



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 2 Nuthatch Way
BOTLEY, SO32 2UH

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 22/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 31				Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E			
Property	2 Nuthatch Way, BOTLEY, SO32 2UH					
SAP Rating	88 B	DER	12.57	TER	18.07	
Environmental	91 B	% DER<TER	30.43			
CO ₂ Emissions (t/year)	0.64	DFEE	36.87	TFEE	46.95	
General Requirements Compliance	Pass	% DFEE<TFEE	21.47			
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)	18.07	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.57	kgCO ₂ /m ²	Pass
	-5.50 (-30.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	46.95	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	36.87	kWh/m ² /yr	
	-10.0 (-21.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (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	4.98 (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 30i ErP
Combi boiler
Efficiency: 89.6% 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

7.49 m², No overhang

Windows facing South

3.16 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.98 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.10

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.73

kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 31	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Property	2 Nuthatch Way, BOTLEY, SO32 2UH		

SAP Rating	88 B	DER	12.57	TER	18.07
Environmental	91 B	% DER<TER	30.43		
CO ₂ Emissions (t/year)	0.64	DFEE	36.87	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	21.47		

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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.76	0.27	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	3.60	0.24	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.51	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	6.34	0.13	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	22.50	0.36	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	8.58	0.53	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	8.58	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.58	0.51	
External wall	E18 Party wall between dwellings	Independently assessed	0.036	20.20	0.73	Knauf P25 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	17.00	2.72	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	17.00	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	17.00	0.60	Knauf P29 Halved

Total: **6.20** W/mK:
Y-Value: **0.054** W/m²K:

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Mid-Terrace House, total floor area 72 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.07 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.57 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)46.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (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: 4.98 (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 30i ErP
Combi boiler
Efficiency: 89.6% 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: 7.49 m², No overhang
Windows facing South: 3.16 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 0.73 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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3778	0.3339	0.3339	0.3251	0.3515	0.3778	0.3954	0.4130 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			18.0000	648.7200 (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) = 15090.4708 (34)
209.3573 (35)
6.1960 (36)
(33) + (36) = 35.2842 (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	36.1327	35.8980	35.6680	34.5877	34.3856	33.4446	33.4446	33.2704	33.8071	34.3856	34.7945	35.2220 (38)
Heat transfer coeff	71.4169	71.1822	70.9522	69.8719	69.6698	68.7288	68.7288	68.5546	69.0913	69.6698	70.0787	70.5062 (39)
Average = Sum(39)m / 12 =												69.8709 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9908	0.9875	0.9844	0.9694	0.9666	0.9535	0.9535	0.9511	0.9585	0.9666	0.9722	0.9782 (40)
HLP (average)												0.9694 (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)
2.2955 (42)
88.7192 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (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 = 1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												
21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237	(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	36.3941	32.8593	36.3596	35.1636	36.3190	35.1280	36.2869	36.3077	35.1474	36.3428	35.1972	36.3874 (61)
Total heat required for water heating calculated for each month												
181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(64)
Total per year (kWh/year) = Sum (64)m =												1823.7912 (64)
Heat gains from water heating, kWh/month												
57.2195	50.3018	52.5198	46.6542	45.4105	40.1326	38.1227	42.4133	42.5214	48.4001	51.7140	55.6995	(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	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
19.1070	16.9706	13.8014	10.4486	7.8104	6.5939	7.1249	9.2613	12.4305	15.7833	18.4215	19.6380	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
202.1021	204.1993	198.9145	187.6637	173.4615	160.1135	151.1963	149.0991	154.3839	165.6347	179.8369	193.1849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)												
76.9080	74.8538	70.5912	64.7975	61.0356	55.7398	51.2402	57.0072	59.0575	65.0539	71.8250	74.8649	(72)
Total internal gains	358.5502	356.4569	343.7403	323.3429	302.7407	282.8804	269.9946	275.8007	286.3051	306.9051	330.5165	348.1209 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	Specific data		FF	Access	Gains					
	m2	Table 6a	or Table 6b		or Table 6c	factor	W					
		W/m2				Table 6d						
North	7.4900	10.6334	0.6300		0.7000	0.7700	24.3403		(74)			
South	3.1600	46.7521	0.6300		0.7000	0.7700	45.1502		(78)			
Solar gains	69.4905	120.4599	173.2333	233.4179	281.9626	289.8500	275.2489	236.9179	193.4279	135.1266	83.5452	59.3052 (83)
Total gains	428.0407	476.9168	516.9735	556.7608	584.7033	572.7304	545.2435	512.7186	479.7329	442.0317	414.0618	407.4261 (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	58.6948	58.8882	59.0791	59.9926	60.1667	60.9904	60.9904	61.1454	60.6704	60.1667	59.8156	59.4529
alpha	4.9130	4.9259	4.9386	4.9995	5.0111	5.0660	5.0660	5.0764	5.0447	5.0111	4.9877	4.9635
util living area	0.9958	0.9922	0.9831	0.9539	0.8733	0.7094	0.5418	0.5939	0.8319	0.9655	0.9919	0.9967 (86)
MIT	19.8147	19.9587	20.1938	20.5116	20.7866	20.9477	20.9891	20.9831	20.8791	20.5370	20.1252	19.7928 (87)
Th 2	20.0910	20.0937	20.0964	20.1089	20.1113	20.1223	20.1223	20.1243	20.1180	20.1113	20.1065	20.1016 (88)
util rest of house	0.9947	0.9900	0.9781	0.9397	0.8346	0.6324	0.4399	0.4906	0.7697	0.9520	0.9892	0.9958 (89)
MIT 2	19.0054	19.1506	19.3855	19.7050	19.9589	20.0952	20.1188	20.1184	20.0456	19.7353	19.3272	18.9921 (90)
Living area fraction												
MIT	19.1840	19.3290	19.5639	19.8830	20.1416	20.2834	20.3109	20.3093	20.2295	19.9123	19.5034	19.1688 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1840	19.3290	19.5639	19.8830	20.1416	20.2834	20.3109	20.3093	20.2295	19.9123	19.5034	19.1688 (93)

8. Space heating requirement

Utilisation	0.9931	0.9876	0.9745	0.9354	0.8361	0.6474	0.4624	0.5133	0.7786	0.9483	0.9869	0.9945 (94)
Useful gains	425.0970	471.0171	503.7719	520.7898	488.8483	370.7956	252.1255	263.1536	373.5008	419.1608	408.6305	405.1980 (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	1062.9690	1027.0887	926.9142	767.4049	588.1223	390.6111	255.0457	267.9973	423.4984	648.7842	869.2115	1055.3945 (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	474.5768	373.6801	314.8178	177.5629	73.8599	0.0000	0.0000	0.0000	0.0000	170.8398	331.6183	483.7462 (98)
Space heating												2400.7018 (98)
Space heating per m2												(98) / (4) = 33.3061 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2652.7092 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	474.5768	373.6801	314.8178	177.5629	73.8599	0.0000	0.0000	0.0000	0.0000	170.8398	331.6183	483.7462	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	524.3942	412.9062	347.8650	196.2021	81.6131	0.0000	0.0000	0.0000	0.0000	188.7733	366.4291	534.5262	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(64)
Efficiency of water heater (217)m	89.3880	89.2973	89.1092	88.6776	87.8746	86.6000	86.6000	86.6000	86.6000	88.6045	89.1698	86.6000	(216)
Fuel for water heating, kWh/month	202.6210	178.5457	187.3835	168.0674	165.6728	149.4407	142.7925	157.6993	157.7422	174.4623	184.2149	197.4271	(219)
Water heating fuel used												2066.0693	(219)
Annual totals kWh/year													
Space heating fuel - main system												2652.7092	(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)												337.4348	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4500.7710	(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	2652.7092	0.2160	572.9852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2066.0693	0.2160	446.2710 (264)
Space and water heating			1019.2562 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4348	0.5190	175.1287 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total CO2, kg/year			906.1102 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5700 (273)

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

DER		12.5700	ZC1
Total Floor Area	TFA	72.0800	
Assumed number of occupants	N	2.2955	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6151	ZC2
CO2 emissions from cooking, equation (L16)		2.4153	ZC3
Total CO2 emissions		31.6004	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.6004	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1645 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4145 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3523 (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	0.4492	0.4404	0.4316	0.3876	0.3788	0.3347	0.3347	0.3259	0.3523	0.3788	0.3964	0.4140	(22b)				
Effective ac	0.6009	0.5970	0.5931	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			10.6500	1.3258	14.1193			(27)					
Ground Floor			36.0400	0.1300	4.6852			(28a)					
Brick and Block	31.2300	10.5700	20.6600	0.1800	3.7188			(29a)					
Cladding & Block	12.1800	2.2000	9.9800	0.1800	1.7964			(29a)					
Pitched Roof	36.0400		36.0400	0.1300	4.6852			(30)					
Total net area of external elements Aum(A, m2)			115.4900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5489			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3851	(36)					
Total fabric heat loss						(33) + (36) =	39.9340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 36.1619	Feb 35.9262	Mar 35.6950	Apr 34.6095	May 34.4064	Jun 33.4609	Jul 33.4609	Aug 33.2858	Sep 33.8251	Oct 34.4064	Nov 34.8172	Dec 35.2468	(38)
Heat transfer coeff	76.0960	75.8602	75.6291	74.5435	74.3404	73.3949	73.3949	73.2198	73.7591	74.3404	74.7513	75.1808	(39)
Average = Sum(39)m / 12 =												74.5425	(39)
HLP	Jan 1.0557	Feb 1.0524	Mar 1.0492	Apr 1.0342	May 1.0314	Jun 1.0182	Jul 1.0182	Aug 1.0158	Sep 1.0233	Oct 1.0314	Nov 1.0371	Dec 1.0430	(40)
HLP (average)												1.0342	(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												2.2955 (42)
Average daily hot water use (litres/day)												88.7192 (43)
Daily hot water use	Jan 97.5911	Feb 94.0423	Mar 90.4936	Apr 86.9448	May 83.3960	Jun 79.8473	Jul 79.8473	Aug 83.3960	Sep 86.9448	Oct 90.4936	Nov 94.0423	Dec 97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (45)
Energy content (annual)										Total = Sum(45)m =		1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237 (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)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.7314	43.2852	46.1145	42.8769	42.4977	39.3767	40.6893	42.4977	42.8769	46.1145	46.3770	49.7314	(61)
Total heat required for water heating calculated for each month	194.4561	169.8625	176.7309	156.7514	151.7630	133.6644	128.0607	142.7576	144.3342	164.3533	175.4439	189.8896	(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	194.4561	169.8625	176.7309	156.7514	151.7630	133.6644	128.0607	142.7576	144.3342	164.3533	175.4439	189.8896	(64)
Heat gains from water heating, kWh/month	60.5538	52.9082	54.9586	48.5825	46.9551	41.1948	39.2233	43.9608	44.4538	50.8430	54.5090	59.0354	(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	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1070	16.9706	13.8014	10.4486	7.8104	6.5939	7.1249	9.2613	12.4305	15.7833	18.4215	19.6380	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.1021	204.1993	198.9145	187.6637	173.4615	160.1135	151.1963	149.0991	154.3839	165.6347	179.8369	193.1849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	81.3896	78.7325	73.8690	67.4757	63.1117	57.2150	52.7195	59.0872	61.7414	68.3374	75.7069	79.3487	(72)
Total internal gains	363.0318	360.3356	347.0181	326.0211	304.8169	284.3556	271.4739	277.8807	288.9889	310.1886	334.3984	352.6047	(73)

6. Solar gains

[Jan]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Table 6b		Table 6c		factor		
					W/m2		or		or		Table 6d		
North	7.4900				10.6334		0.6300		0.7000		0.7700		24.3403
South	3.1600				46.7521		0.6300		0.7000		0.7700		45.1502 (78)

Solar gains	69.4905	120.4599	173.2333	233.4179	281.9626	289.8500	275.2489	236.9179	193.4279	135.1266	83.5452	59.3052	(83)
Total gains	432.5223	480.7955	520.2514	559.4390	586.7795	574.2056	546.7228	514.7985	482.4168	445.3152	417.9437	411.9099	(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	65.7795	65.9840	66.1856	67.1495	67.3329	68.2003	68.2003	68.3634	67.8636	67.3329	66.9628	66.5802	
alpha	5.3853	5.3989	5.4124	5.4766	5.4889	5.5467	5.5467	5.5576	5.5242	5.4889	5.4642	5.4387	
util living area	0.9980	0.9960	0.9906	0.9709	0.9061	0.7513	0.5772	0.6314	0.8684	0.9789	0.9959	0.9985	(86)
MIT	19.8875	20.0151	20.2285	20.5224	20.7874	20.9488	20.9902	20.9843	20.8800	20.5509	20.1714	19.8682	(87)
Th 2	20.0372	20.0399	20.0425	20.0549	20.0573	20.0682	20.0682	20.0702	20.0640	20.0573	20.0526	20.0476	(88)
util rest of house	0.9973	0.9947	0.9873	0.9596	0.8690	0.6670	0.4620	0.5152	0.8051	0.9685	0.9942	0.9980	(89)
MIT 2	18.5495	18.7376	19.0499	19.4804	19.8400	20.0323	20.0643	20.0633	19.9634	19.5272	18.9757	18.5288	(90)
Living area fraction	18.8449	19.0196	19.3101	19.7104	20.0491	20.2346	20.2687	20.2666	20.1657	19.7531	19.2396	18.8245	(92)
MIT	18.8449	19.0196	19.3101	19.7104	20.0491	20.2346	20.2687	20.2666	20.1657	19.7531	19.2396	18.8245	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.8449	19.0196	19.3101	19.7104	20.0491	20.2346	20.2687	20.2666	20.1657	19.7531	19.2396	18.8245	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.8461	477.2666	511.7704	533.8521	509.6854	392.3389	266.5467	278.4260	392.2547	429.2756	414.6617	410.6719	(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	1106.8046	1071.1152	968.8125	805.8456	620.6784	413.5521	269.2614	283.1112	447.4002	680.4479	907.4514	1099.4790	(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	502.9131	399.0663	340.0393	195.8353	82.5788	0.0000	0.0000	0.0000	0.0000	186.8722	354.8086	512.4725	(98)
Space heating												2574.5861	(98)
Space heating per m2												35.7185	(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													2756.5161 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	502.9131	399.0663	340.0393	195.8353	82.5788	0.0000	0.0000	0.0000	0.0000	186.8722	354.8086	512.4725	(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)	538.4508	427.2658	364.0678	209.6738	88.4142	0.0000	0.0000	0.0000	0.0000	200.0773	379.8807	548.6857	(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	194.4561	169.8625	176.7309	156.7514	151.7630	133.6644	128.0607	142.7576	144.3342	164.3533	175.4439	189.8896	(64)
Efficiency of water heater (217)m	87.3369	87.1281	86.6718	85.6127	83.5910	80.3000	80.3000	80.3000	80.3000	85.3751	86.7882	87.4270	(216)
Fuel for water heating, kWh/month	222.6506	194.9572	203.9082	183.0936	181.5542	166.4563	159.4778	177.7803	179.7437	192.5073	202.1517	217.1978	(219)
Water heating fuel used												2281.4788	(219)
Annual totals kWh/year													
Space heating fuel - main system												2756.5161	(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)												337.4348	(232)
Total delivered energy for all uses												5450.4298	(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	2756.5161	0.2160	595.4075 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2281.4788	0.2160	492.7994 (264)
Space and water heating			1088.2069 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4348	0.5190	175.1287 (268)
Total CO2, kg/m2/year			1302.2606 (272)
Emissions per m2 for space and water heating			15.0972 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4296 (272b)
Emissions per m2 for pumps and fans			0.5400 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0972 * 1.00) + 2.4296 + 0.5400, rounded to 2 d.p.			18.0700 (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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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												
Effective ac	0.4481	0.4394	0.4306	0.3866	0.3778	0.3339	0.3339	0.3251	0.3515	0.3778	0.3954	0.4130 (22b)
	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			9.0000	324.3600 (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) = 14766.1108 (34)
204.8573 (35)
6.1960 (36)
(33) + (36) = 35.2842 (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	36.1327	35.8980	35.6680	34.5877	34.3856	33.4446	33.4446	33.2704	33.8071	34.3856	34.7945	35.2220 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	71.4169	71.1822	70.9522	69.8719	69.6698	68.7288	68.7288	68.5546	69.0913	69.6698	70.0787	70.5062 (39)
												69.8709 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9908	0.9875	0.9844	0.9694	0.9666	0.9535	0.9535	0.9511	0.9585	0.9666	0.9722	0.9782 (40)
HLP (average)												0.9694 (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)
2.2955 (42)
88.7192 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (45)

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Energy content (annual)	Total = Sum(45)m = 1395.8982 (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	30.7540	26.8977	27.7560	24.1983	23.2189	20.0361	18.5664	21.3052	21.5597	25.1257	27.4267	29.7836 (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	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1070	16.9706	13.8014	10.4486	7.8104	6.5939	7.1249	9.2613	12.4305	15.7833	18.4215	19.6380	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.1021	204.1993	198.9145	187.6637	173.4615	160.1135	151.1963	149.0991	154.3839	165.6347	179.8369	193.1849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	41.3360	40.0263	37.3064	33.6088	31.2082	27.8280	24.9549	28.6361	29.9440	33.7711	38.0926	40.0318	(72)
Total internal gains	319.9783	318.6294	307.4555	289.1542	269.9133	251.9686	240.7092	244.4296	254.1915	272.6224	293.7841	310.2878	(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					7.4900	10.6334	0.6300	0.7000			0.7700	24.3403 (74)	
South					3.1600	46.7521	0.6300	0.7000			0.7700	45.1502 (78)	

Solar gains	69.4905	120.4599	173.2333	233.4179	281.9626	289.8500	275.2489	236.9179	193.4279	135.1266	83.5452	59.3052 (83)	
Total gains	389.4688	439.0893	480.6888	522.5721	551.8759	541.8185	515.9581	481.3474	447.6194	407.7490	377.3294	369.5930 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.4331	57.6225	57.8093	58.7031	58.8734	59.6794	59.6794	59.8311	59.3664	58.8734	58.5299	58.1750	
alpha	4.8289	4.8415	4.8540	4.9135	4.9249	4.9786	4.9786	4.9887	4.9578	4.9249	4.9020	4.8783	
util living area	0.9970	0.9940	0.9866	0.9619	0.8904	0.7359	0.5684	0.6254	0.8572	0.9733	0.9941	0.9977	(86)
MIT	19.7346	19.8830	20.1264	20.4582	20.7524	20.9347	20.9855	20.9773	20.8526	20.4818	20.0539	19.7131	(87)
Th 2	20.0910	20.0937	20.0964	20.1089	20.1113	20.1223	20.1223	20.1243	20.1180	20.1113	20.1065	20.1016	(88)
util rest of house	0.9961	0.9924	0.9826	0.9498	0.8552	0.6600	0.4634	0.5196	0.8000	0.9627	0.9922	0.9970	(89)
MIT 2	18.9272	19.0771	19.3208	19.6556	19.9309	20.0875	20.1175	20.1161	20.0266	19.6841	19.2582	18.9142	(90)
Living area fraction	19.1055	19.2550	19.4986	19.8327	20.1122	20.2745	20.3091	20.3062	20.2090	19.8602	19.4338	19.0906	(92)
Temperature adjustment	19.1055	19.2550	19.4986	19.8327	20.1122	20.2745	20.3091	20.3062	20.2090	19.8602	19.4338	19.0906	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9949	0.9904	0.9793	0.9453	0.8552	0.6742	0.4865	0.5427	0.8068	0.9589	0.9902	0.9960	(94)
Ext temp.	387.4840	434.8644	470.7337	493.9860	471.9606	365.2735	251.0090	261.2154	361.1367	390.9813	373.6454	368.1196	(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	1057.3597	1021.8212	922.2789	763.8914	586.0767	390.0009	254.9216	267.7846	422.0763	645.1538	864.3356	1049.8766	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	498.3875	394.4349	335.9496	194.3319	84.9024	0.0000	0.0000	0.0000	0.0000	189.1044	353.2969	507.2272	(98)
Space heating per m2												2557.6349	(98)
												35.4833	(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	646.0512	508.5935	521.0150	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8740	0.9304	0.9096	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	564.6284	473.1875	473.8970	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.0535	687.1325	648.2219	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	111.1861	159.1751	129.6977	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												400.0589 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	27.7965	39.7938	32.4244	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												100.0147 (107)
Space cooling per m2												1.3876 (108)
Energy for space heating												35.4833 (99)
Energy for space cooling												1.3876 (108)
Total												36.8708 (109)
Dwelling Fabric Energy Efficiency (DFEE)												36.9 (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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1645 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4145 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3523 (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	0.4492	0.4404	0.4316	0.3876	0.3788	0.3347	0.3347	0.3259	0.3523	0.3788	0.3964	0.4140	(22b)				
Effective ac	0.6009	0.5970	0.5931	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			10.6500	1.3258	14.1193			(27)					
Ground Floor			36.0400	0.1300	4.6852			(28a)					
Brick and Block	31.2300	10.5700	20.6600	0.1800	3.7188			(29a)					
Cladding & Block	12.1800	2.2000	9.9800	0.1800	1.7964			(29a)					
Pitched Roof	36.0400		36.0400	0.1300	4.6852			(30)					
Total net area of external elements Aum(A, m2)			115.4900					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.5489		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3851	(36)					
Total fabric heat loss						(33) + (36) =	39.9340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 36.1619	Feb 35.9262	Mar 35.6950	Apr 34.6095	May 34.4064	Jun 33.4609	Jul 33.4609	Aug 33.2858	Sep 33.8251	Oct 34.4064	Nov 34.8172	Dec 35.2468	(38)
Heat transfer coeff	76.0960	75.8602	75.6291	74.5435	74.3404	73.3949	73.3949	73.2198	73.7591	74.3404	74.7513	75.1808	(39)
Average = Sum(39)m / 12 =												74.5425	(39)
HLP	Jan 1.0557	Feb 1.0524	Mar 1.0492	Apr 1.0342	May 1.0314	Jun 1.0182	Jul 1.0182	Aug 1.0158	Sep 1.0233	Oct 1.0314	Nov 1.0371	Dec 1.0430	(40)
HLP (average)												1.0342	(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												2.2955 (42)
Average daily hot water use (litres/day)												88.7192 (43)
Daily hot water use	Jan 97.5911	Feb 94.0423	Mar 90.4936	Apr 86.9448	May 83.3960	Jun 79.8473	Jul 79.8473	Aug 83.3960	Sep 86.9448	Oct 90.4936	Nov 94.0423	Dec 97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (45)
Energy content (annual)										Total = Sum(45)m =		1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	30.7540	26.8977	27.7560	24.1983	23.2189	20.0361	18.5664	21.3052	21.5597	25.1257	27.4267	(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	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	114.7772	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1070	16.9706	13.8014	10.4486	7.8104	6.5939	7.1249	9.2613	12.4305	15.7833	18.4215	19.6380	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.1021	204.1993	198.9145	187.6637	173.4615	160.1135	151.1963	149.0991	154.3839	165.6347	179.8369	193.1849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	34.4777	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	41.3360	40.0263	37.3064	33.6088	31.2082	27.8280	24.9549	28.6361	29.9440	33.7711	38.0926	40.0318	(72)
Total internal gains	319.9783	318.6294	307.4555	289.1542	269.9133	251.9686	240.7092	244.4296	254.1915	272.6224	293.7841	310.2878	(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					7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)		
South					3.1600	46.7521	0.6300	0.7000	0.7700	45.1502 (78)		

Solar gains	69.4905	120.4599	173.2333	233.4179	281.9626	289.8500	275.2489	236.9179	193.4279	135.1266	83.5452	59.3052 (83)
Total gains	389.4688	439.0893	480.6888	522.5721	551.8759	541.8185	515.9581	481.3474	447.6194	407.7490	377.3294	369.5930 (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	65.7795	65.9840	66.1856	67.1495	67.3329	68.2003	68.2003	68.3634	67.8636	67.3329	66.9628	66.5802		
alpha	5.3853	5.3989	5.4124	5.4766	5.4889	5.5467	5.5467	5.5576	5.5242	5.4889	5.4642	5.4387		
util living area	0.9988	0.9974	0.9935	0.9782	0.9238	0.7809	0.6076	0.6678	0.8955	0.9857	0.9975	0.9991	(86)	
MIT	19.8310	19.9608	20.1783	20.4798	20.7582	20.9378	20.9874	20.9795	20.8558	20.5056	20.1185	19.8123	(87)	
Th 2	20.0372	20.0399	20.0425	20.0549	20.0573	20.0682	20.0682	20.0702	20.0640	20.0573	20.0526	20.0476	(88)	
util rest of house	0.9984	0.9966	0.9911	0.9693	0.8913	0.6984	0.4883	0.5484	0.8393	0.9782	0.9964	0.9988	(89)	
MIT 2	18.9651	19.0968	19.3154	19.6224	19.8850	20.0376	20.0647	20.0638	19.9783	19.6522	19.2647	18.9550	(90)	
Living area fraction									fLA = Living area / (4) =			0.2207	(91)	
MIT	19.1562	19.2875	19.5059	19.8116	20.0777	20.2363	20.2684	20.2659	20.1720	19.8406	19.4532	19.1442	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.1562	19.2875	19.5059	19.8116	20.0777	20.2363	20.2684	20.2659	20.1720	19.8406	19.4532	19.1442	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	388.6461	437.1603	475.5375	505.0098	492.3440	387.2590	265.6991	276.7699	379.1147	397.9550	375.6462	369.0059	(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	1130.4977	1091.4391	983.6219	813.3912	622.8022	413.6742	269.2400	283.0626	447.8651	686.9479	923.4143	1123.5175	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	551.9376	439.6753	378.0148	222.0346	97.0609	0.0000	0.0000	0.0000	0.0000	215.0107	394.3930	561.3566	(98)	
Space heating												2859.4836	(98)	
Space heating per m2												39.6710	(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	689.9120	543.1222	556.4705	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8642	0.9276	0.9042	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	596.2321	503.8111	503.1415	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.0535	687.1325	648.2219	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	88.4314	136.3911	107.9398	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												332.7623	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	22.1078	34.0978	26.9849	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												83.1906 (107)
Space cooling per m2												1.1541 (108)
Energy for space heating												39.6710 (99)
Energy for space cooling												1.1541 (108)
Total												40.8251 (109)
Target Fabric Energy Efficiency (TFEE)												46.9 (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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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												
Effective ac	0.3691	0.3427	0.3515	0.3339	0.3339	0.3251	0.3163	0.3075	0.2988	0.3251	0.3075	0.3251 (22b)
	0.5681	0.5587	0.5618	0.5557	0.5557	0.5529	0.5500	0.5473	0.5446	0.5529	0.5473	0.5529 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			18.0000	648.7200 (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) = 15090.4708 (34)
209.3573 (35)
6.1960 (36)
(33) + (36) = 35.2842 (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	34.1881	33.6235	33.8071	33.4446	33.4446	33.2704	33.1008	32.9358	32.7755	33.2704	32.9358	33.2704 (38)
Heat transfer coeff	69.4723	68.9077	69.0913	68.7288	68.7288	68.5546	68.3850	68.2200	68.0597	68.5546	68.2200	68.5546 (39)
Average = Sum(39)m / 12 =												68.6231 (39)
HLP	0.9638	0.9560	0.9585	0.9535	0.9535	0.9511	0.9487	0.9464	0.9442	0.9511	0.9464	0.9511 (40)
HLP (average)												0.9520 (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												2.2955 (42)
Average daily hot water use (litres/day)												88.7192 (43)
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (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 = 1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237 (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	36.3941	32.8593	36.3596	35.1636	36.3190	35.1280	36.2869	36.3077	35.1474	36.3428	35.1972	36.3874 (61)
Total heat required for water heating calculated for each month	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457 (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	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	57.2195	50.3018	52.5198	46.6542	45.4105	40.1326	38.1227	42.4133	42.5214	48.4001	51.7140	55.6995 (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	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7674	42.4266	34.5036	26.1215	19.5261	16.4848	17.8124	23.1532	31.0761	39.4583	46.0537	49.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	76.9080	74.8538	70.5912	64.7975	61.0356	55.7398	51.2402	57.0072	59.0575	65.0539	71.8250	74.8649	(72)
Total internal gains	526.3000	522.0352	501.9618	470.9936	439.4392	411.1797	394.6983	402.6760	420.5371	451.7079	486.2716	512.2752	(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	7.4900				13.4839	0.6300		0.7000		0.7700		30.8652 (74)	
South	3.1600				56.7559	0.6300		0.7000		0.7700		54.8112 (78)	
Solar gains	85.6764	126.9191	185.6776	254.5356	294.0951	328.9777	309.7507	272.0286	219.9787	154.0647	102.7685	71.8210 (83)	
Total gains	611.9765	648.9543	687.6394	725.5292	733.5343	740.1574	704.4490	674.7046	640.5158	605.7726	589.0401	584.0962 (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	60.3377	60.8320	60.6704	60.9904	60.9904	61.1454	61.2970	61.4452	61.5900	61.1454	61.4452	61.1454
alpha	5.0225	5.0555	5.0447	5.0660	5.0660	5.0764	5.0865	5.0963	5.1060	5.0764	5.0963	5.0764
util living area	0.9775	0.9684	0.9408	0.8687	0.7281	0.5180	0.3769	0.3922	0.6382	0.8680	0.9558	0.9805 (86)
MIT	20.1906	20.2934	20.5011	20.7504	20.9218	20.9885	20.9981	20.9978	20.9688	20.7936	20.4836	20.1823 (87)
Th 2	20.1136	20.1202	20.1180	20.1223	20.1223	20.1243	20.1263	20.1282	20.1301	20.1243	20.1282	20.1243 (88)
util rest of house	0.9719	0.9606	0.9262	0.8377	0.6715	0.4427	0.2934	0.3057	0.5617	0.8301	0.9433	0.9755 (89)
MIT 2	19.3947	19.5003	19.6984	19.9316	20.0735	20.1195	20.1258	20.1277	20.1148	19.9757	19.6932	19.3958 (90)
Living area fraction	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	0.2207 (91)
MIT	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	19.5694 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	19.5694 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	592.1919	620.3635	633.6720	607.5200	499.5150	339.7717	219.6803	219.1630	369.9507	503.7598	553.0418	567.5390	(94)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1019.1830	990.5720	889.5874	729.3757	533.3879	343.5475	220.0880	219.6497	381.3592	600.2790	816.4364	998.7974	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	317.6814	248.7801	190.4010	87.7361	25.2014	0.0000	0.0000	0.0000	0.0000	71.8103	189.6441	320.8563	(98)
Space heating												1452.1108	(98)
RHI space heating demand												1452	(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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3778	0.3339	0.3339	0.3251	0.3515	0.3778	0.3954	0.4130 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			18.0000	648.7200 (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) = 15090.4708 (34)
209.3573 (35)
6.1960 (36)
(33) + (36) = 35.2842 (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	36.1327	35.8980	35.6680	34.5877	34.3856	33.4446	33.4446	33.2704	33.8071	34.3856	34.7945	35.2220 (38)
Heat transfer coeff	71.4169	71.1822	70.9522	69.8719	69.6698	68.7288	68.7288	68.5546	69.0913	69.6698	70.0787	70.5062 (39)
Average = Sum(39)m / 12 =												69.8709 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9908	0.9875	0.9844	0.9694	0.9666	0.9535	0.9535	0.9511	0.9585	0.9666	0.9722	0.9782 (40)
HLP (average)												0.9694 (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)
2.2955 (42)
88.7192 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (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 = 1395.8982 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237 (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	36.3941	32.8593	36.3596	35.1636	36.3190	35.1280	36.2869	36.3077	35.1474	36.3428	35.1972 (61)
Total heat required for water heating calculated for each month											
181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457 (64)
Heat gains from water heating, kWh/month											
57.2195	50.3018	52.5198	46.6542	45.4105	40.1326	38.1227	42.4133	42.5214	48.4001	51.7140	55.6995 (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	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7674	42.4266	34.5036	26.1215	19.5261	16.4848	17.8124	23.1532	31.0761	39.4583	46.0537	49.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	76.9080	74.8538	70.5912	64.7975	61.0356	55.7398	51.2402	57.0072	59.0575	65.0539	71.8250	74.8649	(72)
Total internal gains	526.3000	522.0352	501.9618	470.9936	439.4392	411.1797	394.6983	402.6760	420.5371	451.7079	486.2716	512.2752	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access		Gains
						Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W
North				7.4900	10.6334	0.6300		0.7000		0.7700		24.3403 (74)
South				3.1600	46.7521	0.6300		0.7000		0.7700		45.1502 (78)

Solar gains	69.4905	120.4599	173.2333	233.4179	281.9626	289.8500	275.2489	236.9179	193.4279	135.1266	83.5452	59.3052 (83)
Total gains	595.7905	642.4951	675.1950	704.4116	721.4018	701.0296	669.9472	639.5939	613.9650	586.8345	569.8168	571.5804 (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	58.6948	58.8882	59.0791	59.9926	60.1667	60.9904	60.9904	61.1454	60.6704	60.1667	59.8156	59.4529
alpha	4.9130	4.9259	4.9386	4.9995	5.0111	5.0660	5.0660	5.0764	5.0447	5.0111	4.9877	4.9635
util living area	0.9832	0.9737	0.9532	0.8993	0.7859	0.6040	0.4470	0.4861	0.7146	0.9080	0.9702	0.9859 (86)
MIT	20.0614	20.1946	20.4034	20.6707	20.8741	20.9744	20.9954	20.9930	20.9409	20.7019	20.3459	20.0370 (87)
Th 2	20.0910	20.0937	20.0964	20.1089	20.1113	20.1223	20.1223	20.1243	20.1180	20.1113	20.1065	20.1016 (88)
util rest of house	0.9790	0.9673	0.9414	0.8742	0.7369	0.5300	0.3600	0.3969	0.6434	0.8799	0.9617	0.9824 (89)
MIT 2	19.2490	19.3817	19.5868	19.8488	20.0267	20.1098	20.1209	20.1220	20.0857	19.8839	19.5421	19.2337 (90)
Living area fraction	19.4283	19.5612	19.7671	20.0302	20.2137	20.3007	20.3139	20.3143	20.2745	20.0644	19.7195	19.4110 (91)
MIT	19.4283	19.5612	19.7671	20.0302	20.2137	20.3007	20.3139	20.3143	20.2745	20.0644	19.7195	19.4110 (92)
Temperature adjustment	19.4283	19.5612	19.7671	20.0302	20.2137	20.3007	20.3139	20.3143	20.2745	20.0644	19.7195	19.4110 (93)
adjusted MIT	19.4283	19.5612	19.7671	20.0302	20.2137	20.3007	20.3139	20.3143	20.2745	20.0644	19.7195	19.4110 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9752	0.9627	0.9364	0.8717	0.7430	0.5456	0.3792	0.4166	0.6568	0.8782	0.9572	0.9790	(94)
Useful gains	581.0004	618.5014	632.2334	614.0289	535.9859	382.4570	254.0578	266.4370	403.2751	515.3653	545.4337	559.5530	(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	1080.4158	1043.6145	941.3280	777.6917	593.1509	391.8002	255.2514	268.3415	426.6016	659.3851	884.3599	1072.4687	(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	371.5650	285.6760	229.9664	117.8373	42.5308	0.0000	0.0000	0.0000	0.0000	107.1507	244.0268	381.6093	(98)
Space heating												1780.3623	(98)
Space heating per m2												(98) / (4) =	24.6998 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1967.2512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	371.5650	285.6760	229.9664	117.8373	42.5308	0.0000	0.0000	0.0000	0.0000	107.1507	244.0268	381.6093	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	410.5691	315.6641	254.1065	130.2069	46.9953	0.0000	0.0000	0.0000	0.0000	118.3986	269.6429	421.6677	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(64)
Efficiency of water heater (217)m	89.1838	89.0633	88.8174	88.2798	87.4521	86.6000	86.6000	86.6000	86.6000	88.1553	88.8895	86.6000	(216)
Fuel for water heating, kWh/month	203.0850	179.0148	187.9990	168.8248	166.4732	149.4407	142.7925	157.6993	157.7422	175.3514	184.7958	197.8569	(219)
Water heating fuel used												2071.0757	(219)
Annual totals kWh/year													
Space heating fuel - main system												1967.2512	(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)												337.4348	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3820.3193	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1967.2512	3.4800	68.4603 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2071.0757	3.4800	72.0734 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	337.4348	13.1900	44.5077 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-630.4424	13.1900	-83.1553 (252)
Total energy cost			231.7786 (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] =	0.8315 (257)
SAP value		88.4012
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	1967.2512	0.2160	424.9263 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2071.0757	0.2160	447.3523 (264)
Space and water heating			872.2786 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4348	0.5190	175.1287 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			759.1327 (272)
CO2 emissions per m2			10.5300 (273)
EI value			91.3116
EI rating			91 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8796 = 3.957$, stars = 4
Water heating environmental impact	$0.216 / 0.8796 = 0.2456$, 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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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												
Effective ac	0.3691	0.3427	0.3515	0.3339	0.3339	0.3251	0.3163	0.3075	0.2988	0.3251	0.3075	0.3251 (22b)
	0.5681	0.5587	0.5618	0.5557	0.5557	0.5529	0.5500	0.5473	0.5446	0.5529	0.5473	0.5529 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			18.0000	648.7200 (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) = 15090.4708 (34)
209.3573 (35)
6.1960 (36)
(33) + (36) = 35.2842 (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	34.1881	33.6235	33.8071	33.4446	33.4446	33.2704	33.1008	32.9358	32.7755	33.2704	32.9358	33.2704 (38)
Heat transfer coeff	69.4723	68.9077	69.0913	68.7288	68.7288	68.5546	68.3850	68.2200	68.0597	68.5546	68.2200	68.5546 (39)
Average = Sum(39)m / 12 =												68.6231 (39)
HLP	0.9638	0.9560	0.9585	0.9535	0.9535	0.9511	0.9487	0.9464	0.9442	0.9511	0.9464	0.9511 (40)
HLP (average)												0.9520 (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												2.2955 (42)
Average daily hot water use (litres/day)												88.7192 (43)
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (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 = 1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												
21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237	(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	36.3941	32.8593	36.3596	35.1636	36.3190	35.1280	36.2869	36.3077	35.1474	36.3428	35.1972	36.3874 (61)
Total heat required for water heating calculated for each month												
181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(64)
Total per year (kWh/year) = Sum(64)m =												1823.7912 (64)
Heat gains from water heating, kWh/month												
57.2195	50.3018	52.5198	46.6542	45.4105	40.1326	38.1227	42.4133	42.5214	48.4001	51.7140	55.6995	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
47.7674	42.4266	34.5036	26.1215	19.5261	16.4848	17.8124	23.1532	31.0761	39.4583	46.0537	49.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)												
76.9080	74.8538	70.5912	64.7975	61.0356	55.7398	51.2402	57.0072	59.0575	65.0539	71.8250	74.8649	(72)
Total internal gains	526.3000	522.0352	501.9618	470.9936	439.4392	411.1797	394.6983	402.6760	420.5371	451.7079	486.2716	512.2752 (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				7.4900	13.4839	0.6300	0.7000			0.7700			30.8652 (74)
South				3.1600	56.7559	0.6300	0.7000			0.7700			54.8112 (78)
Solar gains	85.6764	126.9191	185.6776	254.5356	294.0951	328.9777	309.7507	272.0286	219.9787	154.0647	102.7685	71.8210 (83)	
Total gains	611.9765	648.9543	687.6394	725.5292	733.5343	740.1574	704.4490	674.7046	640.5158	605.7726	589.0401	584.0962 (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	60.3377	60.8320	60.6704	60.9904	60.9904	61.1454	61.2970	61.4452	61.5900	61.1454	61.4452	61.1454
alpha	5.0225	5.0555	5.0447	5.0660	5.0660	5.0764	5.0865	5.0963	5.1060	5.0764	5.0963	5.0764
util living area	0.9775	0.9684	0.9408	0.8687	0.7281	0.5180	0.3769	0.3922	0.6382	0.8680	0.9558	0.9805 (86)
MIT	20.1906	20.2934	20.5011	20.7504	20.9218	20.9885	20.9981	20.9978	20.9688	20.7936	20.4836	20.1823 (87)
Th 2	20.1136	20.1202	20.1180	20.1223	20.1223	20.1243	20.1263	20.1282	20.1301	20.1243	20.1282	20.1243 (88)
util rest of house	0.9719	0.9606	0.9262	0.8377	0.6715	0.4427	0.2934	0.3057	0.5617	0.8301	0.9433	0.9755 (89)
MIT 2	19.3947	19.5003	19.6984	19.9316	20.0735	20.1195	20.1258	20.1277	20.1148	19.9757	19.6932	19.3958 (90)
Living area fraction	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	19.5694 (92)
MIT	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	19.5694 (93)
Temperature adjustment												0.0000
adjusted MIT	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	19.5694 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9677	0.9559	0.9215	0.8373	0.6810	0.4591	0.3118	0.3248	0.5776	0.8316	0.9389	0.9717	(94)	
Useful gains	592.1919	620.3635	633.6720	607.5200	499.5150	339.7717	219.6803	219.1630	369.9507	503.7598	553.0418	567.5390	(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	1019.1830	990.5720	889.5874	729.3757	533.3879	343.5475	220.0880	219.6497	381.3592	600.2790	816.4364	998.7974	(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	317.6814	248.7801	190.4010	87.7361	25.2014	0.0000	0.0000	0.0000	0.0000	71.8103	189.6441	320.8563	(98)	
Space heating												1452.1108	(98)	
Space heating per m2												(98) / (4) =	20.1458	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1604.5423 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	317.6814	248.7801	190.4010	87.7361	25.2014	0.0000	0.0000	0.0000	0.0000	71.8103	189.6441	320.8563	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	351.0292	274.8952	210.3879	96.9460	27.8469	0.0000	0.0000	0.0000	0.0000	79.3484	209.5515	354.5373	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457	(64)
Efficiency of water heater (217)m	89.0439	88.9357	88.6350	88.0053	87.1542	86.6000	86.6000	86.6000	86.6000	87.8002	88.6471	86.6000	(216)
Fuel for water heating, kWh/month	203.4040	179.2717	188.3860	169.3513	167.0421	149.4407	142.7925	157.6993	157.7422	176.0606	185.3011	198.1963	(219)
Water heating fuel used												2074.6880	(219)
Annual totals kWh/year													
Space heating fuel - main system												1604.5423	(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)												337.4348	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3386.1049	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1604.5423	7.6100	122.1057 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2074.6880	7.6100	157.8838 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	337.4348	31.0800	104.8748 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-705.5602	31.0800	-219.2881 (252)
Total energy cost			293.8861 (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	1604.5423	0.2160	346.5811 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2074.6880	0.2160	448.1326 (264)
Space and water heating			794.7137 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4348	0.5190	175.1287 (268)
Energy saving/generation technologies			
PV Unit	-705.5602	0.5190	-366.1857 (269)
Total kg/year			642.5817 (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	1604.5423	1.2200	1957.5416 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2074.6880	1.2200	2531.1193 (264)
Space and water heating			4488.6609 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	337.4348	3.0700	1035.9250 (268)
Energy saving/generation technologies			
PV Unit	-705.5602	3.0700	-2166.0698 (269)
Primary energy kWh/year			3588.7661 (272)
Primary energy kWh/m2/year			49.7887 (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 91

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 59	-187 kg (29.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£59 2.59 kg/m²	B 90	A 93
Total Savings	£59 2.59 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 93

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

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

	Current	Potential	Saving
Electricity	£128	£144	-£16
Mains gas	£385	£310	£75
Space heating	£250	£250	£0
Water heating	£158	£98	£59
Lighting	£105	£105	£0
Generated (PV)	-£219	-£219	£0
Total cost of fuels	£294	£235	£59
Total cost of uses	£294	£234	£59
Delivered energy	47 kWh/m²	34 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	6 kg/m²	3 kg/m²
Primary energy	50 kWh/m²	35 kWh/m²	15 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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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												
Effective ac	0.4481	0.4394	0.4306	0.3866	0.3778	0.3339	0.3339	0.3251	0.3515	0.3778	0.3954	0.4130 (22b)
	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			18.0000	648.7200 (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) = 15090.4708 (34)
209.3573 (35)
6.1960 (36)
(33) + (36) = 35.2842 (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	36.1327	35.8980	35.6680	34.5877	34.3856	33.4446	33.4446	33.2704	33.8071	34.3856	34.7945	35.2220 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	71.4169	71.1822	70.9522	69.8719	69.6698	68.7288	68.7288	68.5546	69.0913	69.6698	70.0787	70.5062 (39)
												69.8709 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9908	0.9875	0.9844	0.9694	0.9666	0.9535	0.9535	0.9511	0.9585	0.9666	0.9722	0.9782 (40)
HLP (average)												0.9694 (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)
2.2955 (42)
88.7192 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (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 = 1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237 (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	36.3941	32.8593	36.3596	35.1636	36.3190	35.1280	36.2869	36.3077	35.1474	36.3428	35.1972	36.3874 (61)
Total heat required for water heating calculated for each month	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457 (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												1.2992 (H8)
Utilisation factor												0.5368 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.7192 (H14)
Volume ratio Veff/V												0.8454 (H15)
Solar storage volume factor												0.9664 (H16)
Solar input												-827.3298 (H17)
Solar input	-23.9909	-40.0339	-68.1824	-91.3778	-112.8896	-110.9885	-109.5217	-95.6897	-74.9442	-51.1781	-28.4567	-20.0763 (63)
												-827.3298 (63)
Output from w/h	157.1280	119.4026	98.7935	57.6603	32.6946	18.4272	14.1366	40.8779	61.6606	103.4034	135.8073	156.4694 (64)
												996.4615 (64)
Heat gains from water heating, kWh/month	57.2195	50.3018	52.5198	46.6542	45.4105	40.1326	38.1227	42.4133	42.5214	48.4001	51.7140	55.6995 (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	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7674	42.4266	34.5036	26.1215	19.5261	16.4848	17.8124	23.1532	31.0761	39.4583	46.0537	49.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	76.9080	74.8538	70.5912	64.7975	61.0356	55.7398	51.2402	57.0072	59.0575	65.0539	71.8250	74.8649	(72)
Total internal gains	526.3000	522.0352	501.9618	470.9936	439.4392	411.1797	394.6983	402.6760	420.5371	451.7079	486.2716	512.2752	(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					7.4900	10.6334	0.6300		0.7000		0.7700		24.3403 (74)	
South					3.1600	46.7521	0.6300		0.7000		0.7700		45.1502 (78)	
Solar gains	69.4905	120.4599	173.2333	233.4179	281.9626	289.8500	275.2489	236.9179	193.4279	135.1266	83.5452	59.3052 (83)		
Total gains	595.7905	642.4951	675.1950	704.4116	721.4018	701.0296	669.9472	639.5939	613.9650	586.8345	569.8168	571.5804 (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	58.6948	58.8882	59.0791	59.9926	60.1667	60.9904	60.9904	61.1454	60.6704	60.1667	59.8156	59.4529
alpha	4.9130	4.9259	4.9386	4.9995	5.0111	5.0660	5.0660	5.0764	5.0447	5.0111	4.9877	4.9635
util living area	0.9832	0.9737	0.9532	0.8993	0.7859	0.6040	0.4470	0.4861	0.7146	0.9080	0.9702	0.9859 (86)
MIT	20.0614	20.1946	20.4034	20.6707	20.8741	20.9744	20.9954	20.9930	20.9409	20.7019	20.3459	20.0370 (87)
Th 2	20.0910	20.0937	20.0964	20.1089	20.1113	20.1223	20.1223	20.1243	20.1180	20.1113	20.1065	20.1016 (88)
util rest of house	0.9790	0.9673	0.9414	0.8742	0.7369	0.5300	0.3600	0.3969	0.6434	0.8799	0.9617	0.9824 (89)
MIT 2	19.2490	19.3817	19.5868	19.8488	20.0267	20.1098	20.1209	20.1220	20.0857	19.8839	19.5421	19.2337 (90)
Living area fraction									fLA = Living area / (4) =			0.2207 (91)
MIT	19.4283	19.5612	19.7671	20.0302	20.2137	20.3007	20.3139	20.3143	20.2745	20.0644	19.7195	19.4110 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4283	19.5612	19.7671	20.0302	20.2137	20.3007	20.3139	20.3143	20.2745	20.0644	19.7195	19.4110 (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	0.9752	0.9627	0.9364	0.8717	0.7430	0.5456	0.3792	0.4166	0.6568	0.8782	0.9572	0.9790	(94)
Useful gains	581.0004	618.5014	632.2334	614.0289	535.9859	382.4570	254.0578	266.4370	403.2751	515.3653	545.4337	559.5530	(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	1080.4158	1043.6145	941.3280	777.6917	593.1509	391.8002	255.2514	268.3415	426.6016	659.3851	884.3599	1072.4687	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	371.5650	285.6760	229.9664	117.8373	42.5308	0.0000	0.0000	0.0000	0.0000	107.1507	244.0268	381.6093	(98)
Space heating												1780.3623	(98)
Space heating per m2												24.6998	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1967.2512	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	371.5650	285.6760	229.9664	117.8373	42.5308	0.0000	0.0000	0.0000	0.0000	107.1507	244.0268	381.6093	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	410.5691	315.6641	254.1065	130.2069	46.9953	0.0000	0.0000	0.0000	0.0000	118.3986	269.6429	421.6677	(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	157.1280	119.4026	98.7935	57.6603	32.6946	18.4272	14.1366	40.8779	61.6606	103.4034	135.8073	156.4694	(64)	
Efficiency of water heater	89.3047	89.3144	89.2916	89.1805	88.7626	86.6000	86.6000	86.6000	86.6000	88.5418	89.0659	89.3302	(217)	
Fuel for water heating, kWh/month	175.9459	133.6880	110.6415	64.6557	36.8338	21.2785	16.3240	47.2032	71.2016	116.7849	152.4796	175.1585	(219)	
Water heating fuel used												1122.1952	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1967.2512	(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)												337.4348	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)	
Total delivered energy for all uses												2921.4388	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1967.2512	3.4800	68.4603	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1122.1952	3.4800	39.0524	(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	337.4348	13.1900	44.5077	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			205.3525	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.7367	(257)
SAP value			89.7236	
SAP rating (Section 12)			90	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1967.2512	0.2160	424.9263 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1122.1952	0.2160	242.3942 (264)
Space and water heating			667.3204 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	337.4348	0.5190	175.1287 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			580.1245 (272)
CO2 emissions per m2			8.0500 (273)
EI value			93.3604
EI rating			93 (274)
EI band			A

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	36.0400 (1b)	x 2.3900 (2b)	= 86.1356 (1b) - (3b)
First floor	36.0400 (1c)	x 2.6700 (2c)	= 96.2268 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.3624 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1645 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4135 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3515 (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												
Effective ac	0.3691	0.3427	0.3515	0.3339	0.3339	0.3251	0.3163	0.3075	0.2988	0.3251	0.3075	0.3251 (22b)
	0.5681	0.5587	0.5618	0.5557	0.5557	0.5529	0.5500	0.5473	0.5446	0.5529	0.5473	0.5529 (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)			10.6500	1.1450	12.1947		(27)
Ground Floor			36.0400	0.1000	3.6040	140.0000	5045.6000 (28a)
Brick and Block	31.2300	10.5700	20.6600	0.2400	4.9584	42.2200	872.2652 (29a)
Cladding & Block	12.1800	2.2000	9.9800	0.2400	2.3952	42.2200	421.3556 (29a)
Pitched Roof	36.0400		36.0400	0.1000	3.6040	9.0000	324.3600 (30)
Total net area of external elements Aum(A, m ²)			115.4900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0883		(33)
Party Wall 1			85.5400	0.0000	0.0000	70.0000	5987.8000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor Stud			63.0300			9.0000	567.2700 (32c)
Internal Floor 1			36.0400			18.0000	648.7200 (32d)
Internal Ceiling 1			36.0400			18.0000	648.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15090.4708 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							209.3573 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1960 (36)
Total fabric heat loss						(33) + (36) =	35.2842 (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	34.1881	33.6235	33.8071	33.4446	33.4446	33.2704	33.1008	32.9358	32.7755	33.2704	32.9358	33.2704 (38)
Heat transfer coeff	69.4723	68.9077	69.0913	68.7288	68.7288	68.5546	68.3850	68.2200	68.0597	68.5546	68.2200	68.5546 (39)
Average = Sum(39)m / 12 =												68.6231 (39)
HLP	0.9638	0.9560	0.9585	0.9535	0.9535	0.9511	0.9487	0.9464	0.9442	0.9511	0.9464	0.9511 (40)
HLP (average)												0.9520 (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												2.2955 (42)
Average daily hot water use (litres/day)												88.7192 (43)
Daily hot water use	97.5911	94.0423	90.4936	86.9448	83.3960	79.8473	79.8473	83.3960	86.9448	90.4936	94.0423	97.5911 (44)
Energy conte	144.7248	126.5772	130.6164	113.8745	109.2653	94.2876	87.3714	100.2599	101.4573	118.2387	129.0668	140.1582 (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 =	1395.8982 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.7087	18.9866	19.5925	17.0812	16.3898	14.1431	13.1057	15.0390	15.2186	17.7358	19.3600	21.0237 (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	36.3941	32.8593	36.3596	35.1636	36.3190	35.1280	36.2869	36.3077	35.1474	36.3428	35.1972	36.3874 (61)	
Total heat required for water heating calculated for each month													
	181.1189	159.4365	166.9759	149.0381	145.5843	129.4157	123.6583	136.5676	136.6048	154.5815	164.2640	176.5457 (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												1.4540 (H8)	
Utilisation factor												0.4973 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												88.7192 (H14)	
Volume ratio Veff/V												0.8454 (H15)	
Solar storage volume factor												0.9664 (H16)	
Solar input												-857.6904 (H17)	
Solar input	-27.9799	-39.7857	-68.3820	-92.2632	-108.3687	-115.7549	-113.3205	-101.4253	-79.4090	-54.9007	-33.0929	-23.0076 (63)	
	Solar input (sum of months) = Sum(63)m =											-857.6904 (63)	
Output from w/h	153.1390	119.6509	98.5939	56.7749	37.2156	13.6608	10.3378	35.1423	57.1958	99.6808	131.1711	153.5380 (64)	
	Total per year (kWh/year) = Sum(64)m =											966.1008 (64)	
Heat gains from water heating, kWh/month													
	57.2195	50.3018	52.5198	46.6542	45.4105	40.1326	38.1227	42.4133	42.5214	48.4001	51.7140	55.6995 (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	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7674	42.4266	34.5036	26.1215	19.5261	16.4848	17.8124	23.1532	31.0761	39.4583	46.0537	49.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(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)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	76.9080	74.8538	70.5912	64.7975	61.0356	55.7398	51.2402	57.0072	59.0575	65.0539	71.8250	74.8649	(72)
Total internal gains	526.3000	522.0352	501.9618	470.9936	439.4392	411.1797	394.6983	402.6760	420.5371	451.7079	486.2716	512.2752	(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				7.4900	13.4839	0.6300		0.7000	0.7700		30.8652 (74)	
South				3.1600	56.7559	0.6300		0.7000	0.7700		54.8112 (78)	

Solar gains	85.6764	126.9191	185.6776	254.5356	294.0951	328.9777	309.7507	272.0286	219.9787	154.0647	102.7685	71.8210 (83)
Total gains	611.9765	648.9543	687.6394	725.5292	733.5343	740.1574	704.4490	674.7046	640.5158	605.7726	589.0401	584.0962 (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	60.3377	60.8320	60.6704	60.9904	60.9904	61.1454	61.2970	61.4452	61.5900	61.1454	61.4452	61.1454
alpha	5.0225	5.0555	5.0447	5.0660	5.0660	5.0764	5.0865	5.0963	5.1060	5.0764	5.0963	5.0764
util living area	0.9775	0.9684	0.9408	0.8687	0.7281	0.5180	0.3769	0.3922	0.6382	0.8680	0.9558	0.9805 (86)
MIT	20.1906	20.2934	20.5011	20.7504	20.9218	20.9885	20.9981	20.9978	20.9688	20.7936	20.4836	20.1823 (87)
Th 2	20.1136	20.1202	20.1180	20.1223	20.1223	20.1243	20.1263	20.1282	20.1301	20.1243	20.1282	20.1243 (88)
util rest of house	0.9719	0.9606	0.9262	0.8377	0.6715	0.4427	0.2934	0.3057	0.5617	0.8301	0.9433	0.9755 (89)
MIT 2	19.3947	19.5003	19.6984	19.9316	20.0735	20.1195	20.1258	20.1277	20.1148	19.9757	19.6932	19.3958 (90)
Living area fraction												
MIT	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	fLA = Living area / (4) = 20.3033	20.1562	19.8677	0.2207 (91)
Temperature adjustment												19.5694 (92)
adjusted MIT	19.5704	19.6753	19.8755	20.1124	20.2608	20.3113	20.3184	20.3197	20.3033	20.1562	19.8677	0.0000
												19.5694 (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	0.9677	0.9559	0.9215	0.8373	0.6810	0.4591	0.3118	0.3248	0.5776	0.8316	0.9389	0.9717	(94)
Useful gains	592.1919	620.3635	633.6720	607.5200	499.5150	339.7717	219.6803	219.1630	369.9507	503.7598	553.0418	567.5390	(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	1019.1830	990.5720	889.5874	729.3757	533.3879	343.5475	220.0880	219.6497	381.3592	600.2790	816.4364	998.7974	(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	317.6814	248.7801	190.4010	87.7361	25.2014	0.0000	0.0000	0.0000	0.0000	71.8103	189.6441	320.8563	(98)
Space heating												1452.1108	(98)
Space heating per m2											(98) / (4) =	20.1458	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1604.5423	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	317.6814	248.7801	190.4010	87.7361	25.2014	0.0000	0.0000	0.0000	0.0000	71.8103	189.6441	320.8563	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	351.0292	274.8952	210.3879	96.9460	27.8469	0.0000	0.0000	0.0000	0.0000	79.3484	209.5515	354.5373	(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	153.1390	119.6509	98.5939	56.7749	37.2156	13.6608	10.3378	35.1423	57.1958	99.6808	131.1711	153.5380	(64)	
Efficiency of water heater	89.1935	89.1955	89.1306	88.9266	88.1335	86.6000	86.6000	86.6000	86.6000	88.1914	88.8637	89.1999	(217)	
Fuel for water heating, kWh/month	171.6930	134.1445	110.6173	63.8447	42.2264	15.7746	11.9374	40.5800	66.0459	113.0278	147.6093	172.1281	(219)	
Water heating fuel used												1089.6290	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1604.5423	(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)													337.4348	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602			-705.5602	(233)
Total delivered energy for all uses													2451.0460	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1604.5423	7.6100	122.1057	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1089.6290	7.6100	82.9208	(247)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Pump for solar water heating	50.0000	31.0800	15.5400	(249)
Energy for lighting	337.4348	31.0800	104.8748	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	31.0800	-219.2881	(252)
Total energy cost			234.4631	(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	1604.5423	0.2160	346.5811	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1089.6290	0.2160	235.3599	(264)
Space and water heating			581.9410	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	337.4348	0.5190	175.1287	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			455.7590	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1604.5423	1.2200	1957.5416	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1089.6290	1.2200	1329.3474	(264)
Space and water heating			3286.8890	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	337.4348	3.0700	1035.9250	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			2540.4942	(272)
Primary energy kWh/m2/year			35.2455	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 31	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	2 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	12.57	TER	18.07
Environmental	91 B	% DER<TER	30.43		
CO ₂ Emissions (t/year)	0.64	DFEE	36.87	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	21.47		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

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

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 31	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	2 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	12.57	TER	18.07
Environmental	91 B	% DER<TER	30.43		
CO ₂ Emissions (t/year)	0.64	DFEE	36.87	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	21.47		

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

Wall 000004

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 31	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	2 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	12.57	TER	18.07
Environmental	91 B	% DER<TER	30.43		
CO ₂ Emissions (t/year)	0.64	DFEE	36.87	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	21.47		

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

Wall 000007

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1300			
Layer 1	Tiling, clay						
	Main construction	30	1.0000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	93.18		
	Main construction	100	0.8800	0.1136	6.82		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
Layer 5	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.349 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 383 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 31	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	2 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	12.57	TER	18.07
Environmental	91 B	% DER<TER	30.43		
CO ₂ Emissions (t/year)	0.64	DFEE	36.87	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	21.47		

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

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

Floor Type: Suspended Floor

Area = 36.18 m², Perimeter = 8.58 m, Wall thickness = 300.00 mm, Soil: Clay

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

Floor height above ground: h = 0.000 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

Total resistance: Upper limit = 10.093 m² K/W Lower limit = 5.066 m² K/W Average = 7.579 m² K/W

Total correction = 0.0025 m² K/W

U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 450 mm

U-value: 0.10 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 31	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Property	2 Nuthatch Way, BOTLEY, SO32 2UH		
SAP Rating	88 B	DER	12.57
Environmental	91 B	TER	18.07
CO ₂ Emissions (t/year)	0.64	% DER<TER	30.43
General Requirements Compliance	Pass	DfEE	36.87
		TFEE	46.95
		% DfEE<TFEE	21.47
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2019
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	8.58 m	36.04 m ²	2.39 m
	1st Storey:	8.58 m	36.04 m ²	2.67 m

7.0 Living Area	15.91	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	209.36	kJ/m ² K

9.0 External Walls			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	31.23	20.66
Cladding & Block	Cavity Wall	Other	0.24	42.22	12.18	9.98

9.1 Party Walls			U-Value	Kappa	Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	85.54

9.2 Internal Walls			Kappa	Area
Description	Construction		(kJ/m ² K)	(m ²)
Ground Floor Stud	Plasterboard on timber frame		9.00	63.82
First Floor Stud	Plasterboard on timber frame		9.00	63.03

10.0 External Roofs			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	36.04	36.04

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	36.04

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.10	140.00	36.04

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	36.04

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Half Glazed Door	[1] Brick and Block	South							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					0.96	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.49	
Front Elevation	Window	[2] Cladding & Block	South	None	0.00					2.20	

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)	3.76	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.60	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.070	No	Birtley Supatherm
Independently assessed	E3 Sill	6.34	0.021	No	Knauf P5
Independently assessed	E4 Jamb	22.50	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	8.58	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	8.58	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.58	0.060	No	
Independently assessed	E18 Party wall between dwellings	20.20	0.036	No	Knauf P25 Halved
Table K1 - Default	P1 Party wall - Ground floor	17.00	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	17.00	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	17.00	0.035	No	Knauf P29 Halved

Y-value	0.054	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	4.98	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	11	
Total number of L.E.L. fittings	11	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Database		
Description	Combi Boiler	
Percentage of Heat	100	%
Database Ref. No.	17507	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	86.6	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.73	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£59	B 90	