



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 7, Fieldfare Crescent
Botley, Southampton, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 12/09/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 33			Issued on Date	12/09/2023
Assessment Reference	As Built	Prop Type Ref	B		
Property	7, Fieldfare Crescent , Botley, Southampton, SO32 2TW				
SAP Rating	88 B	DER	13.42	TER	17.64
Environmental	89 B	% DER<TER	23.94		
CO ₂ Emissions (t/year)	1.17	DFEE	48.41	TFEE	59.74
General Requirements Compliance	Pass	% DFEE<TFEE	18.97		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As 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)	17.64	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.42	kgCO ₂ /m ²	Pass
	-4.22 (-23.9%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	59.74	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	48.41	kWh/m ² /yr	
	-11.3 (-18.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
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	4.58 (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 North

0.66 m², No overhang

Windows facing East

9.17 m², Overhang twice as wide as window, ratio 1.11

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

4.58 (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

Thermal bridging y-value

0.024 W/m²K

Photovoltaic array

1.17 kW

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THERMAL BRIDGING

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SAP Rating	88 B	DER	13.42
Environmental	89 B	TER	17.64
CO ₂ Emissions (t/year)	1.17	% DER<TER	23.94
General Requirements Compliance	Pass	DFEE	48.41
		TFEE	59.74
		% DFEE<TFEE	18.97
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.26	0.10	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	9.25	0.66	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.54	0.23	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	5.54	0.31	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	13.04	0.27	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	42.30	0.68	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	33.36	2.07	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	33.36	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	19.97	1.20	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	13.39	0.72	
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: **6.76** W/mK:
Y-Value: **0.024** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	18.97		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS BUILT

Detached House, total floor area 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) 17.64 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.42 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.4 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: 4.58 (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 North: 0.66 m², No overhang
Windows facing East: 9.17 m², Overhang twice as wide as window, ratio 1.11
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
Thermal bridging y-value 0.024 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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =	0.3364 (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	0.4290	0.4206	0.4121	0.3701	0.3617	0.3196	0.3196	0.3112	0.3364	0.3617	0.3785	0.3953 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5781 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			18.0000	1054.0800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 22310.5270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.4929 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7578 (36)
Total fabric heat loss							(33) + (36) = 85.6096 (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	58.0029	57.6529	57.3098	55.6982	55.3967	53.9930	53.9930	53.7331	54.5337	55.3967	56.0066	56.6443 (38)
Heat transfer coeff	143.6125	143.2625	142.9194	141.3078	141.0062	139.6026	139.6026	139.3426	140.1432	141.0062	141.6162	142.2539 (39)
Average = Sum(39)m / 12 =												141.3063 (39)
HLP	1.2262	1.2232	1.2203	1.2065	1.2039	1.1920	1.1920	1.1897	1.1966	1.2039	1.2092	1.2146 (40)
HLP (average)												1.2065 (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												2.8515 (42)
Average daily hot water use (litres/day)												101.9223 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (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 = 1603.6345 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525 (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	26.6443	27.5074	26.5911	27.4595	27.4905	26.6201	27.5288	26.6626	27.5575 (61)
Total heat required for water heating calculated for each month	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (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	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (64)
	Total per year (kWh/year) = Sum(64)m = 1927.7110 (64)											
Heat gains from water heating, kWh/month	62.1738	54.5744	56.7812	50.1591	48.6143	42.6640	40.2392	45.1702	45.4099	52.0473	55.9669	60.4273 (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	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.0884	22.2833	18.1220	13.7195	10.2555	8.6581	9.3554	12.1605	16.3218	20.7243	24.1883	25.7856	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.4150	284.3352	276.9764	261.3103	241.5347	222.9484	210.5316	207.6114	214.9703	230.6363	250.4119	268.9982	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	83.5669	81.2119	76.3189	69.6655	65.3417	59.2555	54.0849	60.7126	63.0694	69.9560	77.7318	81.2195	(72)
Total internal gains	458.8422	456.6023	440.1892	413.4672	385.9039	359.6340	342.7439	349.2565	363.1334	390.0886	421.1040	444.7754	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.6600	10.6334	0.6300	0.7000	0.7700		2.1448 (74)	
East					9.1700	19.6403	0.6300	0.7000	0.7700		55.0413 (76)	
West					16.8400	19.6403	0.6300	0.7000	0.7700		101.0791 (80)	
Solar gains	158.2651	309.5033	509.9226	744.7213	914.0438	936.3925	891.1868	764.5280	593.3347	367.2673	197.3096	130.1738 (83)
Total gains	617.1073	766.1056	950.1118	1158.1885	1299.9477	1296.0266	1233.9307	1113.7845	956.4681	757.3559	618.4136	574.9491 (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	43.1534	43.2588	43.3627	43.8572	43.9510	44.3929	44.3929	44.4758	44.2217	43.9510	43.7617	43.5655
alpha	3.8769	3.8839	3.8908	3.9238	3.9301	3.9595	3.9595	3.9651	3.9481	3.9301	3.9174	3.9044
util living area	0.9961	0.9907	0.9734	0.9180	0.8006	0.6311	0.4815	0.5463	0.8022	0.9625	0.9926	0.9971 (86)
MIT	19.2679	19.4961	19.8841	20.3693	20.7359	20.9260	20.9803	20.9682	20.8048	20.2803	19.6795	19.2313 (87)
Th 2	19.8991	19.9015	19.9038	19.9148	19.9168	19.9264	19.9264	19.9282	19.9227	19.9168	19.9127	19.9083 (88)
util rest of house	0.9951	0.9882	0.9660	0.8953	0.7489	0.5448	0.3714	0.4316	0.7302	0.9479	0.9902	0.9963 (89)
MIT 2	18.3199	18.5487	18.9335	19.4081	19.7362	19.8897	19.9205	19.9175	19.8078	19.3354	18.7409	18.2904 (90)
Living area fraction									fLA = Living area / (4) =			0.1417 (91)
MIT	18.4542	18.6830	19.0682	19.5443	19.8779	20.0366	20.0707	20.0664	19.9491	19.4693	18.8739	18.4238 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4542	18.6830	19.0682	19.5443	19.8779	20.0366	20.0707	20.0664	19.9491	19.4693	18.8739	18.4238 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9844	0.9586	0.8861	0.7469	0.5542	0.3867	0.4472	0.7322	0.9400	0.9870	0.9947	(94)
Useful gains	612.8671	754.1295	910.8115	1026.2220	970.8664	718.3055	477.1811	498.0425	700.3463	711.9146	610.3622	571.9165	(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													
	2032.7274	1974.5827	1796.2395	1504.1247	1153.1396	758.9650	484.5174	510.8914	819.7101	1250.6270	1667.3749	2023.3854	(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													
	1056.3761	820.1445	658.7585	344.0900	135.6112	0.0000	0.0000	0.0000	0.0000	400.8021	761.0491	1079.8928	(98)
Space heating													
Space heating per m2												5256.7243	(98)
	(98) / (4) =											44.8832	(99)

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													5795.7269	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1056.3761	820.1445	658.7585	344.0900	135.6112	0.0000	0.0000	0.0000	0.0000	400.8021	761.0491	1079.8928	(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)	1164.6925	904.2387	726.3048	379.3715	149.5162	0.0000	0.0000	0.0000	0.0000	441.8986	839.0839	1190.6206	(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	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739	(64)	
Efficiency of water heater (217)m	90.2543	90.2059	90.0906	89.8019	89.1936	87.9000	87.9000	87.9000	87.9000	89.8710	90.1632	90.2725	(216)	
Fuel for water heating, kWh/month	214.7581	188.8023	197.1426	175.3477	171.5744	153.4819	145.4304	162.3106	162.8854	181.7757	194.0227	208.8941	(219)	
Water heating fuel used												2156.4259	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5795.7269	(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)													443.0681	(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													7671.7848	(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	5795.7269	0.2160	1251.8770	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2156.4259	0.2160	465.7880	(264)
Space and water heating			1717.6650	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.0681	0.5190	229.9524	(268)
Energy saving/generation technologies				
PV Unit	-798.4360	0.5190	-414.3883	(269)
Total CO2, kg/year			1572.1541	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4200	(273)

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

DER			13.4200	ZC1
Total Floor Area		TFA	117.1200	
Assumed number of occupants		N	2.8515	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			14.2384	ZC2
CO2 emissions from cooking, equation (L16)			1.6004	ZC3
Total CO2 emissions			29.2588	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			29.2588	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3847 (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) =	0.3559 (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	0.4537	0.4448	0.4359	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4181 (22b)
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5571	0.5571	0.5542	0.5633	0.5732	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)			26.6700	1.3258	35.3580		(27)
Ground Floor			58.5600	0.1300	7.6128		(28a)
Brick and Block	151.1700	26.5900	124.5800	0.1800	22.4244		(29a)
Timber Clad	17.9700	2.2000	15.7700	0.1800	2.8386		(29a)
Pitched Roof	58.5600		58.5600	0.1300	7.6128		(30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3906		(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)							12.9091 (36)
Total fabric heat loss						(33) + (36) =	91.2997 (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	59.0739	58.6823	58.2984	56.4953	56.1580	54.5876	54.5876	54.2968	55.1925	56.1580	56.8404	57.5539 (38)
Heat transfer coeff	150.3736	149.9819	149.5981	147.7950	147.4576	145.8872	145.8872	145.5964	146.4921	147.4576	148.1401	148.8536 (39)
Average = Sum(39)m / 12 =												147.7934 (39)
HLP	1.2839	1.2806	1.2773	1.2619	1.2590	1.2456	1.2456	1.2431	1.2508	1.2590	1.2649	1.2709 (40)
HLP (average)												1.2619 (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												2.8515 (42)
Average daily hot water use (litres/day)												101.9223 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy content (annual)	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525 (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	49.2578	48.8222	45.2367	46.7446	48.8222	49.2578	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	217.2215	191.4417	201.0135	180.0790	174.3482	153.5562	147.1185	164.0027	165.8139	186.7938	197.5895	211.9753 (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	217.2215	191.4417	201.0135	180.0790	174.3482	153.5562	147.1185	164.0027	165.8139	186.7938	197.5895	211.9753 (64)
Heat gains from water heating, kWh/month	68.0220	59.8571	62.6329	55.8125	53.9430	47.3254	45.0605	50.5031	51.0694	57.9048	61.6300	66.2777 (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	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.0884	22.2833	18.1220	13.7195	10.2555	8.6581	9.3554	12.1605	16.3218	20.7243	24.1883	25.7856 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.4150	284.3352	276.9764	261.3103	241.5347	222.9484	210.5316	207.6114	214.9703	230.6363	250.4119	268.9982 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573 (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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586 (71)
Water heating gains (Table 5)	91.4275	89.0731	84.1840	77.5174	72.5040	65.7297	60.5652	67.8805	70.9297	77.8291	85.5972	89.0829 (72)
Total internal gains	466.7028	464.4635	448.0543	421.3191	393.0661	366.1082	349.2242	356.4243	370.9937	397.9616	428.9694	452.6387 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				0.6600	10.6334	0.6300	0.7000	0.7700	2.1448 (74)			
East				9.1700	19.6403	0.6300	0.7000	0.7700	55.0413 (76)			
West				16.8400	19.6403	0.6300	0.7000	0.7700	101.0791 (80)			
Solar gains	158.2651	309.5033	509.9226	744.7213	914.0438	936.3925	891.1868	764.5280	593.3347	367.2673	197.3096	130.1738 (83)
Total gains	624.9679	773.9668	957.9769	1166.0404	1307.1099	1302.5007	1240.4110	1120.9523	964.3284	765.2289	626.2790	582.8125 (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	54.0875	54.2288	54.3679	55.0312	55.1571	55.7508	55.7508	55.8622	55.5206	55.1571	54.9030	54.6398
alpha	4.6058	4.6153	4.6245	4.6687	4.6771	4.7167	4.7167	4.7241	4.7014	4.6771	4.6602	4.6427
util living area	0.9988	0.9964	0.9871	0.9482	0.8430	0.6672	0.5061	0.5752	0.8434	0.9802	0.9973	0.9991 (86)
MIT	19.5229	19.7127	20.0411	20.4635	20.7882	20.9491	20.9888	20.9803	20.8445	20.3840	19.8732	19.4948 (87)
Th 2	19.8534	19.8561	19.8587	19.8708	19.8731	19.8837	19.8837	19.8856	19.8796	19.8731	19.8685	19.8637 (88)
util rest of house	0.9983	0.9952	0.9823	0.9288	0.7888	0.5704	0.3835	0.4468	0.7671	0.9697	0.9961	0.9988 (89)
MIT 2	17.8873	18.1664	18.6450	19.2510	19.6726	19.8515	19.8798	19.8780	19.7562	19.1529	18.4101	17.8532 (90)
Living area fraction	18.1191	18.3855	18.8428	19.4229	19.8307	20.0070	20.0370	20.0342	19.9105	19.3274	18.6175	18.0859 (92)
Temperature adjustment	18.1191	18.3855	18.8428	19.4229	19.8307	20.0070	20.0370	20.0342	19.9105	19.3274	18.6175	18.0859 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9972	0.9926	0.9763	0.9189	0.7865	0.5818	0.4009	0.4648	0.7695	0.9624	0.9941	0.9980 (94)
Ext temp.	623.2393	768.2677	935.2409	1071.5174	1028.0427	757.8436	497.2266	520.9637	742.0941	736.4513	622.5533	581.6391 (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	2078.0295	2022.5877	1846.4652	1555.2262	1198.9353	788.8191	501.4177	529.1280	851.1873	1286.9255	1706.2037	2066.9667 (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	1082.3640	842.9030	677.9509	348.2703	127.1441	0.0000	0.0000	0.0000	0.0000	409.5528	780.2283	1105.0838 (98)
												5373.4972 (98)
												45.8803 (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													5753.2090 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1082.3640	842.9030	677.9509	348.2703	127.1441	0.0000	0.0000	0.0000	0.0000	409.5528	780.2283	1105.0838	(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)	1158.8479	902.4658	725.8575	372.8805	136.1286	0.0000	0.0000	0.0000	0.0000	438.4934	835.3622	1183.1732	(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	217.2215	191.4417	201.0135	180.0790	174.3482	153.5562	147.1185	164.0027	165.8139	186.7938	197.5895	211.9753	(64)
Efficiency of water heater (217)m	88.5386	88.3434	87.8724	86.6839	84.2705	80.3000	80.3000	80.3000	80.3000	86.9735	88.1593	88.6063	(216)
Fuel for water heating, kWh/month	245.3410	216.7018	228.7561	207.7421	206.8911	191.2281	183.2111	204.2375	206.4930	214.7711	224.1278	239.2328	(219)
Water heating fuel used												2568.7335	(219)
Annual totals kWh/year													
Space heating fuel - main system												5753.2090	(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)												443.0681	(232)
Total delivered energy for all uses												8840.0106	(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	5753.2090	0.2160	1242.6931 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2568.7335	0.2160	554.8464 (264)
Space and water heating			1797.5396 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.0681	0.5190	229.9524 (268)
Total CO2, kg/m2/year			2066.4169 (272)
Emissions per m2 for space and water heating			15.3478 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9634 (272b)
Emissions per m2 for pumps and fans			0.3324 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3478 * 1.00) + 1.9634 + 0.3324, rounded to 2 d.p.			17.6400 (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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =	0.3364 (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	0.4290	0.4206	0.4121	0.3701	0.3617	0.3196	0.3196	0.3112	0.3364	0.3617	0.3785	0.3953 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5781 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			9.0000	527.0400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21783.4870 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 185.9929 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7578 (36)
Total fabric heat loss (33) + (36) = 85.6096 (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	58.0029	57.6529	57.3098	55.6982	55.3967	53.9930	53.9930	53.7331	54.5337	55.3967	56.0066	56.6443 (38)
Heat transfer coeff	143.6125	143.2625	142.9194	141.3078	141.0062	139.6026	139.6026	139.3426	140.1432	141.0062	141.6162	142.2539 (39)
Average = Sum(39)m / 12 =												141.3063 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2262	1.2232	1.2203	1.2065	1.2039	1.1920	1.1920	1.1897	1.1966	1.2039	1.2092	1.2146 (40)
HLP (average)												1.2065 (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 2.8515 (42)
Average daily hot water use (litres/day) 101.9223 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy conte	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (45)

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Energy content (annual)	Total = Sum(45)m = 1603.6345 (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	35.3308	30.9005	31.8866	27.7995	26.6743	23.0179	21.3295	24.4759	24.7682	28.8649	31.5083	34.2160 (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	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.0884	22.2833	18.1220	13.7195	10.2555	8.6581	9.3554	12.1605	16.3218	20.7243	24.1883	25.7856	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.4150	284.3352	276.9764	261.3103	241.5347	222.9484	210.5316	207.6114	214.9703	230.6363	250.4119	268.9982	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	47.4876	45.9830	42.8583	38.6104	35.8525	31.9693	28.6686	32.8977	34.4002	38.7969	43.7616	45.9892	(72)
Total internal gains	419.7629	418.3734	403.7286	379.4122	353.4147	329.3478	314.3276	318.4415	331.4643	355.9295	384.1337	406.5451	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North				0.6600	10.6334	0.6300		0.7000		0.7700	2.1448 (74)		
East				9.1700	19.6403	0.6300		0.7000		0.7700	55.0413 (76)		
West				16.8400	19.6403	0.6300		0.7000		0.7700	101.0791 (80)		
Solar gains	158.2651	309.5033	509.9226	744.7213	914.0438	936.3925	891.1868	764.5280	593.3347	367.2673	197.3096	130.1738	(83)
Total gains	578.0281	727.8767	913.6513	1124.1335	1267.4584	1265.7403	1205.5144	1082.9695	924.7990	723.1968	581.4433	536.7188	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.1340	42.2369	42.3383	42.8212	42.9128	43.3442	43.3442	43.4251	43.1770	42.9128	42.7279	42.5364
alpha	3.8089	3.8158	3.8226	3.8547	3.8609	3.8896	3.8896	3.8950	3.8785	3.8609	3.8485	3.8358
util living area	0.9966	0.9916	0.9751	0.9218	0.8076	0.6404	0.4907	0.5579	0.8124	0.9658	0.9935	0.9975 (86)
MIT	19.1993	19.4329	19.8310	20.3314	20.7142	20.9175	20.9774	20.9634	20.7854	20.2373	19.6204	19.1627 (87)
Th 2	19.8991	19.9015	19.9038	19.9148	19.9168	19.9264	19.9264	19.9282	19.9227	19.9168	19.9127	19.9083 (88)
util rest of house	0.9957	0.9893	0.9682	0.9002	0.7572	0.5544	0.3794	0.4423	0.7426	0.9525	0.9915	0.9968 (89)
MIT 2	18.2541	18.4884	18.8836	19.3743	19.7193	19.8848	19.9194	19.9156	19.7941	19.2963	18.6846	18.2245 (90)
Living area fraction	18.3881	18.6223	19.0179	19.5100	19.8603	20.0311	20.0694	20.0641	19.9346	fLA = Living area / (4) =	18.8173	0.1417 (91)
MIT	18.3881	18.6223	19.0179	19.5100	19.8603	20.0311	20.0694	20.0641	19.9346	19.4297	18.8173	18.3575 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3881	18.6223	19.0179	19.5100	19.8603	20.0311	20.0694	20.0641	19.9346	19.4297	18.8173	18.3575 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	574.5249	717.4451	877.9963	1001.0211	955.9586	713.0963	475.8859	495.7678	687.5480	683.1220	574.7274	534.2472	(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	2023.2265	1965.8851	1789.0499	1499.2706	1150.6540	758.1994	484.3323	510.5678	817.6823	1245.0357	1659.3528	2013.9542	(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	1077.8340	838.9516	677.8239	358.7397	144.8533	0.0000	0.0000	0.0000	0.0000	418.0639	780.9303	1100.9020	(98)
Space heating												5398.0987	(98)
Space heating per m2												46.0903	(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	1312.2642	1033.0591	1059.0041	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8646	0.9159	0.8856	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1134.5836	946.2194	937.8162	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1592.8477	1519.9199	1378.7604	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	329.9502	426.8332	328.0624	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1084.8458 (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	82.4875	106.7083	82.0156	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												271.2115 (107)
Space cooling per m2												2.3157 (108)
Energy for space heating												46.0903 (99)
Energy for space cooling												2.3157 (108)
Total												48.4060 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.4 (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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3847 (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) =	0.3559 (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	0.4537	0.4448	0.4359	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4181 (22b)
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5571	0.5571	0.5542	0.5633	0.5732	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)			26.6700	1.3258	35.3580		(27)
Ground Floor			58.5600	0.1300	7.6128		(28a)
Brick and Block	151.1700	26.5900	124.5800	0.1800	22.4244		(29a)
Timber Clad	17.9700	2.2000	15.7700	0.1800	2.8386		(29a)
Pitched Roof	58.5600		58.5600	0.1300	7.6128		(30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.3906		(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)							12.9091 (36)
Total fabric heat loss						(33) + (36) =	91.2997 (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	59.0739	58.6823	58.2984	56.4953	56.1580	54.5876	54.5876	54.2968	55.1925	56.1580	56.8404	57.5539 (38)
Heat transfer coeff	150.3736	149.9819	149.5981	147.7950	147.4576	145.8872	145.8872	145.5964	146.4921	147.4576	148.1401	148.8536 (39)
Average = Sum(39)m / 12 =												147.7934 (39)
HLP	1.2839	1.2806	1.2773	1.2619	1.2590	1.2456	1.2456	1.2431	1.2508	1.2590	1.2649	1.2709 (40)
HLP (average)												1.2619 (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												2.8515 (42)
Average daily hot water use (litres/day)												101.9223 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy content (annual)	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (45)
Distribution loss (46)m = 0.15 x (45)m												1603.6345 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.3308	30.9005	31.8866	27.7995	26.6743	23.0179	21.3295	24.4759	24.7682	28.8649	31.5083	(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	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	142.5732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.0884	22.2833	18.1220	13.7195	10.2555	8.6581	9.3554	12.1605	16.3218	20.7243	24.1883	25.7856	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.4150	284.3352	276.9764	261.3103	241.5347	222.9484	210.5316	207.6114	214.9703	230.6363	250.4119	268.9982	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	37.2573	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	47.4876	45.9830	42.8583	38.6104	35.8525	31.9693	28.6686	32.8977	34.4002	38.7969	43.7616	45.9892	(72)
Total internal gains	419.7629	418.3734	403.7286	379.4122	353.4147	329.3478	314.3276	318.4415	331.4643	355.9295	384.1337	406.5451	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6600	10.6334	0.6300	0.7000	0.7700	2.1448	(74)
East	9.1700	19.6403	0.6300	0.7000	0.7700	55.0413	(76)
West	16.8400	19.6403	0.6300	0.7000	0.7700	101.0791	(80)

Solar gains	158.2651	309.5033	509.9226	744.7213	914.0438	936.3925	891.1868	764.5280	593.3347	367.2673	197.3096	130.1738	(83)
Total gains	578.0281	727.8767	913.6513	1124.1335	1267.4584	1265.7403	1205.5144	1082.9695	924.7990	723.1968	581.4433	536.7188	(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	54.0875	54.2288	54.3679	55.0312	55.1571	55.7508	55.7508	55.8622	55.5206	55.1571	54.9030	54.6398		
alpha	4.6058	4.6153	4.6245	4.6687	4.6771	4.7167	4.7167	4.7241	4.7014	4.6771	4.6602	4.6427		
util living area	0.9991	0.9972	0.9893	0.9542	0.8547	0.6818	0.5194	0.5924	0.8592	0.9841	0.9980	0.9994	(86)	
MIT	19.4863	19.6772	20.0084	20.4376	20.7735	20.9442	20.9876	20.9778	20.8297	20.3538	19.8384	19.4588	(87)	
Th 2	19.8534	19.8561	19.8587	19.8708	19.8731	19.8837	19.8837	19.8856	19.8796	19.8731	19.8685	19.8637	(88)	
util rest of house	0.9988	0.9962	0.9853	0.9366	0.8025	0.5846	0.3943	0.4616	0.7863	0.9754	0.9972	0.9992	(89)	
MIT 2	18.4746	18.6671	18.9980	19.4240	19.7252	19.8593	19.8807	19.8796	19.7855	19.3526	18.8382	18.4551	(90)	
Living area fraction										fLA = Living area / (4) =		0.1417	(91)	
MIT	18.6180	18.8103	19.1412	19.5676	19.8738	20.0131	20.0376	20.0353	19.9335	19.4945	18.9799	18.5973	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6180	18.8103	19.1412	19.5676	19.8738	20.0131	20.0376	20.0353	19.9335	19.4945	18.9799	18.5973	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	577.0372	724.1932	897.0386	1046.1782	1017.1595	755.2927	496.7936	519.9360	731.0897	702.4487	579.2062	536.0685	(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	2153.0449	2086.2896	1891.0950	1576.6222	1205.2853	789.7047	501.5032	529.2845	854.5658	1311.5587	1759.8958	2143.0926	(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	1172.5497	915.3288	739.5779	381.9197	139.9656	0.0000	0.0000	0.0000	0.0000	453.1778	850.0966	1195.6259	(98)
Space heating												5848.2420	(98)
Space heating per m2										(98) / (4) =		49.9338	(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	1371.3399	1079.5655	1106.5327	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8807	0.9328	0.9025	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1207.7101	1007.0046	998.5940	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1592.8477	1519.9199	1378.7604	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	277.2991	381.6090	282.8438	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												941.7518 (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	69.3248	95.4022	70.7110	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												235.4380 (107)
Space cooling per m2												2.0102 (108)
Energy for space heating												49.9338 (99)
Energy for space cooling												2.0102 (108)
Total												51.9440 (109)
Target Fabric Energy Efficiency (TFEE)												59.7 (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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =		0.3364 (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	0.3533	0.3280	0.3364	0.3196	0.3196	0.3112	0.3028	0.2944	0.2860	0.3112	0.2944	0.3112 (22b)
Effective ac	0.5624	0.5538	0.5566	0.5511	0.5511	0.5484	0.5458	0.5433	0.5409	0.5484	0.5433	0.5484 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			18.0000	1054.0800 (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) = 22310.5270 (34)
190.4929 (35)
6.7578 (36)
(33) + (36) = 85.6096 (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	55.1021	54.2599	54.5337	53.9930	53.9930	53.7331	53.4801	53.2340	52.9948	53.7331	53.2340	53.7331 (38)
Heat transfer coeff	140.7116	139.8694	140.1432	139.6026	139.6026	139.3426	139.0896	138.8436	138.6044	139.3426	138.8436	139.3426 (39)
Average = Sum(39)m / 12 =												139.4449 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2014	1.1942	1.1966	1.1920	1.1920	1.1897	1.1876	1.1855	1.1834	1.1897	1.1855	1.1897 (40)
HLP (average)												1.1906 (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)
2.8515 (42)
101.9223 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy conte	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (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 = 1603.6345 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525 (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	26.6443	27.5074	26.5911	27.4595	27.4905	26.6201	27.5288	26.6626	27.5575 (61)
Total heat required for water heating calculated for each month	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (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	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (64)
	Total per year (kWh/year) = Sum(64)m = 1927.7110 (64)											1928 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	62.1738	54.5744	56.7812	50.1591	48.6143	42.6640	40.2392	45.1702	45.4099	52.0473	55.9669	60.4273 (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	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7209	55.7081	45.3049	34.2987	25.6387	21.6453	23.3885	30.4012	40.8045	51.8106	60.4707	64.4641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.0224	424.3809	413.3976	390.0154	360.4995	332.7588	314.2263	309.8678	320.8511	344.2333	373.7492	401.4899	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	83.5669	81.2119	76.3189	69.6655	65.3417	59.2555	54.0849	60.7126	63.0694	69.9560	77.7318	81.2195	(72)
Total internal gains	681.2997	676.2905	650.0109	608.9691	566.4695	528.6492	506.6893	515.9711	539.7145	580.9896	626.9412	662.1630	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North					0.6600	13.4839		0.6300	0.7000	0.7700	2.7198 (74)	
East					9.1700	25.1925		0.6300	0.7000	0.7700	70.6014 (76)	
West					16.8400	25.1925		0.6300	0.7000	0.7700	129.6540 (80)	
Solar gains	202.9751	337.6993	559.4702	818.7302	952.1197	1058.2779	999.7898	880.9675	686.4732	432.0469	252.2301	164.0947 (83)
Total gains	884.2748	1013.9897	1209.4810	1427.6993	1518.5892	1586.9271	1506.4790	1396.9387	1226.1877	1013.0364	879.1713	826.2578 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.0430	44.3082	44.2217	44.3929	44.3929	44.4758	44.5567	44.6356	44.7126	44.4758	44.6356	44.4758
alpha	3.9362	3.9539	3.9481	3.9595	3.9595	3.9651	3.9704	3.9757	3.9808	3.9651	3.9757	3.9651
util living area	0.9848	0.9741	0.9375	0.8423	0.6903	0.4839	0.3561	0.3821	0.6471	0.8923	0.9705	0.9876 (86)
MIT	19.6382	19.8183	20.1905	20.6058	20.8646	20.9742	20.9941	20.9924	20.9218	20.5754	20.0538	19.6162 (87)
Th 2	19.9189	19.9246	19.9227	19.9264	19.9264	19.9282	19.9299	19.9316	19.9333	19.9282	19.9316	19.9282 (88)
util rest of house	0.9809	0.9675	0.9219	0.8060	0.6264	0.3995	0.2603	0.2801	0.5593	0.8568	0.9615	0.9843 (89)
MIT 2	18.7022	18.8835	19.2424	19.6282	19.8428	19.9175	19.9286	19.9298	19.8945	19.6146	19.1230	18.6880 (90)
Living area fraction	fLA = Living area / (4) = 0.1417 (91)											
MIT	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	19.7508	19.2549	18.8195 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	19.7508	19.2549	18.8195 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9756	0.9604	0.9124	0.7999	0.6303	0.4108	0.2739	0.2946	0.5687	0.8498	0.9541	0.9798 (94)
Useful gains	862.7239	973.8637	1103.4892	1142.0409	957.2309	651.9002	412.6388	411.5001	697.3714	860.9134	838.8176	809.5376 (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	1960.7999	1918.4526	1734.5227	1433.2608	1045.2945	664.2894	414.4292	413.8154	740.1628	1163.6196	1576.5576	1925.6521 (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	816.9686	634.7637	469.4890	209.6784	65.5193	0.0000	0.0000	0.0000	0.0000	225.2134	531.1728	830.3892 (98)
Space heating												3783.1943 (98)
RHI space heating demand												3783 (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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =	0.3364 (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	0.4290	0.4206	0.4121	0.3701	0.3617	0.3196	0.3196	0.3112	0.3364	0.3617	0.3785	0.3953 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5781 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			18.0000	1054.0800 (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) = 22310.5270 (34)
190.4929 (35)
6.7578 (36)
(33) + (36) = 85.6096 (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	58.0029	57.6529	57.3098	55.6982	55.3967	53.9930	53.9930	53.7331	54.5337	55.3967	56.0066	56.6443 (38)
Heat transfer coeff	143.6125	143.2625	142.9194	141.3078	141.0062	139.6026	139.6026	139.3426	140.1432	141.0062	141.6162	142.2539 (39)
Average = Sum(39)m / 12 =												141.3063 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2262	1.2232	1.2203	1.2065	1.2039	1.1920	1.1920	1.1897	1.1966	1.2039	1.2092	1.2146 (40)
HLP (average)												1.2065 (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)
2.8515 (42)
101.9223 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy conte	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (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 = 1603.6345 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525 (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	26.6443	27.5074	26.5911	27.4595	27.4905	26.6201	27.5288	26.6626	27.5575 (61)
Total heat required for water heating calculated for each month	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (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	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (64)
	Total per year (kWh/year) = Sum (64)m = 1927.7110 (64)											
Heat gains from water heating, kWh/month	62.1738	54.5744	56.7812	50.1591	48.6143	42.6640	40.2392	45.1702	45.4099	52.0473	55.9669	60.4273 (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	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7209	55.7081	45.3049	34.2987	25.6387	21.6453	23.3885	30.4012	40.8045	51.8106	60.4707	64.4641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.0224	424.3809	413.3976	390.0154	360.4995	332.7588	314.2263	309.8678	320.8511	344.2333	373.7492	401.4899	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	83.5669	81.2119	76.3189	69.6655	65.3417	59.2555	54.0849	60.7126	63.0694	69.9560	77.7318	81.2195	(72)
Total internal gains	681.2997	676.2905	650.0109	608.9691	566.4695	528.6492	506.6893	515.9711	539.7145	580.9896	626.9412	662.1630	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6600	10.6334	0.6300	0.7000	0.7700	2.1448	(74)
East	9.1700	19.6403	0.6300	0.7000	0.7700	55.0413	(76)
West	16.8400	19.6403	0.6300	0.7000	0.7700	101.0791	(80)

Solar gains	158.2651	309.5033	509.9226	744.7213	914.0438	936.3925	891.1868	764.5280	593.3347	367.2673	197.3096	130.1738	(83)
Total gains	839.5648	985.7938	1159.9335	1353.6904	1480.5133	1465.0417	1397.8761	1280.4991	1133.0492	948.2569	824.2508	792.3368	(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	43.1534	43.2588	43.3627	43.8572	43.9510	44.3929	44.3929	44.4758	44.2217	43.9510	43.7617	43.5655
alpha	3.8769	3.8839	3.8908	3.9238	3.9301	3.9595	3.9595	3.9651	3.9481	3.9301	3.9174	3.9044
util living area	0.9888	0.9786	0.9511	0.8781	0.7462	0.5731	0.4298	0.4840	0.7303	0.9279	0.9805	0.9910 (86)
MIT	19.4771	19.6960	20.0576	20.4917	20.7984	20.9473	20.9868	20.9792	20.8637	20.4275	19.8690	19.4376 (87)
Th 2	19.8991	19.9015	19.9038	19.9148	19.9168	19.9264	19.9264	19.9282	19.9227	19.9168	19.9127	19.9083 (88)
util rest of house	0.9860	0.9732	0.9387	0.8484	0.6900	0.4899	0.3294	0.3786	0.6515	0.9034	0.9747	0.9887 (89)
MIT 2	18.5274	18.7453	19.0998	19.5169	19.7831	19.9011	19.9226	19.9215	19.8467	19.4707	18.9271	18.4954 (90)
Living area fraction	18.6620	18.8800	19.2356	19.6550	19.9270	20.0494	20.0734	20.0714	19.9908	19.6064	19.0606	18.6289 (91)
MIT	18.6620	18.8800	19.2356	19.6550	19.9270	20.0494	20.0734	20.0714	19.9908	19.6064	19.0606	18.6289 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6620	18.8800	19.2356	19.6550	19.9270	20.0494	20.0734	20.0714	19.9908	19.6064	19.0606	18.6289 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9666	0.9294	0.8402	0.6906	0.4999	0.3434	0.3931	0.6570	0.8947	0.9685	0.9849	(94)
Useful gains	824.1063	952.8605	1077.9972	1137.4198	1022.4382	732.3452	480.0836	503.4159	744.4338	848.3886	798.3174	780.3932	(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	2062.5661	2002.8103	1820.1586	1519.7706	1160.0586	760.7509	484.8948	511.5832	825.5575	1269.9526	1693.8082	2052.5728	(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	921.4141	705.5663	552.1681	275.2926	102.3896	0.0000	0.0000	0.0000	0.0000	313.6437	644.7534	946.5017	(98)
Space heating												4461.7293	(98)
Space heating per m2											(98) / (4) =	38.0954	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4919.2164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	921.4141	705.5663	552.1681	275.2926	102.3896	0.0000	0.0000	0.0000	0.0000	313.6437	644.7534	946.5017	(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)	1015.8921	777.9121	608.7851	303.5199	112.8882	0.0000	0.0000	0.0000	0.0000	345.8034	710.8637	1043.5520	(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	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739	(64)	
Efficiency of water heater (217)m	90.2006	90.1417	90.0023	89.6608	89.0014	87.9000	87.9000	87.9000	87.9000	89.7212	90.0876	90.2225	(216)	
Fuel for water heating, kWh/month	214.8858	188.9369	197.3361	175.6237	171.9450	153.4819	145.4304	162.3106	162.8854	182.0792	194.1856	209.0098	(219)	
Water heating fuel used												2158.1104	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4919.2164	(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)													443.0681	(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													6796.9590	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4919.2164	3.4800	171.1887 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2158.1104	3.4800	75.1022 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.0681	13.1900	58.4407 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-798.4360	13.1900	-105.3137 (252)
Total energy cost			329.3104 (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] =	0.8531 (257)
SAP value		88.0988
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	4919.2164	0.2160	1062.5507 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2158.1104	0.2160	466.1519 (264)
Space and water heating			1528.7026 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.0681	0.5190	229.9524 (268)
Energy saving/generation technologies			
PV Unit	-798.4360	0.5190	-414.3883 (269)
Total kg/year			1383.1917 (272)
CO2 emissions per m2			11.8100 (273)
EI value			88.5673
EI rating			89 (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	$3.48 / 0.8922 = 3.900$, stars = 4
Water heating environmental impact	$0.216 / 0.8922 = 0.2421$, 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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =		0.3364 (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	0.3533	0.3280	0.3364	0.3196	0.3196	0.3112	0.3028	0.2944	0.2860	0.3112	0.2944	0.3112 (22b)
Effective ac	0.5624	0.5538	0.5566	0.5511	0.5511	0.5484	0.5458	0.5433	0.5409	0.5484	0.5433	0.5484 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			18.0000	1054.0800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 22310.5270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.4929 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7578 (36)
Total fabric heat loss							(33) + (36) = 85.6096 (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	55.1021	54.2599	54.5337	53.9930	53.9930	53.7331	53.4801	53.2340	52.9948	53.7331	53.2340	53.7331 (38)
Heat transfer coeff	140.7116	139.8694	140.1432	139.6026	139.6026	139.3426	139.0896	138.8436	138.6044	139.3426	138.8436	139.3426 (39)
Average = Sum(39)m / 12 =												139.4449 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2014	1.1942	1.1966	1.1920	1.1920	1.1897	1.1876	1.1855	1.1834	1.1897	1.1855	1.1897 (40)
HLP (average)												1.1906 (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												2.8515 (42)
Average daily hot water use (litres/day)												101.9223 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy conte	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (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 = 1603.6345 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525	(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	26.6443	27.5074	26.5911	27.4595	27.4905	26.6201	27.5288	26.6626	(61)
Total heat required for water heating calculated for each month												
193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739	(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												
193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739	(64)
Total per year (kWh/year) = Sum(64)m =												1927.7110 (64)
Heat gains from water heating, kWh/month												
62.1738	54.5744	56.7812	50.1591	48.6143	42.6640	40.2392	45.1702	45.4099	52.0473	55.9669	60.4273	(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	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7209	55.7081	45.3049	34.2987	25.6387	21.6453	23.3885	30.4012	40.8045	51.8106	60.4707	64.4641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.0224	424.3809	413.3976	390.0154	360.4995	332.7588	314.2263	309.8678	320.8511	344.2333	373.7492	401.4899	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	83.5669	81.2119	76.3189	69.6655	65.3417	59.2555	54.0849	60.7126	63.0694	69.9560	77.7318	81.2195	(72)
Total internal gains	681.2997	676.2905	650.0109	608.9691	566.4695	528.6492	506.6893	515.9711	539.7145	580.9896	626.9412	662.1630	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.6600	13.4839	0.6300	0.7000	0.7700		2.7198 (74)	
East					9.1700	25.1925	0.6300	0.7000	0.7700		70.6014 (76)	
West					16.8400	25.1925	0.6300	0.7000	0.7700		129.6540 (80)	
Solar gains	202.9751	337.6993	559.4702	818.7302	952.1197	1058.2779	999.7898	880.9675	686.4732	432.0469	252.2301	164.0947 (83)
Total gains	884.2748	1013.9897	1209.4810	1427.6993	1518.5892	1586.9271	1506.4790	1396.9387	1226.1877	1013.0364	879.1713	826.2578 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.0430	44.3082	44.2217	44.3929	44.3929	44.4758	44.5567	44.6356	44.7126	44.4758	44.6356	44.4758
alpha	3.9362	3.9539	3.9481	3.9595	3.9595	3.9651	3.9704	3.9757	3.9808	3.9651	3.9757	3.9651
util living area	0.9848	0.9741	0.9375	0.8423	0.6903	0.4839	0.3561	0.3821	0.6471	0.8923	0.9705	0.9876 (86)
MIT	19.6382	19.8183	20.1905	20.6058	20.8646	20.9742	20.9941	20.9924	20.9218	20.5754	20.0538	19.6162 (87)
Th 2	19.9189	19.9246	19.9227	19.9264	19.9264	19.9282	19.9299	19.9316	19.9333	19.9282	19.9316	19.9282 (88)
util rest of house	0.9809	0.9675	0.9219	0.8060	0.6264	0.3995	0.2603	0.2801	0.5593	0.8568	0.9615	0.9843 (89)
MIT 2	18.7022	18.8835	19.2424	19.6282	19.8428	19.9175	19.9286	19.9298	19.8945	19.6146	19.1230	18.6880 (90)
Living area fraction	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	fLA = Living area / (4) =		0.1417 (91)
MIT	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	19.7508	19.2549	18.8195 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	19.7508	19.2549	18.8195 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9756	0.9604	0.9124	0.7999	0.6303	0.4108	0.2739	0.2946	0.5687	0.8498	0.9541	0.9798	(94)	
Useful gains	862.7239	973.8637	1103.4892	1142.0409	957.2309	651.9002	412.6388	411.5001	697.3714	860.9134	838.8176	809.5376	(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	1960.7999	1918.4526	1734.5227	1433.2608	1045.2945	664.2894	414.4292	413.8154	740.1628	1163.6196	1576.5576	1925.6521	(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	816.9686	634.7637	469.4890	209.6784	65.5193	0.0000	0.0000	0.0000	0.0000	225.2134	531.1728	830.3892	(98)	
Space heating												3783.1943	(98)	
Space heating per m2												(98) / (4) =	32.3019	(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													4171.1073	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	816.9686	634.7637	469.4890	209.6784	65.5193	0.0000	0.0000	0.0000	0.0000	225.2134	531.1728	830.3892	(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)	900.7371	699.8498	517.6284	231.1779	72.2374	0.0000	0.0000	0.0000	0.0000	248.3059	585.6371	915.5338	(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	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739	(64)	
Efficiency of water heater (217)m	90.1493	90.0929	89.9139	89.4775	88.7211	87.9000	87.9000	87.9000	87.9000	89.5014	89.9898	90.1684	(216)	
Fuel for water heating, kWh/month	215.0081	189.0392	197.5301	175.9833	172.4882	153.4819	145.4304	162.3106	162.8854	182.5264	194.3965	209.1352	(219)	
Water heating fuel used												2160.2152	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4171.1073	(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)													443.0681	(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													5944.4753	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4171.1073	10.2300	426.7043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2160.2152	10.2300	220.9900	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	443.0681	36.7200	162.6946	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-904.9154	36.7200	-332.2849	(252)
Total energy cost			608.6440	(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	4171.1073	0.2160	900.9592	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2160.2152	0.2160	466.6065	(264)
Space and water heating			1367.5657	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.0681	0.5190	229.9524	(268)
Energy saving/generation technologies				
PV Unit	-904.9154	0.5190	-469.6511	(269)
Total kg/year			1166.7920	(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	4171.1073	1.2200	5088.7509	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2160.2152	1.2200	2635.4626	(264)
Space and water heating			7724.2135	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	443.0681	3.0700	1360.2191	(268)
Energy saving/generation technologies				
PV Unit	-904.9154	3.0700	-2778.0902	(269)
Primary energy kWh/year			6536.5925	(272)
Primary energy kWh/m2/year			55.8111	(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 89

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 87	-197 kg (16.9%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£87	1.68 kg/m²	B 89	B 90
Total Savings	£87	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 524 TEST (01 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£190	£209	-£18
Mains gas	£751	£645	£106
Space heating	£557	£557	£0
Water heating	£221	£134	£87
Lighting	£163	£163	£0
Generated (PV)	-£332	-£332	£0
Total cost of fuels	£609	£522	£88
Total cost of uses	£609	£522	£87
Delivered energy	51 kWh/m²	42 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	56 kWh/m²	46 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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =	0.3364 (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	0.4290	0.4206	0.4121	0.3701	0.3617	0.3196	0.3196	0.3112	0.3364	0.3617	0.3785	0.3953 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5781 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			18.0000	1054.0800 (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) = 22310.5270 (34)
190.4929 (35)
6.7578 (36)
(33) + (36) = 85.6096 (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	58.0029	57.6529	57.3098	55.6982	55.3967	53.9930	53.9930	53.7331	54.5337	55.3967	56.0066	56.6443 (38)
Heat transfer coeff	143.6125	143.2625	142.9194	141.3078	141.0062	139.6026	139.6026	139.3426	140.1432	141.0062	141.6162	142.2539 (39)
Average = Sum(39)m / 12 =												141.3063 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2262	1.2232	1.2203	1.2065	1.2039	1.1920	1.1920	1.1897	1.1966	1.2039	1.2092	1.2146 (40)
HLP (average)												1.2065 (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)
2.8515 (42)
101.9223 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy conte	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (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 = 1603.6345 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525 (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	26.6443	27.5074	26.5911	27.4595	27.4905	26.6201	27.5288	26.6626	27.5575 (61)
Total heat required for water heating calculated for each month												
	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (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												1.1309 (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												101.9223 (H14)
Volume ratio Veff/V												0.7359 (H15)
Solar storage volume factor												0.9387 (H16)
Solar input												-878.6081 (H17)
Solar input	-25.4779	-42.5153	-72.4084	-97.0415	-119.8866	-117.8676	-116.3099	-101.6206	-79.5893	-54.3501	-30.2204	-21.3206 (63)
												Solar input (sum of months) = Sum(63)m = -878.6081 (63)
Output from w/h												
	168.3505	127.7956	105.1986	60.4241	33.1469	17.0430	11.5234	41.0505	63.5870	109.0136	144.7166	167.2533 (64)
												Total per year (kWh/year) = Sum(64)m = 1049.1029 (64)
Heat gains from water heating, kWh/month												
	62.1738	54.5744	56.7812	50.1591	48.6143	42.6640	40.2392	45.1702	45.4099	52.0473	55.9669	60.4273 (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	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7209	55.7081	45.3049	34.2987	25.6387	21.6453	23.3885	30.4012	40.8045	51.8106	60.4707	64.4641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.0224	424.3809	413.3976	390.0154	360.4995	332.7588	314.2263	309.8678	320.8511	344.2333	373.7492	401.4899	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	83.5669	81.2119	76.3189	69.6655	65.3417	59.2555	54.0849	60.7126	63.0694	69.9560	77.7318	81.2195	(72)
Total internal gains	681.2997	676.2905	650.0109	608.9691	566.4695	528.6492	506.6893	515.9711	539.7145	580.9896	626.9412	662.1630	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.6600	10.6334		0.6300	0.7000	0.7700		2.1448 (74)	
East					9.1700	19.6403		0.6300	0.7000	0.7700		55.0413 (76)	
West					16.8400	19.6403		0.6300	0.7000	0.7700		101.0791 (80)	
Solar gains	158.2651	309.5033	509.9226	744.7213	914.0438	936.3925	891.1868	764.5280	593.3347	367.2673	197.3096	130.1738 (83)	
Total gains	839.5648	985.7938	1159.9335	1353.6904	1480.5133	1465.0417	1397.8761	1280.4991	1133.0492	948.2569	824.2508	792.3368 (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	43.1534	43.2588	43.3627	43.8572	43.9510	44.3929	44.3929	44.4758	44.2217	43.9510	43.7617	43.5655
alpha	3.8769	3.8839	3.8908	3.9238	3.9301	3.9595	3.9595	3.9651	3.9481	3.9301	3.9174	3.9044
util living area	0.9888	0.9786	0.9511	0.8781	0.7462	0.5731	0.4298	0.4840	0.7303	0.9279	0.9805	0.9910 (86)
MIT	19.4771	19.6960	20.0576	20.4917	20.7984	20.9473	20.9868	20.9792	20.8637	20.4275	19.8690	19.4376 (87)
Th 2	19.8991	19.9015	19.9038	19.9148	19.9168	19.9264	19.9264	19.9282	19.9227	19.9168	19.9127	19.9083 (88)
util rest of house	0.9860	0.9732	0.9387	0.8484	0.6900	0.4899	0.3294	0.3786	0.6515	0.9034	0.9747	0.9887 (89)
MIT 2	18.5274	18.7453	19.0998	19.5169	19.7831	19.9011	19.9226	19.9215	19.8467	19.4707	18.9271	18.4954 (90)
Living area fraction	fLA = Living area / (4) =											0.1417 (91)
MIT	18.6620	18.8800	19.2356	19.6550	19.9270	20.0494	20.0734	20.0714	19.9908	19.6064	19.0606	18.6289 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6620	18.8800	19.2356	19.6550	19.9270	20.0494	20.0734	20.0714	19.9908	19.6064	19.0606	18.6289 (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	0.9816	0.9666	0.9294	0.8402	0.6906	0.4999	0.3434	0.3931	0.6570	0.8947	0.9685	0.9849	(94)
Useful gains	824.1063	952.8605	1077.9972	1137.4198	1022.4382	732.3452	480.0836	503.4159	744.4338	848.3886	798.3174	780.3932	(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	2062.5661	2002.8103	1820.1586	1519.7706	1160.0586	760.7509	484.8948	511.5832	825.5575	1269.9526	1693.8082	2052.5728	(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	921.4141	705.5663	552.1681	275.2926	102.3896	0.0000	0.0000	0.0000	0.0000	313.6437	644.7534	946.5017	(98)
Space heating												4461.7293	(98)
Space heating per m2												(98) / (4) =	38.0954 (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													4919.2164 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	921.4141	705.5663	552.1681	275.2926	102.3896	0.0000	0.0000	0.0000	0.0000	313.6437	644.7534	946.5017	(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)	1015.8921	777.9121	608.7851	303.5199	112.8882	0.0000	0.0000	0.0000	0.0000	345.8034	710.8637	1043.5520	(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	168.3505	127.7956	105.1986	60.4241	33.1469	17.0430	11.5234	41.0505	63.5870	109.0136	144.7166	167.2533	(64)
Efficiency of water heater	90.2559	90.2591	90.2400	90.1830	89.9989	87.9000	87.9000	87.9000	87.9000	89.9609	90.1735	90.2682	(216)
Fuel for water heating, kWh/month	186.5258	141.5875	116.5765	67.0016	36.8303	19.3890	13.1097	46.7013	72.3401	121.1789	160.4870	185.2849	(219)
Water heating fuel used												1167.0126	(219)
Annual totals kWh/year													
Space heating fuel - main system												4919.2164	(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)													443.0681 (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												5855.8611	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4919.2164	3.4800	171.1887 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1167.0126	3.4800	40.6120 (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	443.0681	13.1900	58.4407 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-798.4360	13.1900	-105.3137 (252)
Total energy cost			301.4152 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.7809 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	89.1069
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	4919.2164	0.2160	1062.5507 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.0126	0.2160	252.0747 (264)
Space and water heating			1314.6255 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	443.0681	0.5190	229.9524 (268)
Energy saving/generation technologies			
PV Unit	-798.4360	0.5190	-414.3883 (269)
Total kg/year			1195.0645 (272)
CO2 emissions per m2			10.2000 (273)
EI value			90.1222
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	58.5600 (1b)	x 2.3900 (2b)	= 139.9584 (1b) - (3b)
First floor	58.5600 (1c)	x 2.6800 (2c)	= 156.9408 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8992 (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) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.5800
Infiltration rate					0.3637 (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) =		0.3364 (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	0.3533	0.3280	0.3364	0.3196	0.3196	0.3112	0.3028	0.2944	0.2860	0.3112	0.2944	0.3112 (22b)
Effective ac	0.5624	0.5538	0.5566	0.5511	0.5511	0.5484	0.5458	0.5433	0.5409	0.5484	0.5433	0.5484 (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)			26.6700	1.1450	30.5382		(27)
Ground Floor			58.5600	0.1100	6.4416	140.0000	8198.4000 (28a)
Brick and Block	151.1700	26.5900	124.5800	0.2400	29.8992	42.2200	5259.7676 (29a)
Timber Clad	17.9700	2.2000	15.7700	0.2400	3.7848	42.2200	665.8094 (29a)
Pitched Roof	58.5600		58.5600	0.1000	5.8560	9.0000	527.0400 (30)
Total net area of external elements Aum(A, m ²)			286.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.8518		(33)
Ground Floor Block			50.9000			75.0000	3817.5000 (32c)
Ground Floor Stud			45.7900			9.0000	412.1100 (32c)
First Floor Stud			146.8600			9.0000	1321.7400 (32c)
Internal Floor 1			58.5600			18.0000	1054.0800 (32d)
Internal Ceiling 1			58.5600			18.0000	1054.0800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 22310.5270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.4929 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7578 (36)
Total fabric heat loss							(33) + (36) = 85.6096 (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	55.1021	54.2599	54.5337	53.9930	53.9930	53.7331	53.4801	53.2340	52.9948	53.7331	53.2340	53.7331 (38)
Heat transfer coeff	140.7116	139.8694	140.1432	139.6026	139.6026	139.3426	139.0896	138.8436	138.6044	139.3426	138.8436	139.3426 (39)
Average = Sum(39)m / 12 =												139.4449 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2014	1.1942	1.1966	1.1920	1.1920	1.1897	1.1876	1.1855	1.1834	1.1897	1.1855	1.1897 (40)
HLP (average)												1.1906 (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												2.8515 (42)
Average daily hot water use (litres/day)												101.9223 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1145	108.0376	103.9607	99.8838	95.8070	91.7301	91.7301	95.8070	99.8838	103.9607	108.0376	112.1145 (44)
Energy conte	166.2626	145.4143	150.0546	130.8212	125.5261	108.3194	100.3739	115.1805	116.5561	135.8349	148.2744	161.0164 (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 = 1603.6345 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9394	21.8121	22.5082	19.6232	18.8289	16.2479	15.0561	17.2771	17.4834	20.3752	22.2412	24.1525 (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	26.6443	27.5074	26.5911	27.4595	27.4905	26.6201	27.5288	26.6626	27.5575 (61)
Total heat required for water heating calculated for each month	193.8284	170.3109	177.6069	157.4655	153.0334	134.9106	127.8334	142.6710	143.1762	163.3637	174.9371	188.5739 (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												1.2657 (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												101.9223 (H14)
Volume ratio Veff/V												0.7359 (H15)
Solar storage volume factor												0.9387 (H16)
Solar input												-914.9935 (H17)
Solar input	-29.8493	-42.4438	-72.9507	-98.4274	-115.6089	-123.4886	-120.8916	-108.2016	-84.7144	-58.5686	-35.3039	-24.5448 (63)
												Solar input (sum of months) = Sum (63)m = -914.9935 (63)
Output from w/h	163.9791	127.8670	104.6562	59.0381	37.4246	11.4220	6.9418	34.4694	58.4618	104.7950	139.6332	164.0291 (64)
												Total per year (kWh/year) = Sum (64)m = 1012.7175 (64)
Heat gains from water heating, kWh/month	62.1738	54.5744	56.7812	50.1591	48.6143	42.6640	40.2392	45.1702	45.4099	52.0473	55.9669	60.4273 (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	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	171.0879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7209	55.7081	45.3049	34.2987	25.6387	21.6453	23.3885	30.4012	40.8045	51.8106	60.4707	64.4641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.0224	424.3809	413.3976	390.0154	360.4995	332.7588	314.2263	309.8678	320.8511	344.2333	373.7492	401.4899	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	54.9603	(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)	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	-114.0586	(71)
Water heating gains (Table 5)	83.5669	81.2119	76.3189	69.6655	65.3417	59.2555	54.0849	60.7126	63.0694	69.9560	77.7318	81.2195	(72)
Total internal gains	681.2997	676.2905	650.0109	608.9691	566.4695	528.6492	506.6893	515.9711	539.7145	580.9896	626.9412	662.1630	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6600	13.4839	0.6300	0.7000	0.7700	2.7198 (74)
East	9.1700	25.1925	0.6300	0.7000	0.7700	70.6014 (76)
West	16.8400	25.1925	0.6300	0.7000	0.7700	129.6540 (80)

Solar gains	202.9751	337.6993	559.4702	818.7302	952.1197	1058.2779	999.7898	880.9675	686.4732	432.0469	252.2301	164.0947	(83)
Total gains	884.2748	1013.9897	1209.4810	1427.6993	1518.5892	1586.9271	1506.4790	1396.9387	1226.1877	1013.0364	879.1713	826.2578	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.0430	44.3082	44.2217	44.3929	44.3929	44.4758	44.5567	44.6356	44.7126	44.4758	44.6356	44.4758
alpha	3.9362	3.9539	3.9481	3.9595	3.9595	3.9651	3.9704	3.9757	3.9808	3.9651	3.9757	3.9651
util living area	0.9848	0.9741	0.9375	0.8423	0.6903	0.4839	0.3561	0.3821	0.6471	0.8923	0.9705	0.9876 (86)
MIT	19.6382	19.8183	20.1905	20.6058	20.8646	20.9742	20.9941	20.9924	20.9218	20.5754	20.0538	19.6162 (87)
Th 2	19.9189	19.9246	19.9227	19.9264	19.9264	19.9282	19.9299	19.9316	19.9333	19.9282	19.9316	19.9282 (88)
util rest of house	0.9809	0.9675	0.9219	0.8060	0.6264	0.3995	0.2603	0.2801	0.5593	0.8568	0.9615	0.9843 (89)
MIT 2	18.7022	18.8835	19.2424	19.6282	19.8428	19.9175	19.9286	19.9298	19.8945	19.6146	19.1230	18.6880 (90)
Living area fraction	fLA = Living area / (4) = 0.1417 (91)											
MIT	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	19.7508	19.2549	18.8195 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8349	19.0160	19.3768	19.7667	19.9876	20.0673	20.0796	20.0804	20.0401	19.7508	19.2549	18.8195 (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	0.9756	0.9604	0.9124	0.7999	0.6303	0.4108	0.2739	0.2946	0.5687	0.8498	0.9541	0.9798	(94)
Useful gains	862.7239	973.8637	1103.4892	1142.0409	957.2309	651.9002	412.6388	411.5001	697.3714	860.9134	838.8176	809.5376	(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													
	1960.7999	1918.4526	1734.5227	1433.2608	1045.2945	664.2894	414.4292	413.8154	740.1628	1163.6196	1576.5576	1925.6521	(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													
	816.9686	634.7637	469.4890	209.6784	65.5193	0.0000	0.0000	0.0000	0.0000	225.2134	531.1728	830.3892	(98)
Space heating													
Space heating per m2												3783.1943	(98)
											(98) / (4) =	32.3019	(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													4171.1073	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	816.9686	634.7637	469.4890	209.6784	65.5193	0.0000	0.0000	0.0000	0.0000	225.2134	531.1728	830.3892	(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)	900.7371	699.8498	517.6284	231.1779	72.2374	0.0000	0.0000	0.0000	0.0000	248.3059	585.6371	915.5338	(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	163.9791	127.8670	104.6562	59.0381	37.4246	11.4220	6.9418	34.4694	58.4618	104.7950	139.6332	164.0291	(64)	
Efficiency of water heater	90.2196	90.2182	90.1764	90.0696	89.6617	87.9000	87.9000	87.9000	87.9000	89.7917	90.1026	90.2259	(217)	
Fuel for water heating, kWh/month	181.7555	141.7309	116.0573	65.5472	41.7397	12.9943	7.8974	39.2144	66.5095	116.7090	154.9714	181.7982	(219)	
Water heating fuel used												1126.9249	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4171.1073	(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)													443.0681	(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												4961.1850	(238)	

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4171.1073	10.2300	426.7043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1126.9249	10.2300	115.2844	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	443.0681	36.7200	162.6946	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-904.9154	36.7200	-332.2849	(252)
Total energy cost			521.2984	(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	4171.1073	0.2160	900.9592	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1126.9249	0.2160	243.4158	(264)
Space and water heating			1144.3750	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	443.0681	0.5190	229.9524	(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

969.5512 (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	4171.1073	1.2200	5088.7509 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1126.9249	1.2200	1374.8484 (264)
Space and water heating			6463.5993 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	443.0681	3.0700	1360.2191 (268)
Energy saving/generation technologies			
PV Unit	-904.9154	3.0700	-2778.0902 (269)
Primary energy kWh/year			5429.4783 (272)
Primary energy kWh/m2/year			46.3583 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 33	Issued on Date	12/09/2023
Assessment Reference	As Built	Prop Type Ref	B
Project	7, Fieldfare Crescent , Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.42	TER	17.64
Environmental	89 B	% DER<TER	23.94		
CO ₂ Emissions (t/year)	1.17	DFEE	48.41	TFEE	59.74
General Requirements Compliance	Pass	% DFEE<TFEE	18.97		

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

Building Elements

Roof 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 33	Issued on Date	12/09/2023
Assessment Reference	As Built	Prop Type Ref	B
Project	7, Fieldfare Crescent , Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.42	TER	17.64
Environmental	89 B	% DER<TER	23.94		
CO ₂ Emissions (t/year)	1.17	DFEE	48.41	TFEE	59.74
General Requirements Compliance	Pass	% DFEE<TFEE	18.97		

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

Wall 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 33	Issued on Date	12/09/2023
Assessment Reference	As Built	Prop Type Ref	B
Project	7, Fieldfare Crescent , Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.42	TER	17.64
Environmental	89 B	% DER<TER	23.94		
CO ₂ Emissions (t/year)	1.17	DFEE	48.41	TFEE	59.74
General Requirements Compliance	Pass	% DFEE<TFEE	18.97		

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

Wall 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/m ² K
		Kappa:	42.22 kJ/m ² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 33	Issued on Date	12/09/2023
Assessment Reference	As Built	Prop Type Ref	B
Project	7, Fieldfare Crescent , Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.42	TER	17.64
Environmental	89 B	% DER<TER	23.94		
CO ₂ Emissions (t/year)	1.17	DFEE	48.41	TFEE	59.74
General Requirements Compliance	Pass	% DFEE<TFEE	18.97		

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

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

Unheated space: None

Total thickness: 450 mm

U-value: 0.11 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 33			Issued on Date	12/09/2023
Assessment Reference	As Built	Prop Type Ref	B		
Property	7, Fieldfare Crescent , Botley, Southampton, SO32 2TW				
SAP Rating	88 B	DER	13.42	TER	17.64
Environmental	89 B	% DER<TER	23.94		
CO ₂ Emissions (t/year)	1.17	DFEE	48.41	TFEE	59.74
General Requirements Compliance	Pass	% DFEE<TFEE	18.97		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR: New Build (As 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:	33.36 m		58.56 m ²	2.39 m		
		1st Storey:	33.36 m		58.56 m ²	2.68 m		
7.0 Living Area	16.60			m ²				
8.0 Thermal Mass Parameter	Precise calculation							
Thermal Mass	190.49			kJ/m ² K				
9.0 External Walls								
Description	Type	Construction			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other			0.24	42.22	151.17	124.58
Timber Clad	Cavity Wall	Other			0.24	42.22	17.97	15.77
9.2 Internal Walls								
Description	Construction						Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Block	Dense block, plasterboard on dabs						75.00	50.90
Ground Floor Stud	Plasterboard on timber frame						9.00	45.79
First Floor Stud	Plasterboard on timber frame						9.00	146.86
10.0 External Roofs								
Description	Type	Construction			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level			0.10	9.00	58.56	58.56
10.2 Internal Ceilings								
Description	Construction						Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor						9.00	58.56

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	58.56

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	58.56

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	1.11	Yes				1.92	
East Elevation	Window	[1] Brick and Block	East	None	0.00					5.05	
East Cladding	Window	[2] Timber Clad	East	None	0.00					2.20	
West Elevation	Window	[1] Brick and Block	West	None	0.00					16.84	
North Elevation	Window	[1] Brick and Block	North	None	0.00					0.66	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.26	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	9.25	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.54	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.54	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	13.04	0.021	No	Knauf P5
Independently assessed	E4 Jamb	42.30	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	33.36	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	33.36	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	19.97	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	13.39	0.054	No	
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	0.024	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.58	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

Light and motion sensor

23.0 Electricity Tariff

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

Community Heating

28.0 Water Heating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder

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	£87	B 89	