



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 1, Wheatear Road
Botley, Southampton, SO32 2TX

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 25/09/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 17			Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D		
Property	1, Wheatear Road, Botley, Southampton, SO32 2TX				
SAP Rating	87 B	DER	13.81	TER	17.99
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.87	DFEE	41.66	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	19.63		
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)	17.99	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.81	kgCO ₂ /m ²	Pass
	-4.18 (-23.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.84	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	41.66	kWh/m ² /yr	
	-10.1 (-19.5%)	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	0.11 (max. 0.25)	0.11 (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	4.92 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

4.36 m², No overhang

Windows facing South

5.03 m², No overhang

Windows facing West

6.73 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.92 (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	0.11	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.039	W/m ² K
Photovoltaic array	0.63	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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Assessment Reference	As Built	Prop Type Ref	Block D
Property	1, Wheatear Road, Botley, Southampton, SO32 2TX		
SAP Rating	87 B	DER	13.81
Environmental	89 B	TER	17.99
CO ₂ Emissions (t/year)	0.87	% DER<TER	23.25
General Requirements Compliance	Pass	DFEE	41.66
		TFEE	51.84
		% DFEE<TFEE	19.63
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	0.63	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	8.29	0.59	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	3.01	0.20	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	1.77	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	11.18	0.23	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	34.50	0.55	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	18.75	1.16	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.75	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	10.02	0.60	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	9.06	0.40	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	20.20	0.79	Knauf P23
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.062	10.10	0.63	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.77	1.40	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.77	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.77	0.31	Knauf P29 Halved

Total: **7.03** W/mK:
Y-Value: **0.039** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.87	DFEE	41.66	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	19.63		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 84 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.99 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.81 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (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: 4.92 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 4.36 m², No overhang
Windows facing South: 5.03 m², No overhang
Windows facing West: 6.73 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 0.11 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.039 W/m²K
Photovoltaic array 0.63 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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (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) =	0.1889 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.4349 (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) =		0.3697 (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	0.4713	0.4621	0.4528	0.4066	0.3974	0.3512	0.3512	0.3419	0.3697	0.3974	0.4159	0.4343 (22b)
Effective ac	0.6111	0.6068	0.6025	0.5827	0.5790	0.5617	0.5617	0.5585	0.5683	0.5790	0.5865	0.5943 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.9721		(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			18.0000	753.3000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15608.3908 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.4802 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0253 (36)
Total fabric heat loss						(33) + (36) =	54.9974 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7022	42.4008	42.1054	40.7178	40.4581	39.2496	39.2496	39.0258	39.7151	40.4581	40.9833	41.5324 (38)
Heat transfer coeff	97.6996	97.3982	97.1028	95.7152	95.4556	94.2470	94.2470	94.0232	94.7125	95.4556	95.9808	96.5298 (39)
Average = Sum(39)m / 12 =												95.7139 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1673	1.1637	1.1601	1.1436	1.1404	1.1260	1.1260	1.1233	1.1316	1.1404	1.1467	1.1533 (40)
HLP (average)												1.1435 (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												2.5293 (42)
Average daily hot water use (litres/day)												94.2715 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1483.2580 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395	(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	27.5590	24.8892	27.5298	26.6122	27.4778	26.5667	27.4368	27.4634	26.5915	27.5083	26.6552	(61)
Total heat required for water heating calculated for each month												
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(64)
Heat gains from water heating, kWh/month												
58.0223	50.9432	53.0304	46.8859	45.4739	39.9543	37.7283	42.2886	42.4937	48.6519	52.2643	56.4069	(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	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.4690	18.1804	14.7853	11.1934	8.3672	7.0640	7.6329	9.9215	13.3166	16.9085	19.7347	21.0379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.9994	229.3550	223.4191	210.7823	194.8306	179.8382	169.8224	167.4668	173.4027	186.0396	201.9913	216.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	77.9870	75.8083	71.2774	65.1194	61.1208	55.4921	50.7101	56.8395	59.0190	65.3923	72.5892	75.8157	(72)
Total internal gains	389.3953	387.2836	373.4217	351.0350	328.2585	306.3342	292.1052	298.1677	309.6782	332.2802	358.2551	377.7772	(73)

6. Solar gains

[Jan]													Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East													4.3600	19.6403	0.6300	0.7000	0.7700	26.1701 (76)
South													5.0300	46.7521	0.6300	0.7000	0.7700	71.8688 (78)
West													6.7300	19.6403	0.6300	0.7000	0.7700	40.3956 (80)
Solar gains	138.4346	247.9193	364.3806	482.2161	559.8829	562.3127	539.5965	482.1273	406.0342	281.4664	168.1887	116.8417	(83)					
Total gains	527.8299	635.2029	737.8023	833.2511	888.1414	868.6469	831.7017	780.2950	715.7124	613.7466	526.4438	494.6189	(84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.3775	44.5148	44.6503	45.2976	45.4208	46.0032	46.0032	46.1127	45.7771	45.4208	45.1722	44.9153
alpha	3.9585	3.9677	3.9767	4.0198	4.0281	4.0669	4.0669	4.0742	4.0518	4.0281	4.0115	3.9944
util living area	0.9922	0.9833	0.9620	0.9076	0.8009	0.6372	0.4834	0.5308	0.7640	0.9396	0.9853	0.9939 (86)
MIT	19.4506	19.6794	20.0219	20.4349	20.7518	20.9299	20.9822	20.9741	20.8496	20.4145	19.8542	19.4145 (87)
Th 2	19.9463	19.9492	19.9520	19.9654	19.9679	19.9796	19.9796	19.9818	19.9751	19.9679	19.9629	19.9576 (88)
util rest of house	0.9902	0.9791	0.9523	0.8838	0.7512	0.5546	0.3782	0.4235	0.6908	0.9189	0.9810	0.9924 (89)
MIT 2	18.5394	18.7681	19.1065	19.5117	19.7962	19.9440	19.9740	19.9729	19.8876	19.5032	18.9537	18.5121 (90)
Living area fraction	18.7035	18.9323	19.2714	19.6780	19.9684	20.1216	20.1556	20.1533	20.0609	19.6674	19.1160	18.6747 (92)
MIT	18.7035	18.9323	19.2714	19.6780	19.9684	20.1216	20.1556	20.1533	20.0609	19.6674	19.1160	18.6747 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7035	18.9323	19.2714	19.6780	19.9684	20.1216	20.1556	20.1533	20.0609	19.6674	19.1160	18.6747 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9870	0.9738	0.9444	0.8761	0.7513	0.5668	0.3969	0.4423	0.6976	0.9114	0.9761	0.9897	(94)
Useful gains	520.9768	618.5719	696.8135	729.9982	667.2304	492.3316	330.0963	345.1313	499.2759	559.3887	513.8859	489.5433	(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	1407.2192	1366.7176	1240.1408	1031.6222	789.2653	520.3932	335.1087	352.8941	564.5756	865.5359	1153.3032	1397.2398	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	659.3643	502.7539	404.2355	217.1693	90.7939	0.0000	0.0000	0.0000	0.0000	227.7735	460.3804	675.3262	(98)
Space heating												3237.7971	(98)
Space heating per m2												(98) / (4) =	38.6834 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3569.7873	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	659.3643	502.7539	404.2355	217.1693	90.7939	0.0000	0.0000	0.0000	0.0000	227.7735	460.3804	675.3262	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	726.9728	554.3042	445.6841	239.4369	100.1036	0.0000	0.0000	0.0000	0.0000	251.1284	507.5859	744.5714	(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	181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(64)	
Efficiency of water heater (217)m	90.0811	90.0098	89.8655	89.5457	88.9639	87.9000	87.9000	87.9000	87.9000	89.5531	89.9481	90.1053	(216)	
Fuel for water heating, kWh/month	201.3088	177.0785	185.0771	164.8469	161.3927	144.2038	136.8330	152.4436	152.8992	171.0123	182.1044	195.8604	(219)	
Water heating fuel used												2025.0608	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3569.7873	(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)													361.4894	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.63 * 1068 * 1.00) =													-538.3075	(233)
Total delivered energy for all uses													5493.0300	(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	3569.7873	0.2160	771.0741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2025.0608	0.2160	437.4131	(264)
Space and water heating			1208.4872	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.4894	0.5190	187.6130	(268)
Energy saving/generation technologies				
PV Unit	-538.3075	0.5190	-279.3816	(269)
Total CO2, kg/year			1155.6436	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8100	(273)

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

DER			13.8100	ZC1
Total Floor Area		TFA	83.7000	
Assumed number of occupants		N	2.5293	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.0711	ZC2
CO2 emissions from cooking, equation (L16)			2.1470	ZC3
Total CO2 emissions			32.0281	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			32.0281	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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1417 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3917 (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) =							0.3329 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	0.4245	0.4161	0.4078	0.3662	0.3579	0.3163	0.3163	0.3079	0.3329	0.3579	0.3745	0.3912	(22b)				
Effective ac	0.5901	0.5866	0.5832	0.5671	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			16.1200	1.3258	21.3712			(27)					
Ground Floor			41.8500	0.1300	5.4405			(28a)					
Brick and Block	43.8800	11.0900	32.7900	0.1800	5.9022			(29a)					
Tile Clad	51.0000	7.1500	43.8500	0.1800	7.8930			(29a)					
Pitched Roof	41.8500		41.8500	0.1300	5.4405			(30)					
Total net area of external elements Aum(A, m2)			178.5800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			48.5914		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								11.2918 (36)					
Total fabric heat loss						(33) + (36) =	59.8832	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.2360	Feb 40.9916	Mar 40.7519	Apr 39.6265	May 39.4159	Jun 38.4356	Jul 38.4356	Aug 38.2541	Sep 38.8132	Oct 39.4159	Nov 39.8419	Dec 40.2872	(38)
Heat transfer coeff	101.1192	100.8748	100.6351	99.5097	99.2991	98.3188	98.3188	98.1373	98.6964	99.2991	99.7251	100.1704	(39)
Average = Sum(39)m / 12 =												99.5087	(39)
HLP	Jan 1.2081	Feb 1.2052	Mar 1.2023	Apr 1.1889	May 1.1864	Jun 1.1747	Jul 1.1747	Aug 1.1725	Sep 1.1792	Oct 1.1864	Nov 1.1915	Dec 1.1968	(40)
HLP (average)												1.1889	(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												2.5293 (42)
Average daily hot water use (litres/day)												94.2715 (43)
Daily hot water use	Jan 103.6987	Feb 99.9278	Mar 96.1569	Apr 92.3861	May 88.6152	Jun 84.8444	Jul 84.8444	Aug 88.6152	Sep 92.3861	Oct 96.1569	Nov 99.9278	Dec 103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)
Energy content (annual)										Total = Sum(45)m =		1483.2580 (45)
Distribution loss (46)m = 0.15 x (45)m	23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	45.9942	49.0005	45.5603	45.1573	41.8411	43.2358	45.1573	45.5603	49.0005	49.2795	50.9589	(61)
Total heat required for water heating calculated for each month	204.7410	180.4930	187.7913	166.5614	161.2608	142.0295	136.0751	151.6918	153.3671	174.6390	186.4237	199.8887	(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	204.7410	180.4930	187.7913	166.5614	161.2608	142.0295	136.0751	151.6918	153.3671	174.6390	186.4237	199.8887	(64)
Heat gains from water heating, kWh/month	63.8723	56.2194	58.3981	51.6229	49.8937	43.7729	41.6780	46.7121	47.2358	54.0249	57.9203	62.2589	(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	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.4690	18.1804	14.7853	11.1934	8.3672	7.0640	7.6329	9.9215	13.3166	16.9085	19.7347	21.0379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.9994	229.3550	223.4191	210.7823	194.8306	179.8382	169.8224	167.4668	173.4027	186.0396	201.9913	216.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	85.8498	83.6598	78.4920	71.6985	67.0615	60.7957	56.0188	62.7850	65.6053	72.6142	80.4449	83.6813	(72)
Total internal gains	397.2582	395.1351	380.6363	357.6141	334.1992	311.6378	297.4140	304.1132	316.2646	339.5021	366.1107	385.6427	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East					4.3600	19.6403	0.6300	0.7000	0.7700		26.1701 (76)		
South					5.0300	46.7521	0.6300	0.7000	0.7700		71.8688 (78)		
West					6.7300	19.6403	0.6300	0.7000	0.7700		40.3956 (80)		
Solar gains	138.4346	247.9193	364.3806	482.2161	559.8829	562.3127	539.5965	482.1273	406.0342	281.4664	168.1887	116.8417	(83)
Total gains	535.6928	643.0544	745.0169	839.8303	894.0821	873.9505	837.0105	786.2406	722.2988	620.9685	534.2995	502.4844	(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	57.4816	57.6210	57.7581	58.4114	58.5353	59.1189	59.1189	59.2282	58.8927	58.5353	58.2852	58.0261	
alpha	4.8321	4.8414	4.8505	4.8941	4.9024	4.9413	4.9413	4.9485	4.9262	4.9024	4.8857	4.8684	
util living area	0.9973	0.9932	0.9809	0.9411	0.8437	0.6736	0.5071	0.5579	0.8059	0.9653	0.9941	0.9980	(86)
MIT	19.7182	19.9053	20.1903	20.5390	20.8115	20.9548	20.9909	20.9857	20.8896	20.5171	20.0478	19.6856	(87)
Th 2	19.9135	19.9158	19.9181	19.9289	19.9309	19.9403	19.9403	19.9421	19.9367	19.9309	19.9268	19.9226	(88)
util rest of house	0.9964	0.9908	0.9742	0.9201	0.7913	0.5805	0.3900	0.4377	0.7258	0.9488	0.9918	0.9974	(89)
MIT 2	18.2141	18.4880	18.9014	19.3990	19.7515	19.9113	19.9371	19.9364	19.8520	19.3801	18.7047	18.1728	(90)
Living area fraction	18.4851	18.7434	19.1336	19.6044	19.9425	20.0993	20.1270	20.1255	20.0389	19.5850	18.9467	18.4454	(92)
Temperature adjustment	18.4851	18.7434	19.1336	19.6044	19.9425	20.0993	20.1270	20.1255	20.0389	19.5850	18.9467	18.4454	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	532.8066	634.8418	720.8740	766.1729	708.0270	520.2841	344.1421	361.1375	530.5311	584.7633	528.1793	500.4579	(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	1434.3827	1396.4466	1271.3863	1065.1898	818.4736	540.6813	346.7666	365.6082	586.1501	892.1987	1181.4144	1426.9676	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	670.7726	511.7984	409.5811	215.2922	82.1722	0.0000	0.0000	0.0000	0.0000	228.7319	470.3293	689.3232	(98)
Space heating												3278.0010	(98)
Space heating per m2												39.1637	(99)

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													3509.6370 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	670.7726	511.7984	409.5811	215.2922	82.1722	0.0000	0.0000	0.0000	0.0000	228.7319	470.3293	689.3232	(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)	718.1720	547.9641	438.5237	230.5055	87.9788	0.0000	0.0000	0.0000	0.0000	244.8950	503.5645	738.0334	(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	204.7410	180.4930	187.7913	166.5614	161.2608	142.0295	136.0751	151.6918	153.3671	174.6390	186.4237	199.8887	(64)
Efficiency of water heater (217)m	87.8170	87.5297	86.9615	85.6983	83.4471	80.3000	80.3000	80.3000	80.3000	85.7314	87.2837	87.9143	(216)
Fuel for water heating, kWh/month	233.1451	206.2078	215.9475	194.3579	193.2492	176.8736	169.4584	188.9064	190.9927	203.7048	213.5836	227.3676	(219)
Water heating fuel used												2413.7946	(219)
Annual totals kWh/year													
Space heating fuel - main system												3509.6370	(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)												361.4894	(232)
Total delivered energy for all uses												6359.9211	(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	3509.6370	0.2160	758.0816 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2413.7946	0.2160	521.3796 (264)
Space and water heating			1279.4612 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	361.4894	0.5190	187.6130 (268)
Total CO2, kg/m2/year			1505.9992 (272)
Emissions per m2 for space and water heating			15.2863 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2415 (272b)
Emissions per m2 for pumps and fans			0.4651 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2863 * 1.00) + 2.2415 + 0.4651, rounded to 2 d.p.			17.9900 (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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1417 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.3877 (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) =	0.3295 (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	0.4201	0.4119	0.4037	0.3625	0.3542	0.3130	0.3130	0.3048	0.3295	0.3542	0.3707	0.3872 (22b)
Effective ac	0.5883	0.5848	0.5815	0.5657	0.5627	0.5490	0.5490	0.5465	0.5543	0.5627	0.5687	0.5750 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.9721		(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			9.0000	376.6500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15231.7408 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 181.9802 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0253 (36)
Total fabric heat loss (33) + (36) = 54.9974 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1081	40.8686	40.6338	39.5312	39.3249	38.3646	38.3646	38.1868	38.7345	39.3249	39.7423	40.1786 (38)
Heat transfer coeff	96.1055	95.8660	95.6313	94.5287	94.3224	93.3620	93.3620	93.1842	93.7319	94.3224	94.7397	95.1760 (39)
Average = Sum(39)m / 12 =												94.5277 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1482	1.1454	1.1425	1.1294	1.1269	1.1154	1.1154	1.1133	1.1199	1.1269	1.1319	1.1371 (40)
HLP (average)												1.1294 (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 2.5293 (42)
Average daily hot water use (litres/day) 94.2715 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

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Energy content (annual)	Total = Sum(45)m = 1483.2580 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.6787	28.5810	29.4930	25.7127	24.6720	21.2900	19.7284	22.6386	22.9090	26.6982	29.1432	31.6476 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.4690	18.1804	14.7853	11.1934	8.3672	7.0640	7.6329	9.9215	13.3166	16.9085	19.7347	21.0379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.9994	229.3550	223.4191	210.7823	194.8306	179.8382	169.8224	167.4668	173.4027	186.0396	201.9913	216.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	43.9230	42.5313	39.6412	35.7121	33.1613	29.5695	26.5166	30.4282	31.8180	35.8847	40.4766	42.5371	(72)
Total internal gains	352.3314	351.0066	338.7855	318.6277	297.2990	277.4116	264.9118	268.7564	279.4772	299.7726	323.1424	341.4985	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.3600	19.6403	0.6300	0.7000	0.7700		26.1701 (76)	
South					5.0300	46.7521	0.6300	0.7000	0.7700		71.8688 (78)	
West					6.7300	19.6403	0.6300	0.7000	0.7700		40.3956 (80)	

Solar gains	138.4346	247.9193	364.3806	482.2161	559.8829	562.3127	539.5965	482.1273	406.0342	281.4664	168.1887	116.8417 (83)
Total gains	490.7659	598.9259	703.1661	800.8439	857.1819	839.7243	804.5083	750.8837	685.5115	581.2390	491.3312	458.3402 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.0249	44.1349	44.2433	44.7593	44.8572	45.3186	45.3186	45.4051	45.1398	44.8572	44.6596	44.4549	
alpha	3.9350	3.9423	3.9496	3.9840	3.9905	4.0212	4.0212	4.0270	4.0093	3.9905	3.9773	3.9637	
util living area	0.9934	0.9852	0.9651	0.9128	0.8087	0.6478	0.4933	0.5436	0.7764	0.9455	0.9875	0.9949	(86)
MIT	19.4019	19.6356	19.9861	20.4070	20.7356	20.9228	20.9799	20.9705	20.8352	20.3800	19.8060	19.3612	(87)
Th 2	19.9617	19.9640	19.9662	19.9769	19.9789	19.9882	19.9882	19.9900	19.9847	19.9789	19.9749	19.9706	(88)
util rest of house	0.9918	0.9815	0.9562	0.8904	0.7607	0.5659	0.3876	0.4358	0.7055	0.9268	0.9838	0.9937	(89)
MIT 2	18.5052	18.7386	19.0849	19.4971	19.7938	19.9482	19.9817	19.9795	19.8868	19.4817	18.9177	18.4715	(90)
Living area fraction	18.6667	18.9002	19.2473	19.6610	19.9635	20.1238	20.1615	20.1580	20.0577	19.6436	19.0778	18.6318	(91)
MIT	18.6667	18.9002	19.2473	19.6610	19.9635	20.1238	20.1615	20.1580	20.0577	19.6436	19.0778	18.6318	(92)
Temperature adjustment	18.6667	18.9002	19.2473	19.6610	19.9635	20.1238	20.1615	20.1580	20.0577	19.6436	19.0778	18.6318	(93)
adjusted MIT	18.6667	18.9002	19.2473	19.6610	19.9635	20.1238	20.1615	20.1580	20.0577	19.6436	19.0778	18.6318	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	485.3327	584.8874	666.9176	706.5055	651.3935	485.0412	326.8592	341.3382	487.5483	534.2430	481.1949	454.3827	(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	1380.7217	1342.1460	1219.0402	1017.2263	779.4313	515.7090	332.5132	350.1895	558.4258	853.0115	1134.7699	1373.5627	(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	666.1694	508.8778	410.7793	223.7190	95.2602	0.0000	0.0000	0.0000	0.0000	237.1638	470.5740	683.8699	(98)
Space heating												3296.4132	(98)
Space heating per m2												39.3837	(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	877.6031	690.8790	708.1998	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8732	0.9243	0.9048	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	766.3530	638.5511	640.7677	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1076.1851	1033.0540	971.9996	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	223.0791	293.5102	246.4366	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												763.0259 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	55.7698	73.3776	61.6091	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												190.7565 (107)
Space cooling per m2												2.2790 (108)
Energy for space heating												39.3837 (99)
Energy for space cooling												2.2790 (108)
Total												41.6627 (109)
Dwelling Fabric Energy Efficiency (DFEE)												41.7 (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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1417 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3917 (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) =	0.3329 (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	0.4245	0.4161	0.4078	0.3662	0.3579	0.3163	0.3163	0.3079	0.3329	0.3579	0.3745	0.3912 (22b)
Effective ac	0.5901	0.5866	0.5832	0.5671	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			16.1200	1.3258	21.3712		(27)
Ground Floor			41.8500	0.1300	5.4405		(28a)
Brick and Block	43.8800	11.0900	32.7900	0.1800	5.9022		(29a)
Tile Clad	51.0000	7.1500	43.8500	0.1800	7.8930		(29a)
Pitched Roof	41.8500		41.8500	0.1300	5.4405		(30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5914		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2918 (36)
Total fabric heat loss						(33) + (36) =	59.8832 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.2360	40.9916	40.7519	39.6265	39.4159	38.4356	38.4356	38.2541	38.8132	39.4159	39.8419	40.2872 (38)
Heat transfer coeff	101.1192	100.8748	100.6351	99.5097	99.2991	98.3188	98.3188	98.1373	98.6964	99.2991	99.7251	100.1704 (39)
Average = Sum(39)m / 12 =												99.5087 (39)
HLP	1.2081	1.2052	1.2023	1.1889	1.1864	1.1747	1.1747	1.1725	1.1792	1.1864	1.1915	1.1968 (40)
HLP (average)												1.1889 (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												2.5293 (42)
Average daily hot water use (litres/day)												94.2715 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy content (annual)	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)
Distribution loss (46)m = 0.15 x (45)m												1483.2580 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.6787	28.5810	29.4930	25.7127	24.6720	21.2900	19.7284	22.6386	22.9090	26.6982	29.1432	31.6476 (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	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	126.4663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.4690	18.1804	14.7853	11.1934	8.3672	7.0640	7.6329	9.9215	13.3166	16.9085	19.7347	21.0379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.9994	229.3550	223.4191	210.7823	194.8306	179.8382	169.8224	167.4668	173.4027	186.0396	201.9913	216.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	35.6466	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	43.9230	42.5313	39.6412	35.7121	33.1613	29.5695	26.5166	30.4282	31.8180	35.8847	40.4766	42.5371	(72)
Total internal gains	352.3314	351.0066	338.7855	318.6277	297.2990	277.4116	264.9118	268.7564	279.4772	299.7726	323.1424	341.4985	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					4.3600	19.6403	0.6300	0.7000	0.7700	26.1701 (76)			
South					5.0300	46.7521	0.6300	0.7000	0.7700	71.8688 (78)			
West					6.7300	19.6403	0.6300	0.7000	0.7700	40.3956 (80)			

Solar gains	138.4346	247.9193	364.3806	482.2161	559.8829	562.3127	539.5965	482.1273	406.0342	281.4664	168.1887	116.8417	(83)
Total gains	490.7659	598.9259	703.1661	800.8439	857.1819	839.7243	804.5083	750.8837	685.5115	581.2390	491.3312	458.3402	(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	57.4816	57.6210	57.7581	58.4114	58.5353	59.1189	59.1189	59.2282	58.8927	58.5353	58.2852	58.0261	
alpha	4.8321	4.8414	4.8505	4.8941	4.9024	4.9413	4.9413	4.9485	4.9262	4.9024	4.8857	4.8684	
util living area	0.9982	0.9949	0.9848	0.9500	0.8600	0.6943	0.5258	0.5809	0.8285	0.9730	0.9959	0.9987	(86)
MIT	19.6690	19.8578	20.1478	20.5061	20.7923	20.9484	20.9893	20.9830	20.8738	20.4792	20.0012	19.6370	(87)
Th 2	19.9135	19.9158	19.9181	19.9289	19.9309	19.9403	19.9403	19.9421	19.9367	19.9309	19.9268	19.9226	(88)
util rest of house	0.9976	0.9932	0.9793	0.9315	0.8102	0.6007	0.4053	0.4574	0.7518	0.9595	0.9942	0.9983	(89)
MIT 2	18.7041	18.8940	19.1827	19.5373	19.7940	19.9173	19.9377	19.9374	19.8690	19.5198	19.0463	18.6794	(90)
Living area fraction	18.8779	19.0676	19.3565	19.7118	19.9739	20.1031	20.1272	20.1258	20.0500	19.6927	19.2184	18.8519	(92)
MIT	18.8779	19.0676	19.3565	19.7118	19.9739	20.1031	20.1272	20.1258	20.0500	19.6927	19.2184	18.8519	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.8779	19.0676	19.3565	19.7118	19.9739	20.1031	20.1272	20.1258	20.0500	19.6927	19.2184	18.8519	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9967	0.9913	0.9756	0.9269	0.8125	0.6161	0.4272	0.4797	0.7612	0.9556	0.9927	0.9976	(94)
Useful gains	489.1528	593.7310	686.0087	742.2998	696.4523	517.3888	343.6825	360.2339	521.8020	555.4218	487.7234	457.2479	(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	1474.1104	1429.1561	1293.8206	1075.8803	821.5873	541.0565	346.7886	365.6382	587.2443	902.8920	1208.5051	1467.6886	(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	732.8084	561.4057	452.2121	240.1779	93.1005	0.0000	0.0000	0.0000	0.0000	258.5179	518.9629	751.7678	(98)
Space heating												3608.9532	(98)
Space heating per m2												43.1177	(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	924.1970	727.5593	745.8435	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8882	0.9403	0.9209	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	820.8651	684.0885	686.8370	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1076.1851	1033.0540	971.9996	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	183.8304	259.6304	212.1610	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												655.6218 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	45.9576	64.9076	53.0403	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												163.9055 (107)
Space cooling per m2												1.9582 (108)
Energy for space heating												43.1177 (99)
Energy for space cooling												1.9582 (108)
Total												45.0760 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1889 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.4349 (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) =		0.3697 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3881	0.3604	0.3697	0.3512	0.3512	0.3419	0.3327	0.3235	0.3142	0.3419	0.3235	0.3419 (22b)
Effective ac	0.5753	0.5650	0.5683	0.5617	0.5617	0.5585	0.5553	0.5523	0.5494	0.5585	0.5523	0.5585 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	47.9721			(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			18.0000	753.3000 (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) = 15608.3908 (34)
186.4802 (35)
7.0253 (36)
(33) + (36) = 54.9974 (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	40.2045	39.4794	39.7151	39.2496	39.2496	39.0258	38.8079	38.5961	38.3902	39.0258	38.5961	39.0258 (38)
Heat transfer coeff	95.2019	94.4768	94.7125	94.2470	94.2470	94.0232	93.8054	93.5935	93.3876	94.0232	93.5935	94.0232 (39)
Average = Sum(39)m / 12 =												94.1112 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1374	1.1288	1.1316	1.1260	1.1260	1.1233	1.1207	1.1182	1.1157	1.1233	1.1182	1.1233 (40)
HLP (average)												1.1244 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5293 (42)
94.2715 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1483.2580 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395	(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	27.5590	24.8892	27.5298	26.6122	27.4778	26.5667	27.4368	27.4634	26.5915	27.5083	26.6552	27.5509 (61)
Total heat required for water heating calculated for each month												
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
58.0223	50.9432	53.0304	46.8859	45.4739	39.9543	37.7283	42.2886	42.4937	48.6519	52.2643	56.4069	(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	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	51.1726	45.4510	36.9633	27.9836	20.9180	17.6599	19.0821	24.8037	33.2914	42.2711	49.3367	52.5948 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	338.8051	342.3209	333.4613	314.6004	290.7919	268.4152	253.4663	249.9505	258.8101	277.6710	301.4795	323.8562 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731 (71)
Water heating gains (Table 5)												
	77.9870	75.8083	71.2774	65.1194	61.1208	55.4921	50.7101	56.8395	59.0190	65.3923	72.5892	75.8157 (72)
Total internal gains												
	574.2565	569.8720	547.9938	513.9952	479.1225	447.8591	429.5503	437.8855	457.4123	491.6263	529.6972	558.5585 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East					4.3600	25.1925	0.6300	0.7000			0.7700			33.5684 (76)
South					5.0300	56.7559	0.6300	0.7000			0.7700			87.2470 (78)
West					6.7300	25.1925	0.6300	0.7000			0.7700			51.8154 (80)
Solar gains	172.6308	263.2623	390.4914	521.0143	576.2285	629.4008	598.9212	547.2648	459.8992	322.5799	209.0816			143.2116 (83)
Total gains	746.8873	833.1343	938.4852	1035.0095	1055.3511	1077.2599	1028.4715	985.1503	917.3115	814.2062	738.7789			701.7701 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.5418	45.8913	45.7771	46.0032	46.0032	46.1127	46.2198	46.3244	46.4265	46.1127	46.3244	46.1127
alpha	4.0361	4.0594	4.0518	4.0669	4.0669	4.0742	4.0813	4.0883	4.0951	4.0742	4.0883	4.0742
util living area	0.9711	0.9554	0.9127	0.8207	0.6799	0.4825	0.3523	0.3665	0.5997	0.8420	0.9458	0.9756 (86)
MIT	19.8630	20.0303	20.3382	20.6691	20.8820	20.9772	20.9951	20.9944	20.9459	20.6934	20.2542	19.8420 (87)
Th 2	19.9704	19.9774	19.9751	19.9796	19.9796	19.9818	19.9839	19.9860	19.9880	19.9818	19.9860	19.9818 (88)
util rest of house	0.9643	0.9454	0.8934	0.7834	0.6186	0.4023	0.2622	0.2732	0.5178	0.7993	0.9314	0.9698 (89)
MIT 2	18.9643	19.1322	19.4246	19.7300	19.9061	19.9721	19.9827	19.9846	19.9613	19.7613	19.3593	18.9533 (90)
Living area fraction	fLA = Living area / (4) = 0.1802 (91)											
MIT	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9573	0.9372	0.8850	0.7802	0.6251	0.4161	0.2785	0.2900	0.5306	0.7968	0.9233	0.9634	(94)
Useful gains	714.9693	780.8028	830.5385	807.4872	659.7185	448.2661	286.3819	285.6900	486.7251	648.7474	682.1059	676.0880	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1354.3596	1322.1112	1192.3574	980.0923	714.5734	456.3141	287.5244	287.0065	507.9080	801.9446	1087.6057	1326.9874	(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	475.7064	363.7593	269.1932	124.2757	40.8120	0.0000	0.0000	0.0000	0.0000	113.9787	291.9599	484.2691	(98)
Space heating													2163.9544
RHI space heating demand													2164

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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (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) = 0.1889 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.4349 (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)	=	0.3697 (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	0.4713	0.4621	0.4528	0.4066	0.3974	0.3512	0.3512	0.3419	0.3697	0.3974	0.4159	0.4343 (22b)
Effective ac	0.6111	0.6068	0.6025	0.5827	0.5790	0.5617	0.5617	0.5585	0.5683	0.5790	0.5865	0.5943 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.9721		(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			18.0000	753.3000 (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) = 15608.3908 (34)
186.4802 (35)
7.0253 (36)
(33) + (36) = 54.9974 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7022	42.4008	42.1054	40.7178	40.4581	39.2496	39.2496	39.0258	39.7151	40.4581	40.9833	41.5324 (38)
Heat transfer coeff	97.6996	97.3982	97.1028	95.7152	95.4556	94.2470	94.2470	94.0232	94.7125	95.4556	95.9808	96.5298 (39)
Average = Sum(39)m / 12 =												95.7139 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1673	1.1637	1.1601	1.1436	1.1404	1.1260	1.1260	1.1233	1.1316	1.1404	1.1467	1.1533 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5293 (42)
94.2715 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1483.2580 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395 (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	27.5590	24.8892	27.5298	26.6122	27.4778	26.5667	27.4368	27.4634	26.5915	27.5083	26.6552 (61)
Total heat required for water heating calculated for each month											
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807 (64)
Heat gains from water heating, kWh/month											
58.0223	50.9432	53.0304	46.8859	45.4739	39.9543	37.7283	42.2886	42.4937	48.6519	52.2643	56.4069 (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	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.1726	45.4510	36.9633	27.9836	20.9180	17.6599	19.0821	24.8037	33.2914	42.2711	49.3367	52.5948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	338.8051	342.3209	333.4613	314.6004	290.7919	268.4152	253.4663	249.9505	258.8101	277.6710	301.4795	323.8562	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	77.9870	75.8083	71.2774	65.1194	61.1208	55.4921	50.7101	56.8395	59.0190	65.3923	72.5892	75.8157	(72)
Total internal gains	574.2565	569.8720	547.9938	513.9952	479.1225	447.8591	429.5503	437.8855	457.4123	491.6263	529.6972	558.5585	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.3600	19.6403	0.6300	0.7000	0.7700	26.1701 (76)			
South				5.0300	46.7521	0.6300	0.7000	0.7700	71.8688 (78)			
West				6.7300	19.6403	0.6300	0.7000	0.7700	40.3956 (80)			
Solar gains	138.4346	247.9193	364.3806	482.2161	559.8829	562.3127	539.5965	482.1273	406.0342	281.4664	168.1887	116.8417 (83)
Total gains	712.6911	817.7913	912.3744	996.2113	1039.0054	1010.1718	969.1468	920.0128	863.4466	773.0927	697.8860	675.4002 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.3775	44.5148	44.6503	45.2976	45.4208	46.0032	46.0032	46.1127	45.7771	45.4208	45.1722	44.9153
alpha	3.9585	3.9677	3.9767	4.0198	4.0281	4.0669	4.0669	4.0742	4.0518	4.0281	4.0115	3.9944
util living area	0.9784	0.9624	0.9291	0.8561	0.7337	0.5652	0.4200	0.4583	0.6781	0.8871	0.9631	0.9821 (86)
MIT	19.6934	19.9067	20.2151	20.5708	20.8235	20.9545	20.9892	20.9847	20.9040	20.5681	20.0698	19.6554 (87)
Th 2	19.9463	19.9492	19.9520	19.9654	19.9679	19.9796	19.9796	19.9818	19.9751	19.9679	19.9629	19.9576 (88)
util rest of house	0.9734	0.9538	0.9131	0.8245	0.6791	0.4863	0.3263	0.3622	0.6011	0.8548	0.9532	0.9779 (89)
MIT 2	18.7786	18.9893	19.2892	19.6311	19.8502	19.9574	19.9764	19.9768	19.9224	19.6395	19.1629	18.7501 (90)
Living area fraction	18.9434	19.1546	19.4560	19.8004	20.0255	20.1370	20.1589	20.1584	20.0992	19.8068	19.3263	18.9132 (91)
MIT	18.9434	19.1546	19.4560	19.8004	20.0255	20.1370	20.1589	20.1584	20.0992	19.8068	19.3263	18.9132 (92)
Temperature adjustment	18.9434	19.1546	19.4560	19.8004	20.0255	20.1370	20.1589	20.1584	20.0992	19.8068	19.3263	18.9132 (93)
adjusted MIT	18.9434	19.1546	19.4560	19.8004	20.0255	20.1370	20.1589	20.1584	20.0992	19.8068	19.3263	18.9132 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9672	0.9458	0.9040	0.8189	0.6823	0.4990	0.3431	0.3793	0.6111	0.8489	0.9456	0.9724	(94)
Useful gains	689.2794	773.4358	824.8049	815.7512	708.9586	504.0309	332.4667	348.9264	527.6518	656.2782	659.9064	656.7536	(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	1430.6529	1388.3727	1258.0637	1043.3372	794.7201	521.8477	335.4114	353.3735	568.2024	878.8417	1173.4858	1420.2642	(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	551.5818	413.2376	322.3446	163.8619	63.8065	0.0000	0.0000	0.0000	0.0000	165.5872	369.7771	568.0518	(98)
Space heating												2618.2487	(98)
Space heating per m2												31.2813	(99)
												(98) / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2886.7130	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	551.5818	413.2376	322.3446	163.8619	63.8065	0.0000	0.0000	0.0000	0.0000	165.5872	369.7771	568.0518	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	608.1387	455.6093	355.3965	180.6637	70.3490	0.0000	0.0000	0.0000	0.0000	182.5659	407.6925	626.2975	(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	181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(64)	
Efficiency of water heater	89.9907	89.9029	89.7272	89.3511	88.7429	87.9000	87.9000	87.9000	87.9000	89.3327	89.8217	90.0203	(216)	
Fuel for water heating, kWh/month	201.5109	177.2891	185.3625	165.2059	161.7947	144.2038	136.8330	152.4436	152.8992	171.4342	182.3607	196.0455	(219)	
Annual totals kWh/year												2027.3832	(219)	
Space heating fuel - main system												2886.7130	(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)													361.4894	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.63 * 1068 * 1.00) =										-538.3075			-538.3075	(233)
Total delivered energy for all uses													4812.2781	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2886.7130	3.4800	100.4576 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2027.3832	3.4800	70.5529 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	361.4894	13.1900	47.6805 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-538.3075	13.1900	-71.0028 (252)
Total energy cost			277.5807 (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] =	0.9059 (257)
SAP value		87.3633
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2886.7130	0.2160	623.5300 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2027.3832	0.2160	437.9148 (264)
Space and water heating			1061.4448 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	361.4894	0.5190	187.6130 (268)
Energy saving/generation technologies			
PV Unit	-538.3075	0.5190	-279.3816 (269)
Total kg/year			1008.6012 (272)
CO2 emissions per m2			12.0500 (273)
EI value			89.4986
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8904 = 3.908$, stars = 4
Water heating environmental impact	$0.216 / 0.8904 = 0.2426$, 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	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1889 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.4349 (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) =		0.3697 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3881	0.3604	0.3697	0.3512	0.3512	0.3419	0.3327	0.3235	0.3142	0.3419	0.3235	0.3419 (22b)
Effective ac	0.5753	0.5650	0.5683	0.5617	0.5617	0.5585	0.5553	0.5523	0.5494	0.5585	0.5523	0.5585 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	47.9721			(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			18.0000	753.3000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15608.3908			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				186.4802			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.0253			(36)
Total fabric heat loss			(33) + (36) =	54.9974			(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	40.2045	39.4794	39.7151	39.2496	39.2496	39.0258	38.8079	38.5961	38.3902	39.0258	38.5961	39.0258 (38)
Heat transfer coeff	95.2019	94.4768	94.7125	94.2470	94.2470	94.0232	93.8054	93.5935	93.3876	94.0232	93.5935	94.0232 (39)
Average = Sum(39)m / 12 =												94.1112 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1374	1.1288	1.1316	1.1260	1.1260	1.1233	1.1207	1.1182	1.1157	1.1233	1.1182	1.1233 (40)
HLP (average)												1.1244 (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												2.5293 (42)
Average daily hot water use (litres/day)												94.2715 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m = 1483.2580 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395	(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	27.5590	24.8892	27.5298	26.6122	27.4778	26.5667	27.4368	27.4634	26.5915	27.5083	26.6552	(61)
Total heat required for water heating calculated for each month												
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(64)
Heat gains from water heating, kWh/month												
58.0223	50.9432	53.0304	46.8859	45.4739	39.9543	37.7283	42.2886	42.4937	48.6519	52.2643	56.4069	(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	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.1726	45.4510	36.9633	27.9836	20.9180	17.6599	19.0821	24.8037	33.2914	42.2711	49.3367	52.5948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	338.8051	342.3209	333.4613	314.6004	290.7919	268.4152	253.4663	249.9505	258.8101	277.6710	301.4795	323.8562	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	77.9870	75.8083	71.2774	65.1194	61.1208	55.4921	50.7101	56.8395	59.0190	65.3923	72.5892	75.8157	(72)
Total internal gains	574.2565	569.8720	547.9938	513.9952	479.1225	447.8591	429.5503	437.8855	457.4123	491.6263	529.6972	558.5585	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.3600	25.1925	0.6300	0.7000	0.7700		33.5684 (76)	
South					5.0300	56.7559	0.6300	0.7000	0.7700		87.2470 (78)	
West					6.7300	25.1925	0.6300	0.7000	0.7700		51.8154 (80)	
Solar gains	172.6308	263.2623	390.4914	521.0143	576.2285	629.4008	598.9212	547.2648	459.8992	322.5799	209.0816	143.2116 (83)
Total gains	746.8873	833.1343	938.4852	1035.0095	1055.3511	1077.2599	1028.4715	985.1503	917.3115	814.2062	738.7789	701.7701 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.5418	45.8913	45.7771	46.0032	46.0032	46.1127	46.2198	46.3244	46.4265	46.1127	46.3244	46.1127
alpha	4.0361	4.0594	4.0518	4.0669	4.0669	4.0742	4.0813	4.0883	4.0951	4.0742	4.0883	4.0742
util living area	0.9711	0.9554	0.9127	0.8207	0.6799	0.4825	0.3523	0.3665	0.5997	0.8420	0.9458	0.9756 (86)
MIT	19.8630	20.0303	20.3382	20.6691	20.8820	20.9772	20.9951	20.9944	20.9459	20.6934	20.2542	19.8420 (87)
Th 2	19.9704	19.9774	19.9751	19.9796	19.9796	19.9818	19.9839	19.9860	19.9880	19.9818	19.9860	19.9818 (88)
util rest of house	0.9643	0.9454	0.8934	0.7834	0.6186	0.4023	0.2622	0.2732	0.5178	0.7993	0.9314	0.9698 (89)
MIT 2	18.9643	19.1322	19.4246	19.7300	19.9061	19.9721	19.9827	19.9846	19.9613	19.7613	19.3593	18.9533 (90)
Living area fraction	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (92)
MIT	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (93)
Temperature adjustment												0.0000
adjusted MIT	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9573	0.9372	0.8850	0.7802	0.6251	0.4161	0.2785	0.2900	0.5306	0.7968	0.9233	0.9634	(94)
Useful gains	714.9693	780.8028	830.5385	807.4872	659.7185	448.2661	286.3819	285.6900	486.7251	648.7474	682.1059	676.0880	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1354.3596	1322.1112	1192.3574	980.0923	714.5734	456.3141	287.5244	287.0065	507.9080	801.9446	1087.6057	1326.9874	(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	475.7064	363.7593	269.1932	124.2757	40.8120	0.0000	0.0000	0.0000	0.0000	113.9787	291.9599	484.2691	(98)
Space heating												2163.9544	(98)
Space heating per m2											(98) / (4) =	25.8537	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2385.8372	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	475.7064	363.7593	269.1932	124.2757	40.8120	0.0000	0.0000	0.0000	0.0000	113.9787	291.9599	484.2691	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	524.4833	401.0576	296.7952	137.0184	44.9967	0.0000	0.0000	0.0000	0.0000	125.6656	321.8962	533.9241	(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	181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807	(64)	
Efficiency of water heater (217)m	89.9095	89.8282	89.6099	89.1581	88.5047	87.9000	87.9000	87.9000	87.9000	89.0733	89.6734	89.9348	(216)	
Fuel for water heating, kWh/month	201.6928	177.4365	185.6051	165.5637	162.2301	144.2038	136.8330	152.4436	152.8992	171.9335	182.6623	196.2317	(219)	
Water heating fuel used												2029.7353	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2385.8372	(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)													361.4894	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.63 * 1187 * 1.00) =										-598.0152		-598.0152	(233)	
Total delivered energy for all uses												4254.0468	(238)	

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2385.8372	10.2300	244.0711	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2029.7353	10.2300	207.6419	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	361.4894	36.7200	132.7389	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-598.0152	36.7200	-219.5912	(252)
Total energy cost			495.4008	(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	2385.8372	0.2160	515.3408	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2029.7353	0.2160	438.4228	(264)
Space and water heating			953.7637	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.4894	0.5190	187.6130	(268)
Energy saving/generation technologies				
PV Unit	-598.0152	0.5190	-310.3699	(269)
Total kg/year			869.9318	(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	2385.8372	1.2200	2910.7214	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2029.7353	1.2200	2476.2771	(264)
Space and water heating			5386.9985	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	361.4894	3.0700	1109.7725	(268)
Energy saving/generation technologies				
PV Unit	-598.0152	3.0700	-1835.9066	(269)
Primary energy kWh/year			4891.1144	(272)
Primary energy kWh/m2/year			58.4363	(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 87
Current environmental impact rating: B 89

(For testing purposes):			
A			Not considered
B			Not considered
C			Not considered
D			Not considered
E	Low energy lighting		Already installed
F			Not considered
G			Not considered
H			Not considered
I			Not considered
J			Not considered
K			Not considered
M			Not considered
N	Solar water heating		Recommended
O			Not considered
P			Not considered
R			Not considered
S			Not considered
T			Not considered
U	Solar photovoltaic panels		Already installed
A2			Not considered
A3			Not considered
T2			Not considered
W			Not considered
X			Not considered
Y			Not considered
J2			Not considered
Q2			Not considered
Z1			Not considered
Z2			Not considered
Z3			Not considered
Z4			Not considered
Z5			Not considered
V2	Wind turbine		Not applicable
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 1.2	Cost change -£ 84
			CO2 change -190 kg (21.8%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£84	2.27 kg/m²	B 89	B 91
Total Savings	£84	2.27 kg/m²		
Potential energy efficiency rating:			B 89	
Potential environmental impact rating:				B 91

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
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	£160	£179	-£18
Mains gas	£555	£453	£102
Space heating	£375	£375	£0
Water heating	£208	£124	£84
Lighting	£133	£133	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£495	£412	£84
Total cost of uses	£496	£412	£84
Delivered energy	51 kWh/m²	39 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	46 kWh/m²	13 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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (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) = 0.1889 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.4349 (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) =	0.3697 (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	0.4713	0.4621	0.4528	0.4066	0.3974	0.3512	0.3512	0.3419	0.3697	0.3974	0.4159	0.4343 (22b)
Effective ac	0.6111	0.6068	0.6025	0.5827	0.5790	0.5617	0.5617	0.5585	0.5683	0.5790	0.5865	0.5943 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.9721		(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			18.0000	753.3000 (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) = 15608.3908 (34)
186.4802 (35)
7.0253 (36)
(33) + (36) = 54.9974 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7022	42.4008	42.1054	40.7178	40.4581	39.2496	39.2496	39.0258	39.7151	40.4581	40.9833	41.5324 (38)
Heat transfer coeff	97.6996	97.3982	97.1028	95.7152	95.4556	94.2470	94.2470	94.0232	94.7125	95.4556	95.9808	96.5298 (39)
Average = Sum(39)m / 12 =												95.7139 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1673	1.1637	1.1601	1.1436	1.1404	1.1260	1.1260	1.1233	1.1316	1.1404	1.1467	1.1533 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5293 (42)
94.2715 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1483.2580 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395 (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	27.5590	24.8892	27.5298	26.6122	27.4778	26.5667	27.4368	27.4634	26.5915	27.5083	26.6552 (61)
Total heat required for water heating calculated for each month											
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-24.6507	-41.1349	-70.0574	-93.8908	-115.9942	-114.0407	-112.5336	-98.3212	-77.0052	-52.5855	-29.2393 (63)
Output from w/h											
156.6904	118.2531	96.2631	53.7226	27.5872	12.7144	7.7426	35.6767	57.3932	100.5613	134.5602	155.8523 (64)
Heat gains from water heating, kWh/month											
58.0223	50.9432	53.0304	46.8859	45.4739	39.9543	37.7283	42.2886	42.4937	48.6519	52.2643	56.4069 (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	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.1726	45.4510	36.9633	27.9836	20.9180	17.6599	19.0821	24.8037	33.2914	42.2711	49.3367	52.5948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	338.8051	342.3209	333.4613	314.6004	290.7919	268.4152	253.4663	249.9505	258.8101	277.6710	301.4795	323.8562	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	77.9870	75.8083	71.2774	65.1194	61.1208	55.4921	50.7101	56.8395	59.0190	65.3923	72.5892	75.8157	(72)
Total internal gains	574.2565	569.8720	547.9938	513.9952	479.1225	447.8591	429.5503	437.8855	457.4123	491.6263	529.6972	558.5585	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.3600	19.6403		0.6300		0.7000		0.7700		26.1701 (76)
South				5.0300	46.7521		0.6300		0.7000		0.7700		71.8688 (78)
West				6.7300	19.6403		0.6300		0.7000		0.7700		40.3956 (80)
Solar gains	138.4346	247.9193	364.3806	482.2161	559.8829	562.3127	539.5965	482.1273	406.0342	281.4664	168.1887	116.8417	(83)
Total gains	712.6911	817.7913	912.3744	996.2113	1039.0054	1010.1718	969.1468	920.0128	863.4466	773.0927	697.8860	675.4002	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.3775	44.5148	44.6503	45.2976	45.4208	46.0032	46.0032	46.1127	45.7771	45.4208	45.1722	44.9153
alpha	3.9585	3.9677	3.9767	4.0198	4.0281	4.0669	4.0669	4.0742	4.0518	4.0281	4.0115	3.9944
util living area	0.9784	0.9624	0.9291	0.8561	0.7337	0.5652	0.4200	0.4583	0.6781	0.8871	0.9631	0.9821 (86)
MIT	19.6934	19.9067	20.2151	20.5708	20.8235	20.9545	20.9892	20.9847	20.9040	20.5681	20.0698	19.6554 (87)
Th 2	19.9463	19.9492	19.9520	19.9654	19.9679	19.9796	19.9796	19.9818	19.9751	19.9679	19.9629	19.9576 (88)
util rest of house	0.9734	0.9538	0.9131	0.8245	0.6791	0.4863	0.3263	0.3622	0.6011	0.8548	0.9532	0.9779 (89)
MIT 2	18.7786	18.9893	19.2892	19.6311	19.8502	19.9574	19.9764	19.9768	19.9224	19.6395	19.1629	18.7501 (90)
Living area fraction	fLA = Living area / (4) =											0.1802 (91)
MIT	18.9434	19.1546	19.4560	19.8004	20.0255	20.1370	20.1589	20.1584	20.0992	19.8068	19.3263	18.9132 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9434	19.1546	19.4560	19.8004	20.0255	20.1370	20.1589	20.1584	20.0992	19.8068	19.3263	18.9132 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9672	0.9458	0.9040	0.8189	0.6823	0.4990	0.3431	0.3793	0.6111	0.8489	0.9456	0.9724	(94)
Useful gains	689.2794	773.4358	824.8049	815.7512	708.9586	504.0309	332.4667	348.9264	527.6518	656.2782	659.9064	656.7536	(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													
	1430.6529	1388.3727	1258.0637	1043.3372	794.7201	521.8477	335.4114	353.3735	568.2024	878.8417	1173.4858	1420.2642	(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	551.5818	413.2376	322.3446	163.8619	63.8065	0.0000	0.0000	0.0000	0.0000	165.5872	369.7771	568.0518	(98)
Space heating												2618.2487	(98)
Space heating per m2											(98) / (4) =	31.2813	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2886.7130 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	551.5818	413.2376	322.3446	163.8619	63.8065	0.0000	0.0000	0.0000	0.0000	165.5872	369.7771	568.0518	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	608.1387	455.6093	355.3965	180.6637	70.3490	0.0000	0.0000	0.0000	0.0000	182.5659	407.6925	626.2975	(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	156.6904	118.2531	96.2631	53.7226	27.5872	12.7144	7.7426	35.6767	57.3932	100.5613	134.5602	155.8523	(64)
Efficiency of water heater	90.0653	90.0617	90.0404	89.9922	89.8362	87.9000	87.9000	87.9000	87.9000	89.6213	89.9356	90.0822	(216)
(217)m	173.9743	131.3024	106.9110	59.6969	30.7083	14.4647	8.8084	40.5879	65.2937	112.2069	149.6183	173.0112	(219)
Fuel for water heating, kWh/month												1066.5838	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												2886.7130	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.4894	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.63 * 1068 * 1.00) =										-538.3075		-538.3075	(233)
Total delivered energy for all uses												3901.4787	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2886.7130	3.4800	100.4576 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1066.5838	3.4800	37.1171 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	361.4894	13.1900	47.6805 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-538.3075	13.1900	-71.0028 (252)
Total energy cost			250.7399 (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] =	0.8183 (257)
SAP value		88.5852
SAP rating (Section 12)		89 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2886.7130	0.2160	623.5300 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1066.5838	0.2160	230.3821 (264)
Space and water heating			853.9121 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	361.4894	0.5190	187.6130 (268)
Energy saving/generation technologies			
PV Unit	-538.3075	0.5190	-279.3816 (269)
Total kg/year			827.0185 (272)
CO2 emissions per m2			9.8800 (273)
EI value			91.3892
EI rating			91 (274)
EI band			B

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.8500 (1b)	x 2.3900 (2b)	= 100.0215 (1b) - (3b)
First floor	41.8500 (1c)	x 2.6700 (2c)	= 111.7395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.7610 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1889 (8)
Pressure test					Yes
Measured/design AP50					4.9200
Infiltration rate					0.4349 (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) =		0.3697 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3881	0.3604	0.3697	0.3512	0.3512	0.3419	0.3327	0.3235	0.3142	0.3419	0.3235	0.3419 (22b)
Effective ac	0.5753	0.5650	0.5683	0.5617	0.5617	0.5585	0.5553	0.5523	0.5494	0.5585	0.5523	0.5585 (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		(26a)
Windows (Uw = 1.20)			16.1200	1.1450	18.4580		(27)
Ground Floor			41.8500	0.1100	4.6035	140.0000	5859.0000 (28a)
Brick and Block	43.8800	11.0900	32.7900	0.2400	7.8696	42.2200	1384.3938 (29a)
Tile Clad	51.0000	7.1500	43.8500	0.2400	10.5240	42.2200	1851.3470 (29a)
Pitched Roof	41.8500		41.8500	0.1000	4.1850	9.0000	376.6500 (30)
Total net area of external elements Aum(A, m ²)			178.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.9721		(33)
Party Wall 1			44.2400	0.0000	0.0000	70.0000	3096.8000 (32)
Ground Floor Stud			71.6000			9.0000	644.4000 (32c)
First Floor Stud			98.8000			9.0000	889.2000 (32c)
Internal Floor 1			41.8500			18.0000	753.3000 (32d)
Internal Ceiling 1			41.8500			18.0000	753.3000 (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) = 15608.3908 (34)
186.4802 (35)
7.0253 (36)
(33) + (36) = 54.9974 (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	40.2045	39.4794	39.7151	39.2496	39.2496	39.0258	38.8079	38.5961	38.3902	39.0258	38.5961	39.0258 (38)
Heat transfer coeff	95.2019	94.4768	94.7125	94.2470	94.2470	94.0232	93.8054	93.5935	93.3876	94.0232	93.5935	94.0232 (39)
Average = Sum(39)m / 12 =												94.1112 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1374	1.1288	1.1316	1.1260	1.1260	1.1233	1.1207	1.1182	1.1157	1.1233	1.1182	1.1233 (40)
HLP (average)												1.1244 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5293 (42)
94.2715 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.6987	99.9278	96.1569	92.3861	88.6152	84.8444	84.8444	88.6152	92.3861	96.1569	99.9278	103.6987 (44)
Energy conte	153.7821	134.4988	138.7907	121.0011	116.1035	100.1885	92.8393	106.5345	107.8069	125.6385	137.1443	148.9298 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum (45)m = 1483.2580 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0673	20.1748	20.8186	18.1502	17.4155	15.0283	13.9259	15.9802	16.1710	18.8458	20.5716	22.3395 (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	27.5590	24.8892	27.5298	26.6122	27.4778	26.5667	27.4368	27.4634	26.5915	27.5083	26.6552 (61)
Total heat required for water heating calculated for each month											
181.3411	159.3880	166.3206	147.6134	143.5813	126.7552	120.2762	133.9979	134.3984	153.1468	163.7994	176.4807 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-28.8051	-40.9589	-70.3986	-94.9840	-111.5644	-119.1684	-116.6623	-104.4163	-81.7507	-56.5197	-34.0688
Solar input (sum of months) = Sum (63)m =											
-882.9833											
Output from w/h											
152.5361	118.4291	95.9220	52.6294	32.0169	7.5868	3.6139	29.5817	52.6476	96.6272	129.7306	152.7946 (64)
Total per year (kWh/year) = Sum (64)m =											
924.1157											
Heat gains from water heating, kWh/month											
58.0223	50.9432	53.0304	46.8859	45.4739	39.9543	37.7283	42.2886	42.4937	48.6519	52.2643	56.4069 (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	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	151.7596	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.1726	45.4510	36.9633	27.9836	20.9180	17.6599	19.0821	24.8037	33.2914	42.2711	49.3367	52.5948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	338.8051	342.3209	333.4613	314.6004	290.7919	268.4152	253.4663	249.9505	258.8101	277.6710	301.4795	323.8562	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	52.7053	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	-101.1731	(71)
Water heating gains (Table 5)	77.9870	75.8083	71.2774	65.1194	61.1208	55.4921	50.7101	56.8395	59.0190	65.3923	72.5892	75.8157	(72)
Total internal gains	574.2565	569.8720	547.9938	513.9952	479.1225	447.8591	429.5503	437.8855	457.4123	491.6263	529.6972	558.5585	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East	4.3600	25.1925	0.6300	0.7000	0.7700	33.5684 (76)
South	5.0300	56.7559	0.6300	0.7000	0.7700	87.2470 (78)
West	6.7300	25.1925	0.6300	0.7000	0.7700	51.8154 (80)

Solar gains	172.6308	263.2623	390.4914	521.0143	576.2285	629.4008	598.9212	547.2648	459.8992	322.5799	209.0816	143.2116	(83)
Total gains	746.8873	833.1343	938.4852	1035.0095	1055.3511	1077.2599	1028.4715	985.1503	917.3115	814.2062	738.7789	701.7701	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	45.5418	45.8913	45.7771	46.0032	46.0032	46.1127	46.2198	46.3244	46.4265	46.1127	46.3244	46.1127
alpha	4.0361	4.0594	4.0518	4.0669	4.0669	4.0742	4.0813	4.0883	4.0951	4.0742	4.0883	4.0742
util living area	0.9711	0.9554	0.9127	0.8207	0.6799	0.4825	0.3523	0.3665	0.5997	0.8420	0.9458	0.9756 (86)
MIT	19.8630	20.0303	20.3382	20.6691	20.8820	20.9772	20.9951	20.9944	20.9459	20.6934	20.2542	19.8420 (87)
Th 2	19.9704	19.9774	19.9751	19.9796	19.9796	19.9818	19.9839	19.9860	19.9880	19.9818	19.9860	19.9818 (88)
util rest of house	0.9643	0.9454	0.8934	0.7834	0.6186	0.4023	0.2622	0.2732	0.5178	0.7993	0.9314	0.9698 (89)
MIT 2	18.9643	19.1322	19.4246	19.7300	19.9061	19.9721	19.9827	19.9846	19.9613	19.7613	19.3593	18.9533 (90)
Living area fraction	fLA = Living area / (4) =											0.1802 (91)
MIT	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1262	19.2940	19.5892	19.8992	20.0819	20.1532	20.1651	20.1665	20.1387	19.9292	19.5205	19.1134 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9573	0.9372	0.8850	0.7802	0.6251	0.4161	0.2785	0.2900	0.5306	0.7968	0.9233	0.9634	(94)
Useful gains	714.9693	780.8028	830.5385	807.4872	659.7185	448.2661	286.3819	285.6900	486.7251	648.7474	682.1059	676.0880	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1354.3596	1322.1112	1192.3574	980.0923	714.5734	456.3141	287.5244	287.0065	507.9080	801.9446	1087.6057	1326.9874	(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	475.7064	363.7593	269.1932	124.2757	40.8120	0.0000	0.0000	0.0000	0.0000	113.9787	291.9599	484.2691	(98)
Space heating												2163.9544	(98)
Space heating per m2												(98) / (4) =	25.8537 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2385.8372 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	475.7064	363.7593	269.1932	124.2757	40.8120	0.0000	0.0000	0.0000	0.0000	113.9787	291.9599	484.2691	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	524.4833	401.0576	296.7952	137.0184	44.9967	0.0000	0.0000	0.0000	0.0000	125.6656	321.8962	533.9241	(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	152.5361	118.4291	95.9220	52.6294	32.0169	7.5868	3.6139	29.5817	52.6476	96.6272	129.7306	152.7946	(64)
Efficiency of water heater	90.0039	89.9959	89.9473	89.8485	89.4474	87.9000	87.9000	87.9000	87.9000	89.3935	89.8198	90.0123	(217)
Fuel for water heating, kWh/month	169.4772	131.5939	106.6425	58.5757	35.7941	8.6311	4.1114	33.6538	59.8949	108.0919	144.4344	169.7485	(219)
Water heating fuel used												1030.6493	(219)
Annual totals kWh/year													
Space heating fuel - main system												2385.8372	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													361.4894 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.63 * 1187 * 1.00) =									-598.0152			-598.0152	(233)
Total delivered energy for all uses												3304.9608	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2385.8372	10.2300	244.0711	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1030.6493	10.2300	105.4354	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	361.4894	36.7200	132.7389	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-598.0152	36.7200	-219.5912	(252)
Total energy cost			411.5543	(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	2385.8372	0.2160	515.3408	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1030.6493	0.2160	222.6202	(264)
Space and water heating			737.9611	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	361.4894	0.5190	187.6130	(268)
Energy saving/generation technologies				
PV Unit	-598.0152	0.5190	-310.3699	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Total kg/year

680.0792 (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	2385.8372	1.2200	2910.7214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1030.6493	1.2200	1257.3921 (264)
Space and water heating			4168.1136 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	361.4894	3.0700	1109.7725 (268)
Energy saving/generation technologies			
PV Unit	-598.0152	3.0700	-1835.9066 (269)
Primary energy kWh/year			3825.7294 (272)
Primary energy kWh/m2/year			45.7076 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 17	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	1, Wheatear Road, Botley, Southampton, SO32 2TX		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	13.81	TER	17.99
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.87	DFEE	41.66	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	19.63		

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 (%)
Ext surface				0.0400	
Layer 1	Mineral wool batt				
	Main construction	350	0.0380	9.2105	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Mineral wool batt				
	Main construction	100	0.0380	2.6316	87.50
	Main construction	100	0.1300	0.7692	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

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

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 17	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	1, Wheatear Road, Botley, Southampton, SO32 2TX		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	13.81	TER	17.99
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.87	DFEE	41.66	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	19.63		

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 000004

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 0645 Plot 17	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	1, Wheatear Road, Botley, Southampton, SO32 2TX		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	13.81	TER	17.99
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.87	DFEE	41.66	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	19.63		

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 000007

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				0.1300			
Layer 1	Tiling, clay						
	Main construction	30	1.0000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	93.18		
	Main construction	100	0.8800	0.1136	6.82		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
Layer 5	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 6	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 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.349 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 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: 383 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 17	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	1, Wheatear Road, Botley, Southampton, SO32 2TX		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	13.81	TER	17.99
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.87	DFEE	41.66	TFEE	51.84
General Requirements Compliance	Pass	% DFEE<TFEE	19.63		

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

Floor 000006 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 41.77 m², Perimeter = 18.92 m, Wall thickness = 300.00 mm, Soil: Clay

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

Floor height above ground: h = 0.000 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	Extruded polystyrene						
	Main construction	100	0.0270	3.7037	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Extruded polystyrene						
	Main construction	200	0.0270	7.4074	91.67		
	Main construction	200	2.3000	0.0870	8.33		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Concrete, reinforced (1% steel)						
	Main construction	75	2.3000	0.0326	100.00	2000	1000
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance:	Upper limit = 10.093 m ² K/W	Lower limit = 5.066 m ² K/W	Average = 7.579 m ² K/W
	Total correction = 0.0025 m ² K/W	U-value (unrounded) = 0.11 W/m ² K	

Unheated space: None

Total thickness: 450 mm

U-value: 0.11 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 17	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Property	1, Wheatear Road, Botley, Southampton, SO32 2TX		
SAP Rating	87 B	DER	13.81
Environmental	89 B	TER	17.99
CO ₂ Emissions (t/year)	0.87	% DER<TER	23.25
General Requirements Compliance	Pass	DFEE	41.66
		TFEE	51.84
		% DFEE<TFEE	19.63
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	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2019
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	18.75 m	41.85 m ²	2.39 m
	1st Storey:	18.75 m	41.85 m ²	2.67 m

7.0 Living Area	15.08	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	186.48	kJ/m ² K

9.0 External Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Brick and Block	Cavity Wall	Other		0.24	42.22	43.88	32.79
Tile Clad	Cavity Wall	Other		0.24	42.22	51.00	43.85

9.1 Party Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction				
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		0.00	70.00	44.24

9.2 Internal Walls				Kappa (kJ/m ² K)	Area (m ²)
Description	Construction				
Ground Floor Stud	Plasterboard on timber frame			9.00	71.60
First Floor Stud	Plasterboard on timber frame			9.00	98.80

10.0 External Roofs				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	41.85	41.85

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	41.85

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.11	140.00	41.85

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	41.85

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Half Glazed Door	[1] Brick and Block	South							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					2.18	
Front Elevation	Window	[2] Tile Clad	South	None	0.00					2.85	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					2.18	
Side Elevation	Window	[2] Tile Clad	East	None	0.00					2.18	
Side Elevation	Window	[1] Brick and Block	West	None	0.00					4.61	
Side Elevation	Window	[2] Tile Clad	West	None	0.00					2.12	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	0.63	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	8.29	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.01	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.77	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	11.18	0.021	No	Knauf P5
Independently assessed	E4 Jamb	34.50	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	18.75	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	18.75	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	10.02	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	9.06	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	20.20	0.039	No	Knauf P23
Independently assessed	E25 Staggered party wall between dwellings	10.10	0.062	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.77	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.77	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.77	0.035	No	Knauf P29 Halved

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Tested ?	Yes	m ³ /(h.m ²) @ 50 Pa
As Built AP ₅₀	4.92	m ³ /(h.m ²) @ 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
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20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	22	
Total number of L.E.L. fittings	22	
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	Combi Boiler	
Percentage of Heat	100	%
Database Ref. No.	17515	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.9	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Combi keep hot type	Gas/Oil, time clock			
25.0 Main Heating 2	None			
Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.63	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£84	B 89	