and water heating			2092.3426 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.9372	0.5190	271.4044 (268)
Total CO2, kg/m2/year			2402.6720 (272)
Emissions per m2 for space and water heating			14.1441 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8347 (272b)
Emissions per m2 for pumps and fans			0.2631 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1441 * 1.00) + 1.8347 + 0.2631, rounded to 2 d.p.			16.2400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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) = 0.1070 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3140 (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) =	0.2669 (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	0.3402	0.3336	0.3269	0.2935	0.2869	0.2535	0.2535	0.2468	0.2669	0.2869	0.3002	0.3136 (22b)
Effective ac	0.5579	0.5556	0.5534	0.5431	0.5411	0.5321	0.5321	0.5305	0.5356	0.5411	0.5451	0.5492 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			23.6300	1.1450	27.0573		(27)
Ground Floor			74.9000	0.1200	8.9880	84.0000	6291.6000 (28a)
Brick and Block	184.0200	25.7500	158.2700	0.2400	37.9848	42.2200	6682.1594 (29a)
Pitched Roof	74.9000		74.9000	0.1000	7.4900	9.1000	681.5900 (30)
Total net area of external elements Aum(A, m ²)			333.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8521		(33)
GF Block			84.6700			75.0000	6350.2500 (32c)
GF Stud			31.4800			9.0000	283.3200 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			73.0300			18.0000	1314.5400 (32d)
Internal Ceiling 1			73.0300			9.0000	657.2700 (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) = 23808.2794 (34)
160.9429 (35)
6.3955 (36)
(33) + (36) = 90.2475 (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	68.8542	68.5768	68.3048	67.0277	66.7887	65.6763	65.6763	65.4703	66.1048	66.7887	67.2721	67.7775 (38)
Heat transfer coeff	159.1017	158.8243	158.5523	157.2752	157.0362	155.9238	155.9238	155.7178	156.3523	157.0362	157.5196	158.0250 (39)
Average = Sum(39)m / 12 =												157.2740 (39)
HLP	1.0755	1.0736	1.0718	1.0632	1.0616	1.0540	1.0540	1.0526	1.0569	1.0616	1.0648	1.0682 (40)
HLP (average)												1.0632 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1899	110.0376	105.8852	101.7329	97.5805	93.4281	93.4281	97.5805	101.7329	105.8852	110.0376	114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (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	35.9848	31.4726	32.4769	28.3141	27.1681	23.4440	21.7243	24.9289	25.2267	29.3993	32.0916	34.8494 (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	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	146.5453	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6109	26.3001	21.3887	16.1926	12.1042	10.2188	11.0418	14.3526	19.2640	24.4601	28.5485	30.4338	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.2620	321.5645	313.2422	295.5249	273.1600	252.1401	238.0975	234.7950	243.1173	260.8346	283.1995	304.2194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	(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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	(71)
Water heating gains (Table 5)	48.3667	46.8342	43.6517	39.3252	36.5162	32.5611	29.1993	33.5066	35.0370	39.5151	44.5717	46.8406	(72)
Total internal gains	463.2031	461.6624	445.2462	418.0063	388.7440	361.8836	345.3023	349.6178	364.3820	391.7734	423.2833	448.4574	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				4.2000	10.6334	0.6300	0.7000			0.7700			13.6488 (74)
East				8.0200	19.6403	0.6300	0.7000			0.7700			48.1386 (76)
West				11.4100	19.6403	0.6300	0.7000			0.7700			68.4865 (80)
Solar gains	130.2738	254.2269	420.0418	619.1575	767.4546	790.1195	750.3356	638.2380	490.2671	301.7603	162.2553	107.2851	(83)
Total gains	593.4770	715.8893	865.2880	1037.1638	1156.1985	1152.0032	1095.6379	987.8558	854.6491	693.5338	585.5386	555.7425	(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	41.5672	41.6398	41.7112	42.0499	42.1139	42.4144	42.4144	42.4705	42.2981	42.1139	41.9847	41.8504	
alpha	3.7711	3.7760	3.7807	3.8033	3.8076	3.8276	3.8276	3.8314	3.8199	3.8076	3.7990	3.7900	
util living area	0.9973	0.9941	0.9843	0.9522	0.8731	0.7325	0.5826	0.6513	0.8735	0.9776	0.9951	0.9979	(86)
MIT	19.1398	19.3369	19.6951	20.1728	20.5924	20.8604	20.9568	20.9340	20.6992	20.1365	19.5486	19.1046	(87)
Th 2	20.0209	20.0224	20.0239	20.0310	20.0324	20.0385	20.0385	20.0397	20.0362	20.0324	20.0297	20.0269	(88)
util rest of house	0.9966	0.9927	0.9804	0.9394	0.8379	0.6582	0.4726	0.5425	0.8239	0.9696	0.9937	0.9974	(89)
MIT 2	18.3007	18.4984	18.8555	19.3296	19.7253	19.9573	20.0219	20.0117	19.8334	19.3012	18.7156	18.2700	(90)
Living area fraction	18.4214	18.6190	18.9763	19.4509	19.8500	20.0872	20.1564	20.1444	19.9580	19.4214	18.8354	18.3901	(91)
Temperature adjustment	18.4214	18.6190	18.9763	19.4509	19.8500	20.0872	20.1564	20.1444	19.9580	19.4214	18.8354	18.3901	(92)
adjusted MIT	18.4214	18.6190	18.9763	19.4509	19.8500	20.0872	20.1564	20.1444	19.9580	19.4214	18.8354	18.3901	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9951	0.9899	0.9748	0.9299	0.8302	0.6624	0.4870	0.5554	0.8190	0.9628	0.9913	0.9962	(94)
Ext temp.	590.5885	708.6664	843.5059	964.4560	959.8743	763.0770	533.5360	548.6835	699.9785	667.7526	580.4437	553.6261	(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	2246.7373	2178.9126	1978.1489	1659.3869	1279.8501	855.5871	554.5293	583.0695	915.9057	1385.2773	1848.5624	2242.3877	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1232.1747	988.0054	844.1744	500.3502	238.0620	0.0000	0.0000	0.0000	0.0000	533.8384	913.0455	1256.4386	(98)
												6506.0892	(98)
												43.9809	(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	1465.6840	1153.8363	1183.4555	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7946	0.8625	0.8229	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1164.6082	995.2148	973.8582	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1472.0875	1403.3234	1279.9553	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	221.3851	303.6329	227.7362	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												752.7542 (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	55.3463	75.9082	56.9341	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												188.1885 (107)
Space cooling per m2												1.2721 (108)
Energy for space heating												43.9809 (99)
Energy for space cooling												1.2721 (108)
Total												45.2530 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1070 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3570	(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) =	0.3034 (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	0.3868	0.3793	0.3717	0.3337	0.3262	0.2882	0.2882	0.2807	0.3034	0.3262	0.3413	0.3565 (22b)
Effective ac	0.5748	0.5719	0.5691	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5583	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			23.6300	1.3258	31.3277		(27)					
Ground Floor			74.9000	0.1300	9.7370		(28a)					
Brick and Block	184.0200	25.7500	158.2700	0.1800	28.4886		(29a)					
Pitched Roof	74.9000		74.9000	0.1300	9.7370		(30)					
Total net area of external elements Aum(A, m2)			333.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4103		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5892 (36)					
Total fabric heat loss						(33) + (36) =	95.9995 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.9451	Feb 70.5865	Mar 70.2350	Apr 68.5840	May 68.2751	Jun 66.8371	Jul 66.8371	Aug 66.5709	Sep 67.3910	Oct 68.2751	Nov 68.9000	Dec 69.5533 (38)
Heat transfer coeff	166.9446	166.5860	166.2345	164.5835	164.2746	162.8366	162.8366	162.5703	163.3905	164.2746	164.8995	165.5528 (39)
Average = Sum(39)m / 12 =												164.5820 (39)
HLP	Jan 1.1285	Feb 1.1261	Mar 1.1237	Apr 1.1126	May 1.1105	Jun 1.1008	Jul 1.1008	Aug 1.0990	Sep 1.1045	Oct 1.1105	Nov 1.1147	Dec 1.1191 (40)
HLP (average)												1.1126 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
Daily hot water use	Jan 114.1899	Feb 110.0376	Mar 105.8852	Apr 101.7329	May 97.5805	Jun 93.4281	Jul 93.4281	Aug 97.5805	Sep 101.7329	Oct 105.8852	Nov 110.0376	Dec 114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (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	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Built)

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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)
	35.9848	31.4726	32.4769	28.3141	27.1681	23.4440	21.7243	24.9289	25.2267	29.3993	32.0916	34.8494 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 146.5453	Feb 146.5453	Mar 146.5453	Apr 146.5453	May 146.5453	Jun 146.5453	Jul 146.5453	Aug 146.5453	Sep 146.5453	Oct 146.5453	Nov 146.5453	Dec 146.5453 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6109	26.3001	21.3887	16.1926	12.1042	10.2188	11.0418	14.3526	19.2640	24.4601	28.5485	30.4338 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.2620	321.5645	313.2422	295.5249	273.1600	252.1401	238.0975	234.7950	243.1173	260.8346	283.1995	304.2194 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545	37.6545 (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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363 (71)
Water heating gains (Table 5)	48.3667	46.8342	43.6517	39.3252	36.5162	32.5611	29.1993	33.5066	35.0370	39.5151	44.5717	46.8406 (72)
Total internal gains	463.2031	461.6624	445.2462	418.0063	388.7440	361.8836	345.3023	349.6178	364.3820	391.7734	423.2833	448.4574 (73)

6. Solar gains												

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North			4.2000		10.6334		0.6300		0.7000		0.7700	13.6488 (74)
East			8.0200		19.6403		0.6300		0.7000		0.7700	48.1386 (76)
West			11.4100		19.6403		0.6300		0.7000		0.7700	68.4865 (80)

Solar gains	130.2738	254.2269	420.0418	619.1575	767.4546	790.1195	750.3356	638.2380	490.2671	301.7603	162.2553	107.2851 (83)
Total gains	593.4770	715.8893	865.2880	1037.1638	1156.1985	1152.0032	1095.6379	987.8558	854.6491	693.5338	585.5386	555.7425 (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	61.5349	61.6674	61.7978	62.4177	62.5350	63.0873	63.0873	63.1906	62.8734	62.5350	62.2981	62.0522
alpha	5.1023	5.1112	5.1199	5.1612	5.1690	5.2058	5.2058	5.2127	5.1916	5.1690	5.1532	5.1368
util living area	0.9997	0.9991	0.9966	0.9832	0.9298	0.7941	0.6272	0.7046	0.9300	0.9944	0.9993	0.9998 (86)
MIT	19.6012	19.7459	20.0125	20.3788	20.7105	20.9184	20.9813	20.9668	20.7871	20.3485	19.9093	19.5790 (87)
Th 2	19.9776	19.9796	19.9815	19.9906	19.9923	20.0002	20.0002	20.0017	19.9972	19.9923	19.9888	19.9852 (88)
util rest of house	0.9996	0.9988	0.9953	0.9759	0.8982	0.7088	0.4981	0.5763	0.8843	0.9911	0.9991	0.9997 (89)
MIT 2	18.6875	18.8337	19.1012	19.4708	19.7853	19.9600	19.9951	19.9913	19.8641	19.4452	19.0046	18.6715 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8190	18.9649	19.2323	19.6014	19.9184	20.0979	20.1370	20.1316	19.9969	19.5751	19.1347	18.8020 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8190	18.9649	19.2323	19.6014	19.9184	20.0979	20.1370	20.1316	19.9969	19.5751	19.1347	18.8020 (93)

8. Space heating requirement												

Utilisation	Jan 0.9994	Feb 0.9984	Mar 0.9939	Apr 0.9722	May 0.8953	Jun 0.7182	Jul 0.5167	Aug 0.5945	Sep 0.8843	Oct 0.9892	Nov 0.9987	Dec 0.9996 (94)
Useful gains	593.1354	714.7281	860.0181	1008.3359	1035.1854	827.3618	566.1603	587.2795	755.7529	686.0155	584.7726	555.5177 (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	2423.8648	2343.0225	2116.5512	1761.2761	1350.0664	895.2543	575.9476	606.6484	963.4982	1474.3846	1984.5190	2417.4071 (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	1362.0626	1094.2139	934.8606	542.1169	234.2714	0.0000	0.0000	0.0000	0.0000	586.5466	1007.8174	1385.2457 (98)
Space heating												7147.1353 (98)
Space heating per m2	(98) / (4) =											48.3143 (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	1530.6640	1204.9908	1235.5344	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8221	0.8955	0.8535	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1258.2952	1079.0117	1054.5071	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1472.0875	1403.3234	1279.9553	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	153.9304	241.2879	167.7335	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												562.9519 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	38.4826	60.3220	41.9334	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												140.7380 (107)
Space cooling per m2												0.9514 (108)
Energy for space heating												48.3143 (99)
Energy for space cooling												0.9514 (108)
Total												49.2657 (109)
Target Fabric Energy Efficiency (TFEE)												56.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3407 (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) =	0.2896 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.3403	0.3185	0.3185	0.2896	0.2968	0.2823	0.2823	0.2751	0.2751	0.2968	0.2896	0.2968 (22b)
Effective ac	0.5579	0.5507	0.5507	0.5419	0.5441	0.5399	0.5399	0.5378	0.5378	0.5441	0.5419	0.5441 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			23.6300	1.1450	27.0573		(27)
Ground Floor			74.9000	0.1200	8.9880	84.0000	6291.6000 (28a)
Brick and Block	184.0200	25.7500	158.2700	0.2400	37.9848	42.2200	6682.1594 (29a)
Pitched Roof	74.9000		74.9000	0.1000	7.4900	9.1000	681.5900 (30)
Total net area of external elements Aum(A, m ²)			333.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8521		(33)
GF Block			84.6700			75.0000	6350.2500 (32c)
GF Stud			31.4800			9.0000	283.3200 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			73.0300			18.0000	1314.5400 (32d)
Internal Ceiling 1			73.0300			18.0000	1314.5400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24465.5494 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.3860 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3955 (36)
Total fabric heat loss (33) + (36) = 90.2475 (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	68.8549	67.9720	67.9720	66.8852	67.1472	66.6297	66.6297	66.3806	66.3806	67.1472	66.8852	67.1472 (38)
Heat transfer coeff	159.1025	158.2195	158.2195	157.1327	157.3947	156.8772	156.8772	156.6281	156.6281	157.3947	157.1327	157.3947 (39)
Average = Sum(39)m / 12 =												157.4168 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0755	1.0696	1.0696	1.0622	1.0640	1.0605	1.0605	1.0588	1.0588	1.0640	1.0622	1.0640 (40)
HLP (average)												1.0641 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1899	110.0376	105.8852	101.7329	97.5805	93.4281	93.4281	97.5805	101.7329	105.8852	110.0376	114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4011	22.2159	22.9248	19.9864	19.1775	16.5487	15.3348	17.5969	17.8071	20.7524	22.6529	24.5996 (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	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (64)
RHI water heating demand												1982.7733 (64)
Heat gains from water heating, kWh/month	63.7707	55.9856	58.2658	51.4909	49.9151	43.8160	41.3424	46.3923	46.6329	53.4239	57.4220	61.9847 (65)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												1983 (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	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.0272	65.7503	53.4717	40.4815	30.2604	25.5471	27.6046	35.8815	48.1600	61.1502	71.3713	76.0846	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	475.0179	479.9471	467.5256	441.0819	407.7014	376.3285	355.3694	350.4402	362.8617	389.3054	422.6859	454.0588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	(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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	(71)
Water heating gains (Table 5)	85.7132	83.3119	78.3142	71.5151	67.0902	60.8556	55.5677	62.3552	64.7679	71.8063	79.7528	83.3128	(72)
Total internal gains	751.8928	746.1437	716.4460	670.2130	622.1865	579.8657	555.6762	565.8114	592.9241	639.3964	690.9445	730.5907	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	4.2000				13.4684		0.6300		0.7000		0.7700		17.2877 (74)	
East	8.0200				25.1733		0.6300		0.7000		0.7700		61.7001 (76)	
West	11.4100				25.1733		0.6300		0.7000		0.7700		87.7803 (80)	
Solar gains	166.7680	277.2080	465.6150	686.2780	797.5481	907.0805	828.2135	737.2478	568.1086	354.9791	207.1067	129.9493	(83)	
Total gains	918.6608	1023.3518	1182.0611	1356.4910	1419.7346	1486.9462	1383.8897	1303.0592	1161.0327	994.3755	898.0513	860.5400	(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	42.7145	42.9529	42.9529	43.2500	43.1780	43.3204	43.3204	43.3893	43.3893	43.1780	43.2500	43.1780	
alpha	3.8476	3.8635	3.8635	3.8833	3.8785	3.8880	3.8880	3.8926	3.8926	3.8785	3.8833	3.8785	
util living area	0.9855	0.9776	0.9508	0.8763	0.7393	0.5146	0.3689	0.3788	0.6724	0.9054	0.9728	0.9880	(86)
MIT	19.6357	19.7857	20.1189	20.5356	20.8283	20.9691	20.9937	20.9933	20.9144	20.5567	20.0475	19.6201	(87)
Th 2	20.0209	20.0258	20.0258	20.0318	20.0304	20.0332	20.0332	20.0346	20.0346	20.0304	20.0318	20.0304	(88)
util rest of house	0.9821	0.9723	0.9390	0.8469	0.6798	0.4261	0.2634	0.2674	0.5834	0.8744	0.9649	0.9851	(89)
MIT 2	18.7914	18.9430	19.2686	19.6669	19.9190	20.0201	20.0319	20.0333	19.9915	19.6949	19.2079	18.7834	(90)
Living area fraction	18.9128	19.0642	19.3909	19.7919	20.0498	20.1567	20.1702	20.1714	20.1243	19.8189	19.3287	18.9038	(91)
MIT	18.9128	19.0642	19.3909	19.7919	20.0498	20.1567	20.1702	20.1714	20.1243	19.8189	19.3287	18.9038	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9128	19.0642	19.3909	19.7919	20.0498	20.1567	20.1702	20.1714	20.1243	19.8189	19.3287	18.9038	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9768	0.9655	0.9295	0.8385	0.6811	0.4379	0.2786	0.2835	0.5923	0.8662	0.9575	0.9806	(94)
Ext temp.	897.3826	988.0261	1098.7100	1137.4138	966.9863	651.0708	385.5410	369.4120	687.7202	861.2870	859.9202	843.8146	(95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Month fracti	2118.1016	2067.0166	1865.5554	1522.9089	1093.8693	667.7714	387.5233	371.4222	739.9549	1214.9067	1685.8318	2078.2081	(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	908.2149	725.0816	570.5330	277.5565	94.4009	0.0000	0.0000	0.0000	0.0000	263.0931	594.6563	918.3888	(98)
RHI space heating demand												4351.9251	(98)
												4352	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3407 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403 (22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			23.6300	1.1450	27.0573		(27)
Ground Floor			74.9000	0.1200	8.9880	84.0000	6291.6000 (28a)
Brick and Block	184.0200	25.7500	158.2700	0.2400	37.9848	42.2200	6682.1594 (29a)
Pitched Roof	74.9000		74.9000	0.1000	7.4900	9.1000	681.5900 (30)
Total net area of external elements Aum(A, m ²)			333.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8521		(33)
GF Block			84.6700			75.0000	6350.2500 (32c)
GF Stud			31.4800			9.0000	283.3200 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			73.0300			18.0000	1314.5400 (32d)
Internal Ceiling 1			73.0300			18.0000	1314.5400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24465.5494 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.3860 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3955 (36)
Total fabric heat loss (33) + (36) = 90.2475 (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	70.1228	69.7962	69.4759	67.9720	67.6906	66.3806	66.3806	66.1381	66.8852	67.6906	68.2598	68.8549 (38)
Heat transfer coeff	160.3703	160.0437	159.7235	158.2195	157.9381	156.6281	156.6281	156.3856	157.1327	157.9381	158.5073	159.1025 (39)
Average = Sum(39)m / 12 =												158.2181 (39)
HLP	1.0841	1.0819	1.0797	1.0696	1.0677	1.0588	1.0588	1.0572	1.0622	1.0677	1.0715	1.0755 (40)
HLP (average)												1.0695 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1899	110.0376	105.8852	101.7329	97.5805	93.4281	93.4281	97.5805	101.7329	105.8852	110.0376	114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4011	22.2159	22.9248	19.9864	19.1775	16.5487	15.3348	17.5969	17.8071	20.7524	22.6529	24.5996 (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	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (64)
Heat gains from water heating, kWh/month	63.7707	55.9856	58.2658	51.4909	49.9151	43.8160	41.3424	46.3923	46.6329	53.4239	57.4220	61.9847 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.7733 (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	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.0272	65.7503	53.4717	40.4815	30.2604	25.5471	27.6046	35.8815	48.1600	61.1502	71.3713	76.0846 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	475.0179	479.9471	467.5256	441.0819	407.7014	376.3285	355.3694	350.4402	362.8617	389.3054	422.6859	454.0588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163 (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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363 (71)
Water heating gains (Table 5)	85.7132	83.3119	78.3142	71.5151	67.0902	60.8556	55.5677	62.3552	64.7679	71.8063	79.7528	83.3128 (72)
Total internal gains	751.8928	746.1437	716.4460	670.2130	622.1865	579.8657	555.6762	565.8114	592.9241	639.3964	690.9445	730.5907 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					4.2000	10.6334	0.6300	0.7000	0.7700		13.6488 (74)	
East					8.0200	19.6403	0.6300	0.7000	0.7700		48.1386 (76)	
West					11.4100	19.6403	0.6300	0.7000	0.7700		68.4865 (80)	
Solar gains	130.2738	254.2269	420.0418	619.1575	767.4546	790.1195	750.3356	638.2380	490.2671	301.7603	162.2553	107.2851 (83)
Total gains	882.1666	1000.3706	1136.4879	1289.3706	1389.6411	1369.9852	1306.0118	1204.0494	1083.1913	941.1567	853.1998	837.8758 (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	42.3768	42.4633	42.5485	42.9529	43.0294	43.3893	43.3893	43.4566	43.2500	43.0294	42.8749	42.7145
alpha	3.8251	3.8309	3.8366	3.8635	3.8686	3.8926	3.8926	3.8971	3.8833	3.8686	3.8583	3.8476
util living area	0.9904	0.9835	0.9657	0.9170	0.8160	0.6574	0.5060	0.5623	0.7956	0.9470	0.9841	0.9921 (86)
MIT	19.4098	19.5956	19.9251	20.3524	20.7037	20.9097	20.9749	20.9625	20.8029	20.3351	19.7945	19.3735 (87)
Th 2	20.0138	20.0157	20.0174	20.0258	20.0273	20.0346	20.0346	20.0360	20.0318	20.0273	20.0242	20.0209 (88)
util rest of house	0.9882	0.9798	0.9577	0.8970	0.7722	0.5804	0.4041	0.4585	0.7317	0.9301	0.9798	0.9903 (89)
MIT 2	18.5613	18.7469	19.0729	19.4918	19.8131	19.9849	20.0256	20.0213	19.9081	19.4844	18.9522	18.5306 (90)
Living area fraction									fLA = Living area / (4) =			0.1439 (91)
MIT	18.6834	18.8689	19.1955	19.6156	19.9412	20.1180	20.1622	20.1567	20.0369	19.6068	19.0734	18.6519 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6834	18.8689	19.1955	19.6156	19.9412	20.1180	20.1622	20.1567	20.0369	19.6068	19.0734	18.6519 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	868.2442	974.4506	1078.8008	1143.6636	1066.9969	804.9459	546.0902	568.5698	792.9343	866.7754	831.2657	826.8416 (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	2306.6683	2235.6414	2027.7708	1695.4109	1301.5946	864.2696	557.9376	587.4911	932.8748	1422.5156	1897.8659	2299.3308 (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	1070.1875	847.5203	706.0337	397.2581	174.5407	0.0000	0.0000	0.0000	0.0000	413.4707	767.9521	1095.5320 (98)
Space heating												5472.4952 (98)
Space heating per m2												(98) / (4) = 36.9938 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6053.6451 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1070.1875	847.5203	706.0337	397.2581	174.5407	0.0000	0.0000	0.0000	0.0000	413.4707	767.9521	1095.5320	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1183.8358	937.5224	781.0107	439.4448	193.0760	0.0000	0.0000	0.0000	0.0000	457.3790	849.5046	1211.8717	(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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199	(64)
Efficiency of water heater (217)m	90.0475	90.0156	89.9390	89.7515	89.3430	88.2000	88.2000	88.2000	88.2000	89.7531	89.9741	88.2000	(216)
Fuel for water heating, kWh/month	221.2168	194.4856	203.0582	180.4909	176.2533	157.4342	149.2437	166.5032	167.0705	187.2250	199.8927	215.2065	(219)
Water heating fuel used												2218.0806	(219)
Annual totals kWh/year													
Space heating fuel - main system												6053.6451	(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)												522.9372	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.36 * 908 * 1.00) =												-987.7454	(233)
Total delivered energy for all uses												7881.9175	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6053.6451	3.4800	210.6668 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2218.0806	3.4800	77.1892 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	522.9372	13.1900	68.9754 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-987.7454	13.1900	-130.2836 (252)
Total energy cost			356.4404 (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] =	0.7760 (257)
SAP value		89.1754
SAP rating (Section 12)		89 (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	6053.6451	0.2160	1307.5873 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2218.0806	0.2160	479.1054 (264)
Space and water heating			1786.6927 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.9372	0.5190	271.4044 (268)
Energy saving/generation technologies			
PV Unit	-987.7454	0.5190	-512.6399 (269)
Total kg/year			1584.3823 (272)
CO2 emissions per m2			10.7100 (273)
EI value			88.9956
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8931 = 3.897$, stars = 4
Water heating environmental impact	$0.216 / 0.8931 = 0.2419$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.9000 (1b)	x 2.3900 (2b)	= 179.0110 (1b) - (3b)
First floor	73.0300 (1c)	x 2.6700 (2c)	= 194.9901 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.0011 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3407 (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) =	0.2896 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.3403	0.3185	0.3185	0.2896	0.2968	0.2823	0.2823	0.2751	0.2751	0.2968	0.2896	0.2968 (22b)
Effective ac	0.5579	0.5507	0.5507	0.5419	0.5441	0.5399	0.5399	0.5378	0.5378	0.5441	0.5419	0.5441 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			23.6300	1.1450	27.0573		(27)
Ground Floor			74.9000	0.1200	8.9880	84.0000	6291.6000 (28a)
Brick and Block	184.0200	25.7500	158.2700	0.2400	37.9848	42.2200	6682.1594 (29a)
Pitched Roof	74.9000		74.9000	0.1000	7.4900	9.1000	681.5900 (30)
Total net area of external elements Aum(A, m ²)			333.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8521		(33)
GF Block			84.6700			75.0000	6350.2500 (32c)
GF Stud			31.4800			9.0000	283.3200 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			73.0300			18.0000	1314.5400 (32d)
Internal Ceiling 1			73.0300			18.0000	1314.5400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24465.5494 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.3860 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3955 (36)
Total fabric heat loss (33) + (36) = 90.2475 (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	68.8549	67.9720	67.9720	66.8852	67.1472	66.6297	66.6297	66.3806	66.3806	67.1472	66.8852	67.1472 (38)
Heat transfer coeff	159.1025	158.2195	158.2195	157.1327	157.3947	156.8772	156.8772	156.6281	156.6281	157.3947	157.1327	157.3947 (39)
Average = Sum(39)m / 12 =												157.4168 (39)
HLP	1.0755	1.0696	1.0696	1.0622	1.0640	1.0605	1.0605	1.0588	1.0588	1.0640	1.0622	1.0640 (40)
HLP (average)												1.0641 (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												2.9309 (42)
Average daily hot water use (litres/day)												103.8090 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1899	110.0376	105.8852	101.7329	97.5805	93.4281	93.4281	97.5805	101.7329	105.8852	110.0376	114.1899 (44)
Energy conte	169.3404	148.1062	152.8323	133.2429	127.8497	110.3246	102.2320	117.3127	118.7138	138.3494	151.0192	163.9971 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3204 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.4011	22.2159	22.9248	19.9864	19.1775	16.5487	15.3348	17.5969	17.8071	20.7524	22.6529	24.5996 (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	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199 (64)
Heat gains from water heating, kWh/month	63.7707	55.9856	58.2658	51.4909	49.9151	43.8160	41.3424	46.3923	46.6329	53.4239	57.4220	61.9847 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.7733 (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	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544	175.8544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.0272	65.7503	53.4717	40.4815	30.2604	25.5471	27.6046	35.8815	48.1600	61.1502	71.3713	76.0846 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	475.0179	479.9471	467.5256	441.0819	407.7014	376.3285	355.3694	350.4402	362.8617	389.3054	422.6859	454.0588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163	55.5163 (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)	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363	-117.2363 (71)
Water heating gains (Table 5)	85.7132	83.3119	78.3142	71.5151	67.0902	60.8556	55.5677	62.3552	64.7679	71.8063	79.7528	83.3128 (72)
Total internal gains	751.8928	746.1437	716.4460	670.2130	622.1865	579.8657	555.6762	565.8114	592.9241	639.3964	690.9445	730.5907 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				4.2000	13.4684	0.6300	0.7000	0.7700		17.2877 (74)		
East				8.0200	25.1733	0.6300	0.7000	0.7700		61.7001 (76)		
West				11.4100	25.1733	0.6300	0.7000	0.7700		87.7803 (80)		

Solar gains	166.7680	277.2080	465.6150	686.2780	797.5481	907.0805	828.2135	737.2478	568.1086	354.9791	207.1067	129.9493 (83)
Total gains	918.6608	1023.3518	1182.0611	1356.4910	1419.7346	1486.9462	1383.8897	1303.0592	1161.0327	994.3755	898.0513	860.5400 (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	42.7145	42.9529	42.9529	43.2500	43.1780	43.3204	43.3204	43.3893	43.3893	43.1780	43.2500	43.1780
alpha	3.8476	3.8635	3.8635	3.8833	3.8785	3.8880	3.8880	3.8926	3.8926	3.8785	3.8833	3.8785
util living area	0.9855	0.9776	0.9508	0.8763	0.7393	0.5146	0.3689	0.3788	0.6724	0.9054	0.9728	0.9880 (86)
MIT	19.6357	19.7857	20.1189	20.5356	20.8283	20.9691	20.9937	20.9933	20.9144	20.5567	20.0475	19.6201 (87)
Th 2	20.0209	20.0258	20.0258	20.0318	20.0304	20.0332	20.0332	20.0346	20.0346	20.0304	20.0318	20.0304 (88)
util rest of house	0.9821	0.9723	0.9390	0.8469	0.6798	0.4261	0.2634	0.2674	0.5834	0.8744	0.9649	0.9851 (89)
MIT 2	18.7914	18.9430	19.2686	19.6669	19.9190	20.0201	20.0319	20.0333	19.9915	19.6949	19.2079	18.7834 (90)
Living area fraction									fLA = Living area / (4) =			0.1439 (91)
MIT	18.9128	19.0642	19.3909	19.7919	20.0498	20.1567	20.1702	20.1714	20.1243	19.8189	19.3287	18.9038 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9128	19.0642	19.3909	19.7919	20.0498	20.1567	20.1702	20.1714	20.1243	19.8189	19.3287	18.9038 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9768	0.9655	0.9295	0.8385	0.6811	0.4379	0.2786	0.2835	0.5923	0.8662	0.9575	0.9806 (94)
Ext temp.	897.3826	988.0261	1098.7100	1137.4138	966.9863	651.0708	385.5410	369.4120	687.7202	861.2870	859.9202	843.8146 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	2118.1016	2067.0166	1865.5554	1522.9089	1093.8693	667.7714	387.5233	371.4222	739.9549	1214.9067	1685.8318	2078.2081 (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	908.2149	725.0816	570.5330	277.5565	94.4009	0.0000	0.0000	0.0000	0.0000	263.0931	594.6563	918.3888 (98)
Space heating per m2												4351.9251 (98)
(98) / (4) = 29.4188 (99)												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)												90.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4814.0764	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	908.2149	725.0816	570.5330	277.5565	94.4009	0.0000	0.0000	0.0000	0.0000	263.0931	594.6563	918.3888	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1004.6625	802.0815	631.1205	307.0315	104.4258	0.0000	0.0000	0.0000	0.0000	291.0322	657.8056	1015.9168	(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	199.2003	175.0674	182.6284	161.9934	157.4700	138.8570	131.6329	146.8558	147.3561	168.0402	179.8518	193.8199	(64)
Efficiency of water heater (217)m	89.9962	89.9636	89.8565	89.5765	89.0119	88.2000	88.2000	88.2000	88.2000	89.5296	89.8794	88.2000	(216)
Fuel for water heating, kWh/month	221.3430	194.5981	203.2445	180.8435	176.9090	157.4342	149.2437	166.5032	167.0705	187.6924	200.1034	215.3345	(219)
Water heating fuel used												2220.3199	(219)
Annual totals kWh/year													
Space heating fuel - main system												4814.0764	(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)												522.9372	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.36 * 1030 * 1.00) =										-1120.7046		-1120.7046	(233)
Total delivered energy for all uses												6511.6289	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4814.0764	3.6300	174.7510 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2220.3199	3.6300	80.5976 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	522.9372	19.4400	101.6590 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1120.7046	19.4400	-217.8650 (252)
Total energy cost			248.7226 (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	4814.0764	0.2160	1039.8405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.3199	0.2160	479.5891 (264)
Space and water heating			1519.4296 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.9372	0.5190	271.4044 (268)
Energy saving/generation technologies			
PV Unit	-1120.7046	0.5190	-581.6457 (269)
Total kg/year			1248.1133 (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	4814.0764	1.2200	5873.1732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.3199	1.2200	2708.7903 (264)
Space and water heating			8581.9635 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	522.9372	3.0700	1605.4173 (268)
Energy saving/generation technologies			
PV Unit	-1120.7046	3.0700	-3440.5632 (269)
Primary energy kWh/year			6977.0676 (272)
Primary energy kWh/m2/year			47.1647 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
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
(none)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 28 -198 kg (15.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0		0.00 kg/m²

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

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
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	£116	£116	£0
Mains gas	£350	£350	£0
Space heating	£284	£284	£0
Water heating	£81	£81	£0
Lighting	£102	£102	£0
Generated (PV)	-£218	-£218	£0
Total cost of fuels	£248	£248	£0
Total cost of uses	£249	£249	£0
Delivered energy	44 kWh/m²	44 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	47 kWh/m²	47 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 23	Issued on Date	09/08/2022
Assessment Reference	As Built	Prop Type Ref	MhV
Project	16 Shaw Road, WEST END, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.23	TER	16.24
Environmental	89 B	% DER<TER	24.70		
CO ₂ Emissions (t/year)	1.25	DFEE	45.25	TREE	56.66
General Requirements Compliance	Pass	% DFEE<TFEE	20.13		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 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 0647 Plot 23	Issued on Date	09/08/2022
Assessment Reference	As Built	Prop Type Ref	MhV
Project	16 Shaw Road, WEST END, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.23	TER	16.24
Environmental	89 B	% DER<TER	24.70		
CO ₂ Emissions (t/year)	1.25	DFEE	45.25	TFEE	56.66
General Requirements Compliance	Pass	% DFEE<TFEE	20.13		

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 0647 Plot 23	Issued on Date	09/08/2022
Assessment Reference	As Built	Prop Type Ref	MhV
Project	16 Shaw Road, WEST END, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.23	TER	16.24
Environmental	89 B	% DER<TER	24.70		
CO ₂ Emissions (t/year)	1.25	DFEE	45.25	TFEE	56.66
General Requirements Compliance	Pass	% DFEE<TFEE	20.13		

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

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

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	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene,1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 23	Issued on Date	09/08/2022
Assessment Reference	As Built	Prop Type Ref	MhV
Property	16 Shaw Road, WEST END, SO30 3JZ		
SAP Rating	89 B	DER	12.23
Environmental	89 B	TER	16.24
CO ₂ Emissions (t/year)	1.25	% DER<TER	24.70
General Requirements Compliance	Pass	DfEE	45.25
		TFEE	56.66
		% DfEE<TFEE	20.13
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 Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	37.64 m	74.90 m ²	2.39 m
	1st Storey:	35.23 m	73.03 m ²	2.67 m

7.0 Living Area	21.28	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	165.39	kJ/m ² K

9.0 External Walls			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	184.02	158.27

9.1 Party Walls			U-Value	Kappa	Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00	

9.2 Internal Walls			Kappa	Area
Description	Construction		(kJ/m ² K)	(m ²)
GF Block	Dense block, plasterboard on dabs		75.00	84.67
GF Stud	Plasterboard on timber frame		9.00	31.48
FF Stud	Plasterboard on timber frame		9.00	171.95

10.0 External Roofs			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	74.90	74.90

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	73.03

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	74.90

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	73.03

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	East							2.12	
Front Shaded	Window	[1] Brick and Block	East	None	0.50	Yes				1.68	
Front Elevation	Window	[1] Brick and Block	East	None	0.00					6.34	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					4.20	
Rear Elevation	Window	[1] Brick and Block	West	None	0.00					11.41	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.89	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.00	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.58	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.77	0.056	No	Birtley Supatherm
Table K1 - Approved	E2 Other lintels (including other steel lintels)	2.40	0.300	No	
Independently assessed	E3 Sill	13.83	0.021	No	Knauf P5
Independently assessed	E4 Jamb	38.40	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	37.64	0.022	No	Knauf P10
Independently assessed	E6 Intermediate floor within a dwelling	35.23	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.31	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	3.27	0.240	No	
Independently assessed	E12 Gable (insulation at ceiling level)	22.44	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	34.69	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	14.49	-0.091	No	Knauf P24

Y-value	0.019	W/m²K
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18.0 Pressure Testing

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

As Built AP₅₀

4.14

m³/(h.m²) @ 50 Pa

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

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				5
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

28

Total number of L.E.L. fittings

28

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.	18445	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.4	
In Summer	88.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.36	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None