



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 8 Fieldfare Crescent, Botley
SOUTHAMPTON, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 26/05/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 34	Issued on Date	26/05/2023
Assessment Reference	As Built	Prop Type Ref	Bh
Property	8 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
SAP Rating	88 B	DER	13.62
Environmental	88 B	TER	17.43
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.87
General Requirements Compliance	Pass	DfEE	49.50
		TfEE	58.72
		% DfEE<TfEE	15.69
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)	17.43	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.62	kgCO ₂ /m ²	Pass
	-3.81 (-21.9%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	58.72	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	49.50	kWh/m ² /yr	
	-9.2 (-15.7%)	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
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	4.55 (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

9.17 m², Overhang twice as wide as window, ratio 1.24

Windows facing South

3.54 m², No overhang

Windows facing West

16.84 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.10 W/m²K

Floor U-value

0.11 W/m²K

Door U-value

1.10 W/m²K

Photovoltaic array

1.17 kW

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THERMAL BRIDGING

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Environmental	88 B	TER	17.43
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.87
General Requirements Compliance	Pass	DFEE	49.50
		TFEE	58.72
		% DFEE<TFEE	15.69
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	0.274	21.99	6.03	Knauf P3
External wall	E3 Sill	Independently assessed	0.021	15.44	0.32	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	47.10	0.75	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	33.37	2.07	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	33.37	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	19.90	1.19	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	13.47	0.59	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	25.32	0.99	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	5.06	-0.46	Knauf P24

Total: **11.49** W/mK:
Y-Value: **0.040** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	88 B	% DER<TER	21.87		
CO ₂ Emissions (t/year)	1.19	DFEE	49.50	TFEE	58.72
General Requirements Compliance	Pass	% DFEE<TFEE	15.69		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 117 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) 17.43 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.62 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	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: 4.55 (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: 9.17 m², Overhang twice as wide as window, ratio 1.24
Windows facing South: 3.54 m², No overhang
Windows facing West: 16.84 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 1.17 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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3349 (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	0.4270	0.4187	0.4103	0.3684	0.3601	0.3182	0.3182	0.3098	0.3349	0.3601	0.3768	0.3935 (22b)
Effective ac	0.5912	0.5876	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			18.0000	1055.1600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22182.7044 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2076 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4857 (36)
Total fabric heat loss						(33) + (36) =	92.9686 (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	57.9813	57.6340	57.2936	55.6949	55.3958	54.0033	54.0033	53.7454	54.5397	55.3958	56.0009	56.6335 (38)
Heat transfer coeff	150.9499	150.6026	150.2623	148.6635	148.3644	146.9719	146.9719	146.7141	147.5083	148.3644	148.9695	149.6021 (39)
Average = Sum(39)m / 12 =												148.6621 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2875	1.2846	1.2817	1.2680	1.2655	1.2536	1.2536	1.2514	1.2582	1.2655	1.2706	1.2760 (40)
HLP (average)												1.2680 (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	2.8520 (42)
Average daily hot water use (litres/day)	101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1603.8303 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)	
Total heat required for water heating calculated for each month	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (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)	
	Solar input (sum of months) = Sum(63)m =											0.0000 (63)	
Output from w/h	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (64)	
	Total per year (kWh/year) = Sum(64)m =											1927.9072 (64)	
Heat gains from water heating, kWh/month	62.1805	54.5803	56.7873	50.1645	48.6194	42.6684	40.2433	45.1748	45.4147	52.0528	55.9729	60.4339 (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	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1026	22.2959	18.1323	13.7273	10.2613	8.6630	9.3607	12.1674	16.3311	20.7361	24.2020	25.8003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5753	284.4971	277.1341	261.4591	241.6722	223.0754	210.6515	207.7297	215.0927	230.7677	250.5545	269.1514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	83.5760	81.2207	76.3271	69.6729	65.3486	59.2617	54.0904	60.7189	63.0759	69.9635	77.7402	81.2283	(72)
Total internal gains	459.0337	456.7936	440.3733	413.6391	386.0620	359.7799	342.8825	349.3958	363.2795	390.2470	421.2766	444.9599	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.1700	19.6403	0.6300	0.7000	0.7700	55.0413	(76)
South	3.5400	46.7521	0.6300	0.7000	0.7700	50.5797	(78)
West	16.8400	19.6403	0.6300	0.7000	0.7700	101.0791	(80)

Solar gains	206.7000	388.2409	608.4767	852.7932	1023.2488	1039.8574	992.9790	866.0600	695.1876	451.7351	254.6179	172.0913	(83)
Total gains	665.7337	845.0345	1048.8499	1266.4323	1409.3109	1399.6374	1335.8615	1215.4558	1058.4672	841.9821	675.8945	617.0511	(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	40.8206	40.9147	41.0074	41.4484	41.5320	41.9254	41.9254	41.9991	41.7730	41.5320	41.3632	41.1883
alpha	3.7214	3.7276	3.7338	3.7632	3.7688	3.7950	3.7950	3.7999	3.7849	3.7688	3.7575	3.7459
util living area	0.9948	0.9871	0.9651	0.9027	0.7819	0.6148	0.4677	0.5272	0.7752	0.9509	0.9899	0.9961 (86)
MIT	19.2123	19.4691	19.8765	20.3667	20.7314	20.9223	20.9787	20.9669	20.8091	20.2825	19.6469	19.1691 (87)
Th 2	19.8506	19.8529	19.8552	19.8660	19.8680	19.8774	19.8774	19.8791	19.8737	19.8680	19.8639	19.8597 (88)
util rest of house	0.9934	0.9837	0.9556	0.8767	0.7270	0.5262	0.3557	0.4108	0.6978	0.9324	0.9867	0.9950 (89)
MIT 2	18.2289	18.4855	18.8878	19.3637	19.6869	19.8395	19.8711	19.8683	19.7643	19.2978	18.6720	18.1926 (90)
Living area fraction									fLA = Living area / (4) =			0.1418 (91)
MIT	18.3684	18.6250	19.0280	19.5059	19.8351	19.9931	20.0282	20.0241	19.9125	19.4375	18.8103	18.3312 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3684	18.6250	19.0280	19.5059	19.8351	19.9931	20.0282	20.0241	19.9125	19.4375	18.8103	18.3312 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	659.6098	826.9675	993.0500	1097.8029	1022.0186	750.1188	496.0218	518.5395	741.8553	777.4104	664.0228	612.7020	(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	2123.6195	2067.0253	1882.4899	1576.7165	1206.9572	792.6273	503.8506	531.7131	857.3933	1311.1647	1744.4791	2114.0502	(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	1089.2232	833.3188	661.7433	344.8178	137.5943	0.0000	0.0000	0.0000	0.0000	397.1133	777.9285	1117.0031	(98)
Space heating												5358.7423	(98)
Space heating per m2												45.7075	(99)
	(98) / (4) =												

FULL SAP CALCULATION PRINTOUT

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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													5908.2054	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1089.2232	833.3188	661.7433	344.8178	137.5943	0.0000	0.0000	0.0000	0.0000	397.1133	777.9285	1117.0031	(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)	1200.9077	918.7638	729.5957	380.1740	151.7027	0.0000	0.0000	0.0000	0.0000	437.8316	857.6941	1231.5359	(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	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936	(64)	
Efficiency of water heater (217)m	90.2656	90.2123	90.0927	89.8031	89.2037	87.9000	87.9000	87.9000	87.9000	89.8656	90.1726	90.2846	(216)	
Fuel for water heating, kWh/month	214.7537	188.8086	197.1584	175.3631	171.5723	153.4970	145.4444	162.3267	162.9016	181.8052	194.0225	208.8880	(219)	
Water heating fuel used												2156.5415	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5908.2054	(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)													443.3205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.17 * 853 * 1.00) =										-798.4360			-798.4360	(233)
Total delivered energy for all uses													7784.6313	(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	5908.2054	0.2160	1276.1724	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2156.5415	0.2160	465.8130	(264)
Space and water heating			1741.9853	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.3205	0.5190	230.0833	(268)
Energy saving/generation technologies				
PV Unit	-798.4360	0.5190	-414.3883	(269)
Total CO2, kg/year			1596.6054	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6200	(273)

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

DER			13.6200	ZC1
Total Floor Area		TFA	117.2400	
Assumed number of occupants		N	2.8520	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			14.2320	ZC2
CO2 emissions from cooking, equation (L16)			1.5988	ZC3
Total CO2 emissions			29.4508	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			29.4508	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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3846 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3557 (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	0.4536	0.4447	0.4358	0.3913	0.3824	0.3380	0.3380	0.3291	0.3557	0.3824	0.4002	0.4180 (22b)
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5731	0.5571	0.5571	0.5541	0.5633	0.5731	0.5801	0.5874 (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)			27.1900	1.3258	36.0473		(27)
Ground Floor			58.6200	0.1300	7.6206		(28a)
Brick and Block	150.6000	27.2900	123.3100	0.1800	22.1958		(29a)
Cladding	18.5900	2.0200	16.5700	0.1800	2.9826		(29a)
Pitched Roof	58.6200		58.6200	0.1300	7.6206		(30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.0109		(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)							13.3913 (36)
Total fabric heat loss						(33) + (36) =	92.4022 (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	59.1272	58.7355	58.3515	56.5478	56.2104	54.6395	54.6395	54.3486	55.2446	56.2104	56.8930	57.6067 (38)
Heat transfer coeff	151.5295	151.1377	150.7537	148.9501	148.6126	147.0417	147.0417	146.7508	147.6468	148.6126	149.2953	150.0090 (39)
Average = Sum(39)m / 12 =												148.9485 (39)
HLP	1.2925	1.2891	1.2859	1.2705	1.2676	1.2542	1.2542	1.2517	1.2594	1.2676	1.2734	1.2795 (40)
HLP (average)												1.2705 (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												2.8520 (42)
Average daily hot water use (litres/day)												101.9347 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy content (annual)	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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 (57)
Combi loss	50.9589	46.0274	50.9589	49.2638	48.8281	45.2423	46.7503	48.8281	49.2638	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	217.2418	191.4595	201.0318	180.1010	174.3695	153.5749	147.1365	164.0227	165.8342	186.8104	197.6076	211.9950 (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	217.2418	191.4595	201.0318	180.1010	174.3695	153.5749	147.1365	164.0227	165.8342	186.8104	197.6076	211.9950 (64)
Heat gains from water heating, kWh/month	68.0288	59.8630	62.6390	55.8193	53.9495	47.3312	45.0660	50.5092	51.0756	57.9104	61.6360	66.2842 (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	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1026	22.2959	18.1323	13.7273	10.2613	8.6630	9.3607	12.1674	16.3311	20.7361	24.2020	25.8003 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5753	284.4971	277.1341	261.4591	241.6722	223.0754	210.6515	207.7297	215.0927	230.7677	250.5545	269.1514 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599 (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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796 (71)
Water heating gains (Table 5)	91.4365	89.0819	84.1921	77.5268	72.5128	65.7377	60.5726	67.8887	70.9383	77.8365	85.6056	89.0917 (72)
Total internal gains	466.8943	464.6548	448.2384	421.4931	393.2262	366.2560	349.3646	356.5657	371.1419	398.1201	429.1420	452.8233 (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						8.4400	19.6403	0.6300	0.7000	0.7700	50.6596 (76)	
South						3.2600	46.7521	0.6300	0.7000	0.7700	46.5790 (78)	
West						15.4900	19.6403	0.6300	0.7000	0.7700	92.9759 (80)	
Solar gains	190.2145	357.2659	559.9094	784.7001	941.5289	956.8053	913.6733	796.9009	639.6903	415.6882	234.3086	158.3674 (83)
Total gains	657.1088	821.9207	1008.1478	1206.1931	1334.7552	1323.0613	1263.0379	1153.4666	1010.8322	813.8082	663.4506	611.1907 (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	53.7299	53.8692	54.0064	54.6604	54.7845	55.3698	55.3698	55.4795	55.1429	54.7845	54.5340	54.2745
alpha	4.5820	4.5913	4.6004	4.6440	4.6523	4.6913	4.6913	4.6986	4.6762	4.6523	4.6356	4.6183
util living area	0.9985	0.9955	0.9845	0.9428	0.8371	0.6628	0.5012	0.5647	0.8270	0.9754	0.9966	0.9989 (86)
MIT	19.5364	19.7382	20.0671	20.4787	20.7924	20.9495	20.9890	20.9814	20.8564	20.4104	19.8922	19.5055 (87)
Th 2	19.8467	19.8494	19.8519	19.8640	19.8663	19.8769	19.8769	19.8789	19.8728	19.8663	19.8617	19.8569 (88)
util rest of house	0.9979	0.9939	0.9788	0.9219	0.7818	0.5656	0.3789	0.4372	0.7472	0.9627	0.9951	0.9985 (89)
MIT 2	17.9026	18.1987	18.6772	19.2657	19.6709	19.8451	19.8731	19.8717	19.7611	19.1844	18.4330	17.8643 (90)
Living area fraction	18.1343	18.4171	18.8743	19.4378	19.8300	20.0018	20.0314	20.0291	19.9165	19.3583	18.6400	18.0971 (92)
Temperature adjustment	18.1343	18.4171	18.8743	19.4378	19.8300	20.0018	20.0314	20.0291	19.9165	19.3583	18.6400	18.0971 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9966	0.9908	0.9720	0.9119	0.7798	0.5772	0.3962	0.4550	0.7508	0.9547	0.9926	0.9976 (94)
Ext temp.	654.8881	814.3616	979.9374	1099.9652	1040.8180	763.6320	500.4478	524.8824	758.9254	776.9023	658.5366	609.6945 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2096.3095	2042.9380	1865.4739	1569.6037	1208.2206	794.2901	504.5620	532.5690	858.7893	1301.5958	1722.8680	2084.6938 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1072.4175	825.6033	658.8391	338.1397	124.5475	0.0000	0.0000	0.0000	0.0000	390.3720	766.3186	1097.3995 (98)
												5273.6373 (98)
												44.9816 (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													5646.2926 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1072.4175	825.6033	658.8391	338.1397	124.5475	0.0000	0.0000	0.0000	0.0000	390.3720	766.3186	1097.3995	(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)	1148.1986	883.9436	705.3952	362.0340	133.3485	0.0000	0.0000	0.0000	0.0000	417.9572	820.4696	1174.9459	(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	217.2418	191.4595	201.0318	180.1010	174.3695	153.5749	147.1365	164.0227	165.8342	186.8104	197.6076	211.9950	(64)
Efficiency of water heater (217)m	88.5244	88.3091	87.8176	86.6140	84.2206	80.3000	80.3000	80.3000	80.3000	86.8638	88.1276	88.5958	(216)
Fuel for water heating, kWh/month	245.4033	216.8061	228.9196	207.9351	207.0390	191.2515	183.2335	204.2624	206.5182	215.0612	224.2289	239.2832	(219)
Water heating fuel used												2569.9420	(219)
Annual totals kWh/year													
Space heating fuel - main system												5646.2926	(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)												443.3205	(232)
Total delivered energy for all uses												8734.5551	(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	5646.2926	0.2160	1219.5992 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2569.9420	0.2160	555.1075 (264)
Space and water heating			1774.7067 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.3205	0.5190	230.0833 (268)
Total CO2, kg/m2/year			2043.7150 (272)
Emissions per m2 for space and water heating			15.1374 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9625 (272b)
Emissions per m2 for pumps and fans			0.3320 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1374 * 1.00) + 1.9625 + 0.3320, rounded to 2 d.p.			17.4300 (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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3349 (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	0.4270	0.4187	0.4103	0.3684	0.3601	0.3182	0.3182	0.3098	0.3349	0.3601	0.3768	0.3935 (22b)
Effective ac	0.5912	0.5876	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			9.0000	527.5800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 21655.1244 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							184.7076 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4857 (36)
Total fabric heat loss							(33) + (36) = 92.9686 (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	57.9813	57.6340	57.2936	55.6949	55.3958	54.0033	54.0033	53.7454	54.5397	55.3958	56.0009	56.6335 (38)
Heat transfer coeff	150.9499	150.6026	150.2623	148.6635	148.3644	146.9719	146.9719	146.7141	147.5083	148.3644	148.9695	149.6021 (39)
Average = Sum(39)m / 12 =												148.6621 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2875	1.2846	1.2817	1.2680	1.2655	1.2536	1.2536	1.2514	1.2582	1.2655	1.2706	1.2760 (40)
HLP (average)												1.2680 (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	2.8520 (42)
Average daily hot water use (litres/day)	101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (45)

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Energy content (annual)	Total = Sum(45)m = 1603.8303 (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	35.3351	30.9043	31.8905	27.8029	26.6775	23.0207	21.3321	24.4788	24.7712	28.8684	31.5122	34.2202 (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	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1026	22.2959	18.1323	13.7273	10.2613	8.6630	9.3607	12.1674	16.3311	20.7361	24.2020	25.8003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5753	284.4971	277.1341	261.4591	241.6722	223.0754	210.6515	207.7297	215.0927	230.7677	250.5545	269.1514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	47.4934	45.9886	42.8636	38.6151	35.8569	31.9732	28.6721	32.9017	34.4044	38.8017	43.7669	45.9949	(72)
Total internal gains	419.9512	418.5615	403.9098	379.5814	353.5703	329.4914	314.4642	318.5786	331.6080	356.0852	384.3033	406.7264	(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					9.1700	19.6403		0.6300	0.7000	0.7700		55.0413 (76)	
South					3.5400	46.7521		0.6300	0.7000	0.7700		50.5797 (78)	
West					16.8400	19.6403		0.6300	0.7000	0.7700		101.0791 (80)	

Solar gains	206.7000	388.2409	608.4767	852.7932	1023.2488	1039.8574	992.9790	866.0600	695.1876	451.7351	254.6179	172.0913	(83)
Total gains	626.6512	806.8024	1012.3864	1232.3745	1376.8192	1369.3489	1307.4432	1184.6386	1026.7957	807.8203	638.9212	578.8177	(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	39.8497	39.9416	40.0321	40.4626	40.5442	40.9283	40.9283	41.0002	40.7795	40.5442	40.3795	40.2087	
alpha	3.6566	3.6628	3.6688	3.6975	3.7029	3.7286	3.7286	3.7333	3.7186	3.7029	3.6920	3.6806	
util living area	0.9954	0.9881	0.9669	0.9064	0.7882	0.6231	0.4758	0.5374	0.7846	0.9544	0.9910	0.9965 (86)	
MIT	19.1435	19.4063	19.8242	20.3299	20.7103	20.9138	20.9758	20.9623	20.7910	20.2408	19.5879	19.1001 (87)	
Th 2	19.8506	19.8529	19.8552	19.8660	19.8680	19.8774	19.8774	19.8791	19.8737	19.8680	19.8639	19.8597 (88)	
util rest of house	0.9941	0.9849	0.9580	0.8814	0.7345	0.5348	0.3627	0.4201	0.7091	0.9373	0.9881	0.9956 (89)	
MIT 2	18.1631	18.4259	18.8392	19.3313	19.6707	19.8346	19.8700	19.8665	19.7520	19.2604	18.6163	18.1266 (90)	
Living area fraction	18.3022	18.5650	18.9789	19.4729	19.8182	19.9877	20.0269	20.0219	fLA = Living area / (4) =				0.1418 (91)
MIT	18.3022	18.5650	18.9789	19.4729	19.8182	19.9877	20.0269	20.0219	19.8994	19.3994	18.7541	18.2647 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.3022	18.5650	18.9789	19.4729	19.8182	19.9877	20.0269	20.0219	19.8994	19.3994	18.7541	18.2647 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	621.4621	790.7093	960.9497	1073.4351	1007.6368	745.0013	494.7248	516.3601	730.0767	749.6722	628.7501	575.1802	(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	2113.6314	2057.9788	1875.1116	1571.8063	1204.4528	791.8414	503.6570	531.3892	855.4525	1305.5236	1736.1074	2104.1075	(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	1110.1740	851.6051	680.1364	358.8273	146.4311	0.0000	0.0000	0.0000	0.0000	413.5535	797.2973	1137.5219	(98)
Space heating												5495.5466	(98)
Space heating per m2												46.8743	(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	1381.5360	1087.5922	1115.0268	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8642	0.9149	0.8871	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1193.9352	994.9918	989.1936	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1714.0006	1639.1077	1497.6461	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	374.4471	479.2222	378.2886	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1231.9580 (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	93.6118	119.8056	94.5722	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												307.9895 (107)
Space cooling per m2												2.6270 (108)
Energy for space heating												46.8743 (99)
Energy for space cooling												2.6270 (108)
Total												49.5013 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.5 (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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1346 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3846 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3557 (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	0.4536	0.4447	0.4358	0.3913	0.3824	0.3380	0.3380	0.3291	0.3557	0.3824	0.4002	0.4180 (22b)					
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5731	0.5571	0.5571	0.5541	0.5633	0.5731	0.5801	0.5874 (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)			27.1900	1.3258	36.0473			(27)					
Ground Floor			58.6200	0.1300	7.6206			(28a)					
Brick and Block	150.6000	27.2900	123.3100	0.1800	22.1958			(29a)					
Cladding	18.5900	2.0200	16.5700	0.1800	2.9826			(29a)					
Pitched Roof	58.6200		58.6200	0.1300	7.6206			(30)					
Total net area of external elements Aum(A, m2)			286.4300					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	79.0109		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3913	(36)					
Total fabric heat loss						(33) + (36) =	92.4022	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 59.1272	Feb 58.7355	Mar 58.3515	Apr 56.5478	May 56.2104	Jun 54.6395	Jul 54.6395	Aug 54.3486	Sep 55.2446	Oct 56.2104	Nov 56.8930	Dec 57.6067	(38)
Heat transfer coeff	151.5295	151.1377	150.7537	148.9501	148.6126	147.0417	147.0417	146.7508	147.6468	148.6126	149.2953	150.0090	(39)
Average = Sum(39)m / 12 =												148.9485	(39)
HLP	Jan 1.2925	Feb 1.2891	Mar 1.2859	Apr 1.2705	May 1.2676	Jun 1.2542	Jul 1.2542	Aug 1.2517	Sep 1.2594	Oct 1.2676	Nov 1.2734	Dec 1.2795	(40)
HLP (average)												1.2705	(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												2.8520 (42)
Average daily hot water use (litres/day)												101.9347 (43)
Daily hot water use	Jan 112.1282	Feb 108.0508	Mar 103.9734	Apr 99.8960	May 95.8187	Jun 91.7413	Jul 91.7413	Aug 95.8187	Sep 99.8960	Oct 103.9734	Nov 108.0508	Dec 112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (45)
Energy content (annual)										Total = Sum(45)m =		1603.8303 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.3351	30.9043	31.8905	27.8029	26.6775	23.0207	21.3321	24.4788	24.7712	28.8684	31.5122	34.2202 (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	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	142.5994	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1026	22.2959	18.1323	13.7273	10.2613	8.6630	9.3607	12.1674	16.3311	20.7361	24.2020	25.8003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5753	284.4971	277.1341	261.4591	241.6722	223.0754	210.6515	207.7297	215.0927	230.7677	250.5545	269.1514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	37.2599	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	47.4934	45.9886	42.8636	38.6151	35.8569	31.9732	28.6721	32.9017	34.4044	38.8017	43.7669	45.9949	(72)
Total internal gains	419.9512	418.5615	403.9098	379.5814	353.5703	329.4914	314.4642	318.5786	331.6080	356.0852	384.3033	406.7264	(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	8.4400	19.6403	0.6300	0.7000	0.7700	50.6596 (76)
South	3.2600	46.7521	0.6300	0.7000	0.7700	46.5790 (78)
West	15.4900	19.6403	0.6300	0.7000	0.7700	92.9759 (80)

Solar gains	190.2145	357.2659	559.9094	784.7001	941.5289	956.8053	913.6733	796.9009	639.6903	415.6882	234.3086	158.3674	(83)
Total gains	610.1657	775.8274	963.8192	1164.2815	1295.0992	1286.2967	1228.1375	1115.4795	971.2983	771.7734	618.6119	565.0938	(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	53.7299	53.8692	54.0064	54.6604	54.7845	55.3698	55.3698	55.4795	55.1429	54.7845	54.5340	54.2745	
alpha	4.5820	4.5913	4.6004	4.6440	4.6523	4.6913	4.6913	4.6986	4.6762	4.6523	4.6356	4.6183	
util living area	0.9989	0.9964	0.9869	0.9492	0.8487	0.6771	0.5141	0.5812	0.8429	0.9798	0.9974	0.9992	(86)
MIT	19.5000	19.7029	20.0348	20.4535	20.7781	20.9449	20.9878	20.9790	20.8429	20.3809	19.8576	19.4696	(87)
Th 2	19.8467	19.8494	19.8519	19.8640	19.8663	19.8769	19.8769	19.8789	19.8728	19.8663	19.8617	19.8569	(88)
util rest of house	0.9985	0.9951	0.9821	0.9300	0.7953	0.5795	0.3894	0.4513	0.7661	0.9691	0.9963	0.9989	(89)
MIT 2	18.4830	18.6873	19.0184	19.4327	19.7223	19.8529	19.8740	19.8733	19.7878	19.3729	18.8519	18.4606	(90)
Living area fraction									fLA = Living area / (4) =			0.1418	(91)
MIT	18.6273	18.8314	19.1626	19.5775	19.8721	20.0078	20.0320	20.0301	19.9375	19.5159	18.9946	18.6038	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6273	18.8314	19.1626	19.5775	19.8721	20.0078	20.0320	20.0301	19.9375	19.5159	18.9946	18.6038	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9979	0.9935	0.9782	0.9240	0.7956	0.5918	0.4071	0.4697	0.7713	0.7713	0.9645	0.9951	0.9985	(94)
Useful gains	608.8569	770.8039	942.7879	1075.7662	1030.4322	761.1772	500.0357	523.9516	749.1646	744.4136	615.5670	564.2414	(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	2171.0070	2105.5592	1908.9303	1590.4088	1214.4753	795.1765	504.6475	532.7201	861.8838	1325.0105	1775.8021	2160.6919	(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	1162.2396	896.9556	718.8099	370.5427	136.9281	0.0000	0.0000	0.0000	0.0000	431.9641	835.3693	1187.7592	(98)
Space heating												5740.5685	(98)
Space heating per m2										(98) / (4) =		48.9642	(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	1382.1923	1088.1088	1115.3063	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8822	0.9341	0.9071	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1219.3814	1016.4160	1011.7005	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1616.9266	1546.4127	1416.8108	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	286.2326	394.3176	301.4021	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											981.9523 (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	71.5581	98.5794	75.3505	0.0000	0.0000	0.0000 (107)
Space cooling											245.4881 (107)
Space cooling per m2											2.0939 (108)
Energy for space heating											48.9642 (99)
Energy for space cooling											2.0939 (108)
Total											51.0581 (109)
Target Fabric Energy Efficiency (TFEE)											58.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3349 (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	0.3517	0.3266	0.3349	0.3182	0.3182	0.3098	0.3014	0.2931	0.2847	0.3098	0.2931	0.3098 (22b)
Effective ac	0.5618	0.5533	0.5561	0.5506	0.5506	0.5480	0.5454	0.5429	0.5405	0.5480	0.5429	0.5480 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			18.0000	1055.1600 (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) = 22182.7044 (34)
189.2076 (35)
11.4857 (36)
(33) + (36) = 92.9686 (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	55.1035	54.2680	54.5397	54.0033	54.0033	53.7454	53.4945	53.2503	53.0131	53.7454	53.2503	53.7454 (38)
Heat transfer coeff	148.0721	147.2367	147.5083	146.9719	146.9719	146.7141	146.4631	146.2190	145.9817	146.7141	146.2190	146.7141 (39)
Average = Sum(39)m / 12 =												146.8155 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2630	1.2559	1.2582	1.2536	1.2536	1.2514	1.2493	1.2472	1.2452	1.2514	1.2472	1.2514 (40)
HLP (average)												1.2523 (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)
2.8520 (42)
101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (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 = 1603.8303 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627 (61)
Total heat required for water heating calculated for each month											
193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (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											
193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
62.1805	54.5803	56.7873	50.1645	48.6194	42.6684	40.2433	45.1748	45.4147	52.0528	55.9729	60.4339 (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	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7566	55.7399	45.3307	34.3183	25.6533	21.6576	23.4018	30.4185	40.8277	51.8401	60.5051	64.5008 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	420.2616	424.6226	413.6330	390.2375	360.7049	332.9483	314.4053	310.0443	321.0339	344.4294	373.9620	401.7185 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639 (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)												
	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796 (71)
Water heating gains (Table 5)												
	83.5760	81.2207	76.3271	69.6729	65.3486	59.2617	54.0904	60.7189	63.0759	69.9635	77.7402	81.2283 (72)
Total internal gains												
	681.5978	676.5868	650.2945	609.2323	566.7105	528.8713	506.9012	516.1854	539.9412	581.2367	627.2110	662.4513 (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				9.1700	25.1925		0.6300		0.7000		0.7700		70.6014 (76)
South				3.5400	56.7559		0.6300		0.7000		0.7700		61.4025 (78)
West				16.8400	25.1925		0.6300		0.7000		0.7700		129.6540 (80)
Solar gains	261.6578	418.5106	660.9714	930.9010	1060.6761	1170.5981	1109.1585	991.8723	797.2227	525.3805	321.3410	214.0886	(83)
Total gains	943.2557	1095.0974	1311.2659	1540.1333	1627.3865	1699.4694	1616.0597	1508.0577	1337.1639	1106.6172	948.5520	876.5399	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.6139	41.8501	41.7730	41.9254	41.9254	41.9991	42.0711	42.1413	42.2098	41.9991	42.1413	41.9991	
alpha	3.7743	3.7900	3.7849	3.7950	3.7950	3.7999	3.8047	3.8094	3.8140	3.7999	3.8094	3.7999	
util living area	0.9815	0.9681	0.9262	0.8266	0.6767	0.4746	0.3491	0.3723	0.6261	0.8750	0.9641	0.9850 (86)	
MIT	19.5899	19.7879	20.1765	20.5957	20.8565	20.9712	20.9931	20.9915	20.9199	20.5733	20.0286	19.5612 (87)	
Th 2	19.8699	19.8756	19.8737	19.8774	19.8774	19.8791	19.8808	19.8824	19.8840	19.8791	19.8824	19.8791 (88)	
util rest of house	0.9768	0.9602	0.9082	0.7876	0.6107	0.3882	0.2510	0.2684	0.5360	0.8353	0.9533	0.9811 (89)	
MIT 2	18.6173	18.8154	19.1882	19.5748	19.7898	19.8674	19.8792	19.8805	19.8452	19.5692	19.0597	18.5964 (90)	
Living area fraction	fLA = Living area / (4) =												0.1418 (91)
MIT	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	19.9976	19.7116	19.1971	18.7333 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	19.9976	19.7116	19.1971	18.7333 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9705	0.9518	0.8977	0.7814	0.6147	0.3997	0.2649	0.2832	0.5458	0.8282	0.9447	0.9756 (94)
Useful gains	915.4384	1042.3465	1177.1363	1203.4828	1000.4038	679.3014	428.1397	427.0247	729.8410	916.5489	896.1027	855.1957 (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												
	2051.5799	2010.2711	1818.5451	1501.9973	1093.6294	693.0710	430.1958	429.6011	773.3545	1219.4284	1651.8525	2014.8622 (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												
	845.2893	650.4453	477.2081	214.9304	69.3598	0.0000	0.0000	0.0000	0.0000	225.3423	544.1398	862.7919 (98)
Space heating												
RHI space heating demand												3889.5071 (98)
												3890 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3349 (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	0.4270	0.4187	0.4103	0.3684	0.3601	0.3182	0.3182	0.3098	0.3349	0.3601	0.3768	0.3935 (22b)
Effective ac	0.5912	0.5876	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			18.0000	1055.1600 (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) = 22182.7044 (34)
189.2076 (35)
11.4857 (36)
(33) + (36) = 92.9686 (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	57.9813	57.6340	57.2936	55.6949	55.3958	54.0033	54.0033	53.7454	54.5397	55.3958	56.0009	56.6335 (38)
Heat transfer coeff	150.9499	150.6026	150.2623	148.6635	148.3644	146.9719	146.9719	146.7141	147.5083	148.3644	148.9695	149.6021 (39)
Average = Sum(39)m / 12 =												148.6621 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2875	1.2846	1.2817	1.2680	1.2655	1.2536	1.2536	1.2514	1.2582	1.2655	1.2706	1.2760 (40)
HLP (average)												1.2680 (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)
2.8520 (42)
101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (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 = 1603.8303 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627 (61)
Total heat required for water heating calculated for each month											
193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (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											
193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (64)
Heat gains from water heating, kWh/month											
62.1805	54.5803	56.7873	50.1645	48.6194	42.6684	40.2433	45.1748	45.4147	52.0528	55.9729	60.4339 (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	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7566	55.7399	45.3307	34.3183	25.6533	21.6576	23.4018	30.4185	40.8277	51.8401	60.5051	64.5008	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2616	424.6226	413.6330	390.2375	360.7049	332.9483	314.4053	310.0443	321.0339	344.4294	373.9620	401.7185	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	83.5760	81.2207	76.3271	69.6729	65.3486	59.2617	54.0904	60.7189	63.0759	69.9635	77.7402	81.2283	(72)
Total internal gains	681.5978	676.5868	650.2945	609.2323	566.7105	528.8713	506.9012	516.1854	539.9412	581.2367	627.2110	662.4513	(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				9.1700	19.6403	0.6300	0.7000	0.7700	55.0413 (76)			
South				3.5400	46.7521	0.6300	0.7000	0.7700	50.5797 (78)			
West				16.8400	19.6403	0.6300	0.7000	0.7700	101.0791 (80)			
Solar gains	206.7000	388.2409	608.4767	852.7932	1023.2488	1039.8574	992.9790	866.0600	695.1876	451.7351	254.6179	172.0913 (83)
Total gains	888.2978	1064.8278	1258.7711	1462.0254	1589.9593	1568.7287	1499.8802	1382.2454	1235.1288	1032.9717	881.8288	834.5426 (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	40.8206	40.9147	41.0074	41.4484	41.5320	41.9254	41.9254	41.9991	41.7730	41.5320	41.3632	41.1883	
alpha	3.7214	3.7276	3.7338	3.7632	3.7688	3.7950	3.7950	3.7999	3.7849	3.7688	3.7575	3.7459	
util living area	0.9865	0.9734	0.9412	0.8632	0.7310	0.5619	0.4209	0.4713	0.7086	0.9145	0.9764	0.9892	(86)
MIT	19.4182	19.6638	20.0426	20.4815	20.7898	20.9427	20.9851	20.9773	20.8620	20.4217	19.8321	19.3725	(87)
Th 2	19.8506	19.8529	19.8552	19.8660	19.8680	19.8774	19.8774	19.8791	19.8737	19.8680	19.8639	19.8597	(88)
util rest of house	0.9831	0.9667	0.9266	0.8308	0.6725	0.4766	0.3182	0.3639	0.6265	0.8863	0.9693	0.9864	(89)
MIT 2	18.4328	18.6762	19.0458	19.4645	19.7301	19.8502	19.8731	19.8720	19.7983	19.4238	18.8534	18.3944	(90)
Living area fraction	18.5725	18.8163	19.1872	19.6087	19.8804	20.0052	20.0308	20.0287	19.9492	19.5654	18.9923	18.5331	(92)
MIT	18.5725	18.8163	19.1872	19.6087	19.8804	20.0052	20.0308	20.0287	19.9492	19.5654	18.9923	18.5331	(93)
Temperature adjustment	18.5725	18.8163	19.1872	19.6087	19.8804	20.0052	20.0308	20.0287	19.9492	19.5654	18.9923	18.5331	(93)
adjusted MIT	18.5725	18.8163	19.1872	19.6087	19.8804	20.0052	20.0308	20.0287	19.9492	19.5654	18.9923	18.5331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9779	0.9589	0.9161	0.8223	0.6732	0.4868	0.3326	0.3788	0.6325	0.8770	0.9621	0.9820	0.9820	(94)
Useful gains	868.6873	1021.0739	1153.1981	1202.2402	1070.3317	763.5806	498.8597	523.5789	781.2480	905.9397	848.4210	819.5068	(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	2154.4387	2095.8348	1906.4096	1591.9986	1213.6850	794.4068	504.2345	532.3880	862.8051	1330.1425	1771.5827	2144.2687	(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	956.5990	722.2393	560.3893	280.6260	106.6548	0.0000	0.0000	0.0000	0.0000	315.6069	664.6765	985.6228	(98)
Space heating												4592.4147	(98)
Space heating per m2												39.1711	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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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	5063.3018 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	956.5990	722.2393	560.3893	280.6260	106.6548	0.0000	0.0000	0.0000	0.0000	315.6069	664.6765	985.6228 (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)	1054.6847	796.2947	617.8493	309.4003	117.5908	0.0000	0.0000	0.0000	0.0000	347.9679	732.8296	1086.6845 (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	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (64)
Efficiency of water heater (217)m	90.2158	90.1520	90.0099	89.6732	89.0287	87.9000	87.9000	87.9000	87.9000	89.7251	90.1019	87.9000 (216)
Fuel for water heating, kWh/month	214.8723	188.9350	197.3397	175.6172	171.9095	153.4970	145.4444	162.3267	162.9016	182.0898	194.1747	208.9950 (219)
Water heating fuel used												2158.1028 (219)
Annual totals kWh/year												
Space heating fuel - main system												5063.3018 (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)												443.3205 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.17 * 853 * 1.00) =									-798.4360			-798.4360 (233)
Total delivered energy for all uses												6941.2890 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5063.3018	3.4800	176.2029 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2158.1028	3.4800	75.1020 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.3205	13.1900	58.4740 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-798.4360	13.1900	-105.3137 (252)
Total energy cost			334.3576 (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] = 0.8656 (257)
SAP value	87.9253
SAP rating (Section 12)	88 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5063.3018	0.2160	1093.6732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2158.1028	0.2160	466.1502 (264)
Space and water heating			1559.8234 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.3205	0.5190	230.0833 (268)
Energy saving/generation technologies			
PV Unit	-798.4360	0.5190	-414.3883 (269)
Total kg/year			1414.4434 (272)
CO2 emissions per m2			12.0600 (273)
EI value			88.3176
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

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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	$3.48 / 0.8923 = 3.900$, stars = 4
Water heating environmental impact	$0.216 / 0.8923 = 0.2421$, 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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3349 (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	0.3517	0.3266	0.3349	0.3182	0.3182	0.3098	0.3014	0.2931	0.2847	0.3098	0.2931	0.3098 (22b)
Effective ac	0.5618	0.5533	0.5561	0.5506	0.5506	0.5480	0.5454	0.5429	0.5405	0.5480	0.5429	0.5480 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			18.0000	1055.1600 (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) = 22182.7044 (34)
189.2076 (35)
11.4857 (36)
(33) + (36) = 92.9686 (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	55.1035	54.2680	54.5397	54.0033	54.0033	53.7454	53.4945	53.2503	53.0131	53.7454	53.2503	53.7454 (38)
Heat transfer coeff	148.0721	147.2367	147.5083	146.9719	146.9719	146.7141	146.4631	146.2190	145.9817	146.7141	146.2190	146.7141 (39)
Average = Sum(39)m / 12 =												146.8155 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2630	1.2559	1.2582	1.2536	1.2536	1.2514	1.2493	1.2472	1.2452	1.2514	1.2472	1.2514 (40)
HLP (average)												1.2523 (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)
2.8520 (42)
101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (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 = 1603.8303 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627 (61)
Total heat required for water heating calculated for each month											
193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (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											
193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (64)
Heat gains from water heating, kWh/month											
62.1805	54.5803	56.7873	50.1645	48.6194	42.6684	40.2433	45.1748	45.4147	52.0528	55.9729	60.4339 (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	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7566	55.7399	45.3307	34.3183	25.6533	21.6576	23.4018	30.4185	40.8277	51.8401	60.5051	64.5008	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2616	424.6226	413.6330	390.2375	360.7049	332.9483	314.4053	310.0443	321.0339	344.4294	373.9620	401.7185	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	83.5760	81.2207	76.3271	69.6729	65.3486	59.2617	54.0904	60.7189	63.0759	69.9635	77.7402	81.2283	(72)
Total internal gains	681.5978	676.5868	650.2945	609.2323	566.7105	528.8713	506.9012	516.1854	539.9412	581.2367	627.2110	662.4513	(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	9.1700				25.1925		0.6300		0.7000		0.7700		70.6014 (76)
South	3.5400				56.7559		0.6300		0.7000		0.7700		61.4025 (78)
West	16.8400				25.1925		0.6300		0.7000		0.7700		129.6540 (80)
Solar gains	261.6578	418.5106	660.9714	930.9010	1060.6761	1170.5981	1109.1585	991.8723	797.2227	525.3805	321.3410	214.0886	(83)
Total gains	943.2557	1095.0974	1311.2659	1540.1333	1627.3865	1699.4694	1616.0597	1508.0577	1337.1639	1106.6172	948.5520	876.5399	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.6139	41.8501	41.7730	41.9254	41.9254	41.9991	42.0711	42.1413	42.2098	41.9991	42.1413	41.9991
alpha	3.7743	3.7900	3.7849	3.7950	3.7950	3.7999	3.8047	3.8094	3.8140	3.7999	3.8094	3.7999
util living area	0.9815	0.9681	0.9262	0.8266	0.6767	0.4746	0.3491	0.3723	0.6261	0.8750	0.9641	0.9850 (86)
MIT	19.5899	19.7879	20.1765	20.5957	20.8565	20.9712	20.9931	20.9915	20.9199	20.5733	20.0286	19.5612 (87)
Th 2	19.8699	19.8756	19.8737	19.8774	19.8774	19.8791	19.8808	19.8824	19.8840	19.8791	19.8824	19.8791 (88)
util rest of house	0.9768	0.9602	0.9082	0.7876	0.6107	0.3882	0.2510	0.2684	0.5360	0.8353	0.9533	0.9811 (89)
MIT 2	18.6173	18.8154	19.1882	19.5748	19.7898	19.8674	19.8792	19.8805	19.8452	19.5692	19.0597	18.5964 (90)
Living area fraction	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	fLA = Living area / (4) =	19.9976	19.7116	19.1971
MIT	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	19.9976	19.7116	19.1971	18.7333 (91)
Temperature adjustment												0.0000
adjusted MIT	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	19.9976	19.7116	19.1971	18.7333 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	915.4384	1042.3465	1177.1363	1203.4828	1000.4038	679.3014	428.1397	427.0247	729.8410	916.5489	896.1027	855.1957	(94)
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	2051.5799	2010.2711	1818.5451	1501.9973	1093.6294	693.0710	430.1958	429.6011	773.3545	1219.4284	1651.8525	2014.8622	(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	845.2893	650.4453	477.2081	214.9304	69.3598	0.0000	0.0000	0.0000	0.0000	225.3423	544.1398	862.7919	(98)
Space heating												3889.5071	(98)
Space heating per m2												(98) / (4) =	33.1756 (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													4288.3209	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	845.2893	650.4453	477.2081	214.9304	69.3598	0.0000	0.0000	0.0000	0.0000	225.3423	544.1398	862.7919	(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)	931.9618	717.1393	526.1391	236.9685	76.4717	0.0000	0.0000	0.0000	0.0000	248.4480	599.9337	951.2590	(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	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936	(64)	
Efficiency of water heater (217)m	90.1642	90.1044	89.9230	89.4945	88.7545	87.9000	87.9000	87.9000	87.9000	89.5017	90.0025	90.1847	(216)	
Fuel for water heating, kWh/month	214.9951	189.0348	197.5304	175.9679	172.4407	153.4970	145.4444	162.3267	162.9016	182.5443	194.3893	209.1193	(219)	
Water heating fuel used												2160.1915	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4288.3209	(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)													443.3205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.17 * 967 * 1.00) =										-904.9154			-904.9154	(233)
Total delivered energy for all uses													6061.9175	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4288.3209	9.7400	417.6825 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2160.1915	9.7400	210.4027 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	443.3205	36.8500	163.3636 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-904.9154	36.8500	-333.4613 (252)
Total energy cost			589.6249 (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	4288.3209	0.2160	926.2773 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2160.1915	0.2160	466.6014 (264)
Space and water heating			1392.8787 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.3205	0.5190	230.0833 (268)
Energy saving/generation technologies			
PV Unit	-904.9154	0.5190	-469.6511 (269)
Total kg/year			1192.2359 (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	4288.3209	1.2200	5231.7515 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2160.1915	1.2200	2635.4336 (264)
Space and water heating			7867.1852 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	443.3205	3.0700	1360.9938 (268)
Energy saving/generation technologies			
PV Unit	-904.9154	3.0700	-2778.0902 (269)
Primary energy kWh/year			6680.3388 (272)
Primary energy kWh/m2/year			56.9800 (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 88
Current environmental impact rating: B 88

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 82	-197 kg (16.5%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£82	1.68 kg/m²	B 89	B 90
Total Savings	£82	1.68 kg/m²		
Potential energy efficiency rating:			B 89	
Potential environmental impact rating:				B 90

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 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	£191	£209	-£18
Mains gas	£732	£631	£101
Space heating	£549	£549	£0
Water heating	£210	£128	£82
Lighting	£163	£163	£0
Generated (PV)	-£333	-£333	£0
Total cost of fuels	£590	£507	£83
Total cost of uses	£589	£507	£82
Delivered energy	52 kWh/m²	43 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	48 kWh/m²	9 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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3349 (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	0.4270	0.4187	0.4103	0.3684	0.3601	0.3182	0.3182	0.3098	0.3349	0.3601	0.3768	0.3935 (22b)
Effective ac	0.5912	0.5876	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			18.0000	1055.1600 (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) = 22182.7044 (34)
189.2076 (35)
11.4857 (36)
(33) + (36) = 92.9686 (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	57.9813	57.6340	57.2936	55.6949	55.3958	54.0033	54.0033	53.7454	54.5397	55.3958	56.0009	56.6335 (38)
Heat transfer coeff	150.9499	150.6026	150.2623	148.6635	148.3644	146.9719	146.9719	146.7141	147.5083	148.3644	148.9695	149.6021 (39)
Average = Sum(39)m / 12 =												148.6621 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2875	1.2846	1.2817	1.2680	1.2655	1.2536	1.2536	1.2514	1.2582	1.2655	1.2706	1.2760 (40)
HLP (average)												1.2680 (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)
2.8520 (42)
101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (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 = 1603.8303 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1308 (H8)
Utilisation factor												0.5870 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9347 (H14)
Volume ratio Veff/V												0.7358 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input												-878.6520 (H17)
Solar input	-25.4792	-42.5174	-72.4120	-97.0463	-119.8926	-117.8735	-116.3157	-101.6256	-79.5933	-54.3528	-30.2219	-21.3217 (63)
												Solar input (sum of months) = Sum (63)m = -878.6520 (63)
Output from w/h	168.3695	127.8112	105.2133	60.4352	33.1563	17.0503	11.5299	41.0595	63.5973	109.0274	144.7333	167.2719 (64)
												Total per year (kWh/year) = Sum (64)m = 1049.2552 (64)
Heat gains from water heating, kWh/month	62.1805	54.5803	56.7873	50.1645	48.6194	42.6684	40.2433	45.1748	45.4147	52.0528	55.9729	60.4339 (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	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7566	55.7399	45.3307	34.3183	25.6533	21.6576	23.4018	30.4185	40.8277	51.8401	60.5051	64.5008	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2616	424.6226	413.6330	390.2375	360.7049	332.9483	314.4053	310.0443	321.0339	344.4294	373.9620	401.7185	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	83.5760	81.2207	76.3271	69.6729	65.3486	59.2617	54.0904	60.7189	63.0759	69.9635	77.7402	81.2283	(72)
Total internal gains	681.5978	676.5868	650.2945	609.2323	566.7105	528.8713	506.9012	516.1854	539.9412	581.2367	627.2110	662.4513	(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	9.1700	19.6403	0.6300	0.7000	0.7700	55.0413 (76)
South	3.5400	46.7521	0.6300	0.7000	0.7700	50.5797 (78)
West	16.8400	19.6403	0.6300	0.7000	0.7700	101.0791 (80)

Solar gains	206.7000	388.2409	608.4767	852.7932	1023.2488	1039.8574	992.9790	866.0600	695.1876	451.7351	254.6179	172.0913	(83)
Total gains	888.2978	1064.8278	1258.7711	1462.0254	1589.9593	1568.7287	1499.8802	1382.2454	1235.1288	1032.9717	881.8288	834.5426	(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	40.8206	40.9147	41.0074	41.4484	41.5320	41.9254	41.9254	41.9991	41.7730	41.5320	41.3632	41.1883
alpha	3.7214	3.7276	3.7338	3.7632	3.7688	3.7950	3.7950	3.7999	3.7849	3.7688	3.7575	3.7459
util living area	0.9865	0.9734	0.9412	0.8632	0.7310	0.5619	0.4209	0.4713	0.7086	0.9145	0.9764	0.9892 (86)
MIT	19.4182	19.6638	20.0426	20.4815	20.7898	20.9427	20.9851	20.9773	20.8620	20.4217	19.8321	19.3725 (87)
Th 2	19.8506	19.8529	19.8552	19.8660	19.8680	19.8774	19.8774	19.8791	19.8737	19.8680	19.8639	19.8597 (88)
util rest of house	0.9831	0.9667	0.9266	0.8308	0.6725	0.4766	0.3182	0.3639	0.6265	0.8863	0.9693	0.9864 (89)
MIT 2	18.4328	18.6762	19.0458	19.4645	19.7301	19.8502	19.8731	19.8720	19.7983	19.4238	18.8534	18.3944 (90)
Living area fraction												fLA = Living area / (4) = 0.1418 (91)
MIT	18.5725	18.8163	19.1872	19.6087	19.8804	20.0052	20.0308	20.0287	19.9492	19.5654	18.9923	18.5331 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5725	18.8163	19.1872	19.6087	19.8804	20.0052	20.0308	20.0287	19.9492	19.5654	18.9923	18.5331 (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	0.9779	0.9589	0.9161	0.8223	0.6732	0.4868	0.3326	0.3788	0.6325	0.8770	0.9621	0.9820	(94)
Useful gains	868.6873	1021.0739	1153.1981	1202.2402	1070.3317	763.5806	498.8597	523.5789	781.2480	905.9397	848.4210	819.5068	(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	2154.4387	2095.8348	1906.4096	1591.9986	1213.6850	794.4068	504.2345	532.3880	862.8051	1330.1425	1771.5827	2144.2687	(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	956.5990	722.2393	560.3893	280.6260	106.6548	0.0000	0.0000	0.0000	0.0000	315.6069	664.6765	985.6228	(98)
Space heating												4592.4147	(98)
Space heating per m2											(98) / (4) =	39.1711	(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													5063.3018 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	956.5990	722.2393	560.3893	280.6260	106.6548	0.0000	0.0000	0.0000	0.0000	315.6069	664.6765	985.6228	(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)	1054.6847	796.2947	617.8493	309.4003	117.5908	0.0000	0.0000	0.0000	0.0000	347.9679	732.8296	1086.6845	(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	168.3695	127.8112	105.2133	60.4352	33.1563	17.0503	11.5299	41.0595	63.5973	109.0274	144.7333	167.2719	(64)
Efficiency of water heater	90.2696	90.2677	90.2456	90.1909	90.0200	87.9000	87.9000	87.9000	87.9000	89.9642	90.1863	90.2827	(216)
(217)m	186.5184	141.5914	116.5855	67.0081	36.8321	19.3974	13.1171	46.7116	72.3518	121.1898	160.4825	185.2756	(219)
Fuel for water heating, kWh/month	186.5184	141.5914	116.5855	67.0081	36.8321	19.3974	13.1171	46.7116	72.3518	121.1898	160.4825	1167.0615	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												5063.3018	(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)													443.3205 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.17 * 853 * 1.00) =										-798.4360		-798.4360	(233)
Total delivered energy for all uses												6000.2478	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5063.3018	3.4800	176.2029 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1167.0615	3.4800	40.6137 (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	443.3205	13.1900	58.4740 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-798.4360	13.1900	-105.3137 (252)
Total energy cost			306.4644 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.7934 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.9326
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	5063.3018	0.2160	1093.6732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.0615	0.2160	252.0853 (264)
Space and water heating			1345.7585 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	443.3205	0.5190	230.0833 (268)
Energy saving/generation technologies			
PV Unit	-798.4360	0.5190	-414.3883 (269)
Total kg/year			1226.3285 (272)
CO2 emissions per m2			10.4600 (273)
EI value			89.8713
EI rating			90 (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	58.6200 (1b)	x 2.3900 (2b)	= 140.1018 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2034 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3621 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3349 (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	0.3517	0.3266	0.3349	0.3182	0.3182	0.3098	0.3014	0.2931	0.2847	0.3098	0.2931	0.3098 (22b)
Effective ac	0.5618	0.5533	0.5561	0.5506	0.5506	0.5480	0.5454	0.5429	0.5405	0.5480	0.5429	0.5480 (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)			29.5500	1.1450	33.8359		(27)
Ground Floor			58.6200	0.1100	6.4482	140.0000	8206.8000 (28a)
Brick and Block	150.6000	29.4700	121.1300	0.2400	29.0712	42.2200	5114.1086 (29a)
Cladding	18.5900	2.2000	16.3900	0.2400	3.9336	42.2200	691.9858 (29a)
Pitched Roof	58.6200		58.6200	0.1000	5.8620	9.0000	527.5800 (30)
Total net area of external elements Aum(A, m ²)			286.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4829		(33)
Ground Floor Block			50.7500			75.0000	3806.2500 (32c)
Ground Floor Stud			45.9800			9.0000	413.8200 (32c)
First Floor Stud			145.7600			9.0000	1311.8400 (32c)
Internal Floor 1			58.6200			18.0000	1055.1600 (32d)
Internal Ceiling 1			58.6200			18.0000	1055.1600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 22182.7044 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2076 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4857 (36)
Total fabric heat loss							(33) + (36) = 92.9686 (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	55.1035	54.2680	54.5397	54.0033	54.0033	53.7454	53.4945	53.2503	53.0131	53.7454	53.2503	53.7454 (38)
Heat transfer coeff	148.0721	147.2367	147.5083	146.9719	146.9719	146.7141	146.4631	146.2190	145.9817	146.7141	146.2190	146.7141 (39)
Average = Sum(39)m / 12 =												146.8155 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2630	1.2559	1.2582	1.2536	1.2536	1.2514	1.2493	1.2472	1.2452	1.2514	1.2472	1.2514 (40)
HLP (average)												1.2523 (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	2.8520 (42)
Average daily hot water use (litres/day)	101.9347 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1282	108.0508	103.9734	99.8960	95.8187	91.7413	91.7413	95.8187	99.8960	103.9734	108.0508	112.1282 (44)
Energy conte	166.2829	145.4321	150.0729	130.8372	125.5414	108.3327	100.3861	115.1946	116.5704	135.8515	148.2925	161.0361 (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 = 1603.8303 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9424	21.8148	22.5109	19.6256	18.8312	16.2499	15.0579	17.2792	17.4856	20.3777	22.2439	24.1554 (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	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8487	170.3286	177.6253	157.4816	153.0488	134.9238	127.8456	142.6851	143.1905	163.3803	174.9552	188.5936 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2655 (H8)
Utilisation factor												0.5462 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9347 (H14)
Volume ratio Veff/V												0.7358 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input												-915.0430 (H17)
Solar input	-29.8509	-42.4461	-72.9547	-98.4327	-115.6151	-123.4952	-120.8981	-108.2075	-84.7190	-58.5718	-35.3058	-24.5461 (63)
												Solar input (sum of months) = Sum (63)m = -915.0430 (63)
Output from w/h	163.9978	127.8825	104.6706	59.0488	37.4337	11.4286	6.9475	34.4777	58.4715	104.8085	139.6494	164.0475 (64)
												Total per year (kWh/year) = Sum (64)m = 1012.8641 (64)
Heat gains from water heating, kWh/month	62.1805	54.5803	56.7873	50.1645	48.6194	42.6684	40.2433	45.1748	45.4147	52.0528	55.9729	60.4339 (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	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	171.1193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7566	55.7399	45.3307	34.3183	25.6533	21.6576	23.4018	30.4185	40.8277	51.8401	60.5051	64.5008	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2616	424.6226	413.6330	390.2375	360.7049	332.9483	314.4053	310.0443	321.0339	344.4294	373.9620	401.7185	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	54.9639	(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)	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	-114.0796	(71)
Water heating gains (Table 5)	83.5760	81.2207	76.3271	69.6729	65.3486	59.2617	54.0904	60.7189	63.0759	69.9635	77.7402	81.2283	(72)
Total internal gains	681.5978	676.5868	650.2945	609.2323	566.7105	528.8713	506.9012	516.1854	539.9412	581.2367	627.2110	662.4513	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East	9.1700	25.1925	0.6300		0.7000	0.7700	70.6014	(76)
South	3.5400	56.7559	0.6300		0.7000	0.7700	61.4025	(78)
West	16.8400	25.1925	0.6300		0.7000	0.7700	129.6540	(80)

Solar gains	261.6578	418.5106	660.9714	930.9010	1060.6761	1170.5981	1109.1585	991.8723	797.2227	525.3805	321.3410	214.0886	(83)
Total gains	943.2557	1095.0974	1311.2659	1540.1333	1627.3865	1699.4694	1616.0597	1508.0577	1337.1639	1106.6172	948.5520	876.5399	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.6139	41.8501	41.7730	41.9254	41.9254	41.9991	42.0711	42.1413	42.2098	41.9991	42.1413	41.9991
alpha	3.7743	3.7900	3.7849	3.7950	3.7950	3.7999	3.8047	3.8094	3.8140	3.7999	3.8094	3.7999
util living area	0.9815	0.9681	0.9262	0.8266	0.6767	0.4746	0.3491	0.3723	0.6261	0.8750	0.9641	0.9850 (86)
MIT	19.5899	19.7879	20.1765	20.5957	20.8565	20.9712	20.9931	20.9915	20.9199	20.5733	20.0286	19.5612 (87)
Th 2	19.8699	19.8756	19.8737	19.8774	19.8774	19.8791	19.8808	19.8824	19.8840	19.8791	19.8824	19.8791 (88)
util rest of house	0.9768	0.9602	0.9082	0.7876	0.6107	0.3882	0.2510	0.2684	0.5360	0.8353	0.9533	0.9811 (89)
MIT 2	18.6173	18.8154	19.1882	19.5748	19.7898	19.8674	19.8792	19.8805	19.8452	19.5692	19.0597	18.5964 (90)
Living area fraction												fLA = Living area / (4) = 0.1418 (91)
MIT	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	19.9976	19.7116	19.1971	18.7333 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7553	18.9533	19.3284	19.7196	19.9411	20.0240	20.0372	20.0381	19.9976	19.7116	19.1971	18.7333 (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	0.9705	0.9518	0.8977	0.7814	0.6147	0.3997	0.2649	0.2832	0.5458	0.8282	0.9447	0.9756	(94)
Useful gains	915.4384	1042.3465	1177.1363	1203.4828	1000.4038	679.3014	428.1397	427.0247	729.8410	916.5489	896.1027	855.1957	(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	2051.5799	2010.2711	1818.5451	1501.9973	1093.6294	693.0710	430.1958	429.6011	773.3545	1219.4284	1651.8525	2014.8622	(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	845.2893	650.4453	477.2081	214.9304	69.3598	0.0000	0.0000	0.0000	0.0000	225.3423	544.1398	862.7919	(98)
Space heating												3889.5071	(98)
Space heating per m2											(98) / (4) =	33.1756	(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													4288.3209	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	845.2893	650.4453	477.2081	214.9304	69.3598	0.0000	0.0000	0.0000	0.0000	225.3423	544.1398	862.7919	(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)	931.9618	717.1393	526.1391	236.9685	76.4717	0.0000	0.0000	0.0000	0.0000	248.4480	599.9337	951.2590	(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	163.9978	127.8825	104.6706	59.0488	37.4337	11.4286	6.9475	34.4777	58.4715	104.8085	139.6494	164.0475	(64)	
Efficiency of water heater	90.2330	90.2278	90.1832	90.0816	89.6985	87.9000	87.9000	87.9000	87.9000	89.7920	90.1138	90.2408	(217)	
Fuel for water heating, kWh/month	181.7493	141.7330	116.0644	65.5504	41.7328	13.0018	7.9039	39.2237	66.5205	116.7236	154.9702	181.7886	(219)	
Water heating fuel used												1126.9623	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4288.3209	(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)													443.3205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.17 * 967 * 1.00) =										-904.9154		-904.9154	(233)	
Total delivered energy for all uses												5078.6883	(238)	

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4288.3209	9.7400	417.6825	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1126.9623	9.7400	109.7661	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	443.3205	36.8500	163.3636	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-904.9154	36.8500	-333.4613	(252)
Total energy cost			507.4134	(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	4288.3209	0.2160	926.2773	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1126.9623	0.2160	243.4239	(264)
Space and water heating			1169.7012	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	443.3205	0.5190	230.0833	(268)
Energy saving/generation technologies				
PV Unit	-904.9154	0.5190	-469.6511	(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

995.0084 (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	4288.3209	1.2200	5231.7515 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1126.9623	1.2200	1374.8940 (264)
Space and water heating			6606.6456 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	443.3205	3.0700	1360.9938 (268)
Energy saving/generation technologies			
PV Unit	-904.9154	3.0700	-2778.0902 (269)
Primary energy kWh/year			5573.2992 (272)
Primary energy kWh/m2/year			47.5375 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 34	Issued on Date	26/05/2023
Assessment Reference	As Built	Prop Type Ref	Bh
Project	8 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.43
Environmental	88 B	% DER<TER	21.87		
CO ₂ Emissions (t/year)	1.19	DFEE	49.50	TFEE	58.72
General Requirements Compliance	Pass	% DFEE<TFEE	15.69		

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 000004 - 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 34	Issued on Date	26/05/2023
Assessment Reference	As Built	Prop Type Ref	Bh
Project	8 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.43
Environmental	88 B	% DER<TER	21.87		
CO ₂ Emissions (t/year)	1.19	DFEE	49.50	TFEE	58.72
General Requirements Compliance	Pass	% DFEE<TFEE	15.69		

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 000006

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 34	Issued on Date	26/05/2023
Assessment Reference	As Built	Prop Type Ref	Bh
Project	8 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.43
Environmental	88 B	% DER<TER	21.87		
CO ₂ Emissions (t/year)	1.19	DFEE	49.50	TFEE	58.72
General Requirements Compliance	Pass	% DFEE<TFEE	15.69		

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 000009

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 34	Issued on Date	26/05/2023
Assessment Reference	As Built	Prop Type Ref	Bh
Project	8 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.43
Environmental	88 B	% DER<TER	21.87		
CO ₂ Emissions (t/year)	1.19	DFEE	49.50	TFEE	58.72
General Requirements Compliance	Pass	% DFEE<TFEE	15.69		

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 000008 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 58.62 m², Perimeter = 33.37 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 m² K/W Lower limit = 5.066 m² K/W Average = 7.579 m² K/W

Total correction = 0.0025 m² K/W

U-value (unrounded) = 0.11 W/m² 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 34	Issued on Date	26/05/2023
Assessment Reference	As Built	Prop Type Ref	Bh
Property	8 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
SAP Rating	88 B	DER	13.62
Environmental	88 B	TER	17.43
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.87
General Requirements Compliance	Pass	DFEE	49.50
		TFEE	58.72
		% DFEE<TFEE	15.69
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	East						
Property Tenure	Unknown						
Transaction Type	New dwelling						
Terrain Type	Suburban						
1.0 Property Type	House, Detached						
2.0 Number of Storeys	2						
3.0 Date Built	2019						
4.0 Sheltered Sides	1						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
			Heat Loss Perimeter		Internal Floor Area	Average Storey Height	
		Ground Floor:	33.37 m		58.62 m²	2.39 m	
		1st Storey:	33.37 m		58.62 m²	2.68 m	
7.0 Living Area	16.63			m²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	189.21			kJ/m²K			
9.0 External Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Brick and Block	Cavity Wall	Other		0.24	42.22	150.60	121.13
Cladding	Cavity Wall	Other		0.24	42.22	18.59	16.39
9.2 Internal Walls							
Description	Construction					Kappa (kJ/m²K)	Area (m²)
Ground Floor Block	Dense block, plasterboard on dabs					75.00	50.75
Ground Floor Stud	Plasterboard on timber frame					9.00	45.98
First Floor Stud	Plasterboard on timber frame					9.00	145.76
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	58.62	58.62
10.2 Internal Ceilings							
Description	Construction					Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor					9.00	58.62

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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	58.62

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	58.62

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
East Elevation	Half Glazed Door	[1] Brick and Block	East							2.12	
East Elevation	Window	[1] Brick and Block	East	None	1.24	Yes				1.92	
East Elevation	Window	[1] Brick and Block	East	None	0.00					5.05	
East Elevation	Window	[2] Cladding	East	None	0.00					2.20	
West Elevation	Window	[1] Brick and Block	West	None	0.00					16.84	
South Elevation	Window	[1] Brick and Block	South	None	0.00					3.54	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	21.99	0.274	No	Knauf P3
Independently assessed	E3 Sill	15.44	0.021	No	Knauf P5
Independently assessed	E4 Jamb	47.10	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	33.37	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	33.37	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	19.90	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	13.47	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	25.32	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.06	-0.091	No	Knauf P24

Y-value	0.040	W/m²K
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18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				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	23	
Total number of L.E.L. fittings	23	
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

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

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.17	West	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	£82	B 89	