



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 1 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 32	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Property	1 Nuthatch Way, BOTLEY, SO32 2UH		
SAP Rating	87 B	DER	14.40
Environmental	90 B	TER	19.48
CO ₂ Emissions (t/year)	0.76	% DER<TER	26.07
General Requirements Compliance	Pass	DfEE	44.34
		TfEE	54.34
		% DfEE<TfEE	18.40
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)	19.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.40	kgCO ₂ /m ²	Pass
	-5.08 (-26.1%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	54.34	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	44.34	kWh/m ² /yr	
	-10.0 (-18.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (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	4.75 (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)

Not significant

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

4.75 (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

0.11

W/m²K

Door U-value

1.10

W/m²K

Thermal bridging y-value

0.035

W/m²K

Photovoltaic array

0.73

kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	87 B	DER	14.40
Environmental	90 B	TER	19.48
CO ₂ Emissions (t/year)	0.76	% DER<TER	26.07
General Requirements Compliance	Pass	DFEE	44.34
		TFEE	54.34
		% DFEE<TFEE	18.40
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	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	6.35	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	16.93	1.05	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.93	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.58	0.51	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.50	0.37	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.10	0.39	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	10.10	0.36	Knauf P25 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.50	1.36	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.50	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.50	0.30	Knauf P29 Halved

Total: **5.46** W/mK:
Y-Value: **0.035** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	90 B	% DER<TER	26.07			
CO ₂ Emissions (t/year)	0.76	DFEE	44.34	TFEE	54.34	
General Requirements Compliance	Pass	% DFEE<TFEE	18.40			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
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FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

End-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) 19.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (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: 4.75 (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): Not significant 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 0.11 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.035 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					4.7500
Infiltration rate					0.4020 (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) =	0.3417 (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	0.4357	0.4271	0.4186	0.3759	0.3673	0.3246	0.3246	0.3161	0.3417	0.3673	0.3844	0.4015 (22b)
Effective ac	0.5949	0.5912	0.5876	0.5706	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5739	0.5806 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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) = 15591.5880 (34)
216.3095 (35)
5.4607 (36)
(33) + (36) = 45.0517 (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	35.8012	35.5795	35.3621	34.3410	34.1500	33.2606	33.2606	33.0959	33.6032	34.1500	34.5364	34.9405 (38)
Heat transfer coeff	80.8530	80.6312	80.4138	79.3927	79.2017	78.3124	78.3124	78.1477	78.6549	79.2017	79.5881	79.9922 (39)
Average = Sum(39)m / 12 =												79.3918 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1217	1.1186	1.1156	1.1015	1.0988	1.0865	1.0865	1.0842	1.0912	1.0988	1.1042	1.1098 (40)
HLP (average)												1.1014 (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)
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
114.7772	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	(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 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	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	53.5663	53.7137	53.8589	54.5516	54.6831	55.3041	55.3041	55.4207	55.0633	54.6831	54.4176	54.1427
alpha	4.5711	4.5809	4.5906	4.6368	4.6455	4.6869	4.6869	4.6947	4.6709	4.6455	4.6278	4.6095
util living area	0.9964	0.9935	0.9866	0.9649	0.9032	0.7651	0.6027	0.6555	0.8704	0.9735	0.9933	0.9972 (86)
MIT	19.6451	19.7901	20.0366	20.3763	20.6928	20.9069	20.9765	20.9654	20.8153	20.4203	19.9770	19.6214 (87)
Th 2	19.9831	19.9856	19.9881	19.9996	20.0018	20.0119	20.0119	20.0138	20.0080	20.0018	19.9974	19.9929 (88)
util rest of house	0.9954	0.9916	0.9823	0.9526	0.8675	0.6828	0.4811	0.5352	0.8103	0.9620	0.9910	0.9963 (89)
MIT 2	18.7482	18.8945	19.1410	19.4829	19.7803	19.9635	20.0047	20.0020	19.8959	19.5311	19.0904	18.7322 (90)
Living area fraction												
MIT	18.9461	19.0922	19.3387	19.6801	19.9817	20.1717	20.2192	20.2146	20.0988	19.7274	19.2861	18.9285 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9461	19.0922	19.3387	19.6801	19.9817	20.1717	20.2192	20.2146	20.0988	19.7274	19.2861	18.9285 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9939	0.9893	0.9787	0.9478	0.8667	0.6974	0.5079	0.5614	0.8168	0.9578	0.9887	0.9951	(94)	
Useful gains	425.4222	471.8313	505.9571	527.6855	506.7341	399.4385	276.9288	287.8541	391.8249	423.3948	409.4035	405.4255	(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	1184.1844	1144.3324	1032.4072	855.8619	655.9268	436.3340	283.4255	298.1049	471.8360	722.9018	969.8707	1178.1627	(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	564.5191	451.9208	391.6788	236.2871	110.9993	0.0000	0.0000	0.0000	0.0000	222.8332	403.5364	574.9165	(98)	
Space heating												2956.6911	(98)	
Space heating per m2												(98) / (4) =	41.0196	(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													3267.0620 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	564.5191	451.9208	391.6788	236.2871	110.9993	0.0000	0.0000	0.0000	0.0000	222.8332	403.5364	574.9165	(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)	623.7780	499.3599	432.7943	261.0907	122.6512	0.0000	0.0000	0.0000	0.0000	246.2245	445.8966	635.2668	(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	89.5207	89.4494	89.2980	88.9506	88.2451	86.6000	86.6000	86.6000	86.6000	88.8609	89.3361	86.6000	(216)
Fuel for water heating, kWh/month	202.3207	178.2421	186.9873	167.5516	164.9771	149.4407	142.7925	157.6993	157.7422	173.9589	183.8719	197.1421	(219)
Water heating fuel used												2062.7263	(219)
Annual totals kWh/year													
Space heating fuel - main system												3267.0620	(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												5111.7807	(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	3267.0620	0.2160	705.6854 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2062.7263	0.2160	445.5489 (264)
Space and water heating			1151.2343 (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			1038.0884 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4000 (273)

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

DER			14.4000 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			33.4304 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			33.4304 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	70.7600	10.5700	60.1900	0.1800	10.8342			(29a)					
Cladding & Block	14.9100	2.2000	12.7100	0.1800	2.2878			(29a)					
Pitched Roof	36.0400		36.0400	0.1300	4.6852			(30)					
Total net area of external elements Aum(A, m2)			157.7500					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1557			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8346	(36)					
Total fabric heat loss						(33) + (36) =	47.9903	(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	84.1523	83.9165	83.6854	82.5998	82.3967	81.4512	81.4512	81.2761	81.8154	82.3967	82.8076	83.2371	(39)
Average = Sum(39)m / 12 =												82.5988	(39)
HLP	Jan 1.1675	Feb 1.1642	Mar 1.1610	Apr 1.1459	May 1.1431	Jun 1.1300	Jul 1.1300	Aug 1.1276	Sep 1.1351	Oct 1.1431	Nov 1.1488	Dec 1.1548	(40)
HLP (average)												1.1459	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	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]					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	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	59.4821	59.6493	59.8140	60.6001	60.7495	61.4547	61.4547	61.5871	61.1811	60.7495	60.4480	60.1361	
alpha	4.9655	4.9766	4.9876	5.0400	5.0500	5.0970	5.0970	5.1058	5.0787	5.0500	5.0299	5.0091	
util living area	0.9980	0.9962	0.9916	0.9756	0.9240	0.7931	0.6271	0.6810	0.8936	0.9820	0.9961	0.9985	(86)
MIT	19.7354	19.8667	20.0929	20.4085	20.7077	20.9138	20.9797	20.9695	20.8257	20.4526	20.0425	19.7150	(87)
Th 2	19.9461	19.9487	19.9513	19.9635	19.9658	19.9764	19.9764	19.9784	19.9723	19.9658	19.9612	19.9563	(88)
util rest of house	0.9973	0.9949	0.9884	0.9655	0.8902	0.7064	0.4954	0.5512	0.8338	0.9727	0.9945	0.9979	(89)
MIT 2	18.2620	18.4555	18.7868	19.2498	19.6625	19.9145	19.9684	19.9648	19.8226	19.3189	18.7217	18.2395	(90)
Living area fraction	18.5872	18.7670	19.0751	19.5056	19.8932	20.1351	20.1916	20.1866	20.0440	19.5691	19.0132	18.5651	(92)
MIT	18.5872	18.7670	19.0751	19.5056	19.8932	20.1351	20.1916	20.1866	20.0440	19.5691	19.0132	18.5651	(93)
Temperature adjustment													
adjusted MIT	18.5872	18.7670	19.0751	19.5056	19.8932	20.1351	20.1916	20.1866	20.0440	19.5691	19.0132	18.5651	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.7899	477.3097	512.2982	536.8409	520.6499	414.2299	286.7997	298.4039	404.6676	430.9361	414.7211	410.6104	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1202.3030	1163.6704	1052.3522	876.0183	675.0912	450.8393	292.5412	307.7590	486.3128	739.0256	986.5048	1195.7127	(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	574.0057	461.2344	401.8002	244.2077	114.9044	0.0000	0.0000	0.0000	0.0000	229.2186	411.6843	584.1161	(98)
Space heating												3021.1715	(98)
Space heating per m2												41.9141	(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													3234.6590 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	574.0057	461.2344	401.8002	244.2077	114.9044	0.0000	0.0000	0.0000	0.0000	229.2186	411.6843	584.1161	(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)	614.5672	493.8270	430.1929	261.4644	123.0240	0.0000	0.0000	0.0000	0.0000	245.4161	440.7754	625.3920	(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	87.6115	87.4398	87.0551	86.1632	84.3613	80.3000	80.3000	80.3000	80.3000	85.8888	87.1254	80.3000	(216)
Fuel for water heating, kWh/month	221.9527	194.2621	203.0104	181.9238	179.8965	166.4563	159.4778	177.7803	179.7437	191.3560	201.3693	216.5366	(219)
Water heating fuel used												2273.7657	(219)
Annual totals kWh/year													
Space heating fuel - main system												3234.6590	(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												5920.8595	(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	3234.6590	0.2160	698.6863 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2273.7657	0.2160	491.1334 (264)
Space and water heating			1189.8197 (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			1403.8734 (272)
Emissions per m2 for space and water heating			16.5069 (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) = (16.5069 * 1.00) + 2.4296 + 0.5400, rounded to 2 d.p.			19.4800 (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	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					4.7500
Infiltration rate					0.4020 (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) =	0.3417 (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	0.4357	0.4271	0.4186	0.3759	0.3673	0.3246	0.3246	0.3161	0.3417	0.3673	0.3844	0.4015 (22b)
Effective ac	0.5949	0.5912	0.5876	0.5706	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5739	0.5806 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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)							(28)...(30) + (32) + (32a)...(32e) = 15267.2280 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.8095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4607 (36)
Total fabric heat loss							(33) + (36) = 45.0517 (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	35.8012	35.5795	35.3621	34.3410	34.1500	33.2606	33.2606	33.0959	33.6032	34.1500	34.5364	34.9405 (38)
Heat transfer coeff	80.8530	80.6312	80.4138	79.3927	79.2017	78.3124	78.3124	78.1477	78.6549	79.2017	79.5881	79.9922 (39)
Average = Sum(39)m / 12 =												79.3918 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1217	1.1186	1.1156	1.1015	1.0988	1.0865	1.0865	1.0842	1.0912	1.0988	1.1042	1.1098 (40)
HLP (average)												1.1014 (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)

	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 FABRIC ENERGY EFFICIENCY 09 Jan 2014

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, 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	52.4520	52.5962	52.7384	53.4167	53.5455	54.1536	54.1536	54.2677	53.9178	53.5455	53.2855	53.0164	
alpha	4.4968	4.5064	4.5159	4.5611	4.5697	4.6102	4.6102	4.6178	4.5945	4.5697	4.5524	4.5344	
util living area	0.9973	0.9950	0.9892	0.9706	0.9162	0.7883	0.6293	0.6859	0.8904	0.9793	0.9951	0.9979	(86)
MIT	19.5663	19.7153	19.9694	20.3212	20.6541	20.8888	20.9702	20.9559	20.7837	20.3643	19.9066	19.5429	(87)
Th 2	19.9831	19.9856	19.9881	19.9996	20.0018	20.0119	20.0119	20.0138	20.0080	20.0018	19.9974	19.9929	(88)
util rest of house	0.9966	0.9935	0.9857	0.9603	0.8842	0.7088	0.5055	0.5649	0.8363	0.9701	0.9933	0.9973	(89)
MIT 2	18.6715	18.8220	19.0765	19.4317	19.7478	19.9522	20.0024	19.9980	19.8725	19.4790	19.0225	18.6559	(90)
Living area fraction	18.8690	19.0192	19.2735	19.6280	19.9479	20.1589	20.2160	20.2095	20.0736	19.6744	19.2176	18.8517	(92)
Temperature adjustment	18.8690	19.0192	19.2735	19.6280	19.9479	20.1589	20.2160	20.2095	20.0736	19.6744	19.2176	18.8517	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9954	0.9916	0.9825	0.9554	0.8821	0.7220	0.5327	0.5910	0.8406	0.9661	0.9915	0.9963	(94)
Ext temp.	387.6669	435.3854	472.2711	499.2760	486.8110	391.2046	274.8502	284.4613	376.2528	393.9274	374.1065	368.2402	(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	1177.9493	1138.4460	1027.1695	851.7278	653.2447	435.3313	283.1758	297.7016	469.8527	718.7065	964.4193	1172.0179	(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	587.9701	472.4567	412.8444	253.7653	123.8267	0.0000	0.0000	0.0000	0.0000	241.6356	425.0252	598.0107	(98)
Space heating per m2												3115.5347	(98)
												43.2233	(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	736.1361	579.5114	593.9222	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8120	0.8840	0.8560	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	597.7228	512.2643	508.3741	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	87.3581	130.1019	104.0467	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												321.5067 (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	21.8395	32.5255	26.0117	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												80.3767 (107)
Space cooling per m2												1.1151 (108)
Energy for space heating												43.2233 (99)
Energy for space cooling												1.1151 (108)
Total												44.3384 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	70.7600	10.5700	60.1900	0.1800	10.8342			(29a)					
Cladding & Block	14.9100	2.2000	12.7100	0.1800	2.2878			(29a)					
Pitched Roof	36.0400		36.0400	0.1300	4.6852			(30)					
Total net area of external elements Aum(A, m2)			157.7500					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1557			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8346	(36)					
Total fabric heat loss						(33) + (36) =	47.9903	(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	84.1523	83.9165	83.6854	82.5998	82.3967	81.4512	81.4512	81.2761	81.8154	82.3967	82.8076	83.2371	(39)
Average = Sum(39)m / 12 =												82.5988	(39)
HLP	Jan 1.1675	Feb 1.1642	Mar 1.1610	Apr 1.1459	May 1.1431	Jun 1.1300	Jul 1.1300	Aug 1.1276	Sep 1.1351	Oct 1.1431	Nov 1.1488	Dec 1.1548	(40)
HLP (average)												1.1459	(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

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			Solar flux		g		FF		Access		Gains
	m2			Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		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	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	59.4821	59.6493	59.8140	60.6001	60.7495	61.4547	61.4547	61.5871	61.1811	60.7495	60.4480	60.1361
alpha	4.9655	4.9766	4.9876	5.0400	5.0500	5.0970	5.0970	5.1058	5.0787	5.0500	5.0299	5.0091
util living area	0.9988	0.9975	0.9940	0.9815	0.9382	0.8194	0.6575	0.7160	0.9157	0.9875	0.9975	0.9991 (86)
MIT	19.6800	19.8134	20.0434	20.3656	20.6758	20.8989	20.9749	20.9618	20.7980	20.4074	19.9905	19.6603 (87)
Th 2	19.9461	19.9487	19.9513	19.9635	19.9658	19.9764	19.9764	19.9784	19.9723	19.9658	19.9612	19.9563 (88)
util rest of house	0.9983	0.9966	0.9917	0.9735	0.9089	0.7362	0.5227	0.5851	0.8636	0.9808	0.9965	0.9987 (89)
MIT 2	18.7410	18.8763	19.1074	19.4352	19.7316	19.9254	19.9695	19.9663	19.8496	19.4807	19.0632	18.7295 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9483	19.0831	19.3140	19.6406	19.9400	20.1402	20.1914	20.1860	20.0590	19.6853	19.2679	18.9350 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9483	19.0831	19.3140	19.6406	19.9400	20.1402	20.1914	20.1860	20.0590	19.6853	19.2679	18.9350 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9978	0.9956	0.9898	0.9703	0.9080	0.7513	0.5529	0.6142	0.8690	0.9783	0.9955	0.9983 (94)
Ext temp.	388.5950	437.1459	475.8007	507.0273	501.1133	407.0797	285.2722	295.6241	388.9841	398.8898	375.6368	368.9578 (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	1232.6852	1190.1973	1072.3481	887.1706	678.9517	451.2599	292.5231	307.7146	487.5342	748.5962	1007.5954	1226.4967 (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	628.0031	506.0505	443.8312	273.7032	132.3118	0.0000	0.0000	0.0000	0.0000	260.1815	455.0102	638.0089 (98)
Space heating per m2	(98) / (4) =											46.2972 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	765.6412	602.7389	617.6984	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8087	0.8855	0.8557	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	619.1484	533.7471	528.5669	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	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)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	71.9317	114.1187	89.0233	0.0000	0.0000	0.0000	0.0000 (104)
												275.0737 (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	17.9829	28.5297	22.2558	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												68.7684 (107)
Space cooling per m2												0.9541 (108)
Energy for space heating												46.2972 (99)
Energy for space cooling												0.9541 (108)
Total												47.2512 (109)
Target Fabric Energy Efficiency (TFEE)												54.3 (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	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					4.7500
Infiltration rate					0.4020 (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)	=	0.3417 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3588	0.3332	0.3417	0.3246	0.3246	0.3161	0.3075	0.2990	0.2905	0.3161	0.2990	0.3161 (22b)
Effective ac	0.5644	0.5555	0.5584	0.5527	0.5527	0.5500	0.5473	0.5447	0.5422	0.5500	0.5447	0.5500 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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) = 15591.5880 (34)
216.3095 (35)
5.4607 (36)
(33) + (36) = 45.0517 (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	33.9633	33.4297	33.6032	33.2606	33.2606	33.0959	32.9356	32.7797	32.6282	33.0959	32.7797	33.0959 (38)
Heat transfer coeff	79.0150	78.4814	78.6549	78.3124	78.3124	78.1477	77.9874	77.8315	77.6799	78.1477	77.8315	78.1477 (39)
Average = Sum(39)m / 12 =												78.2124 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0962	1.0888	1.0912	1.0865	1.0865	1.0842	1.0820	1.0798	1.0777	1.0842	1.0798	1.0842 (40)
HLP (average)												1.0851 (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 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	54.8123	55.1850	55.0633	55.3041	55.3041	55.4207	55.5346	55.6458	55.7544	55.4207	55.6458	55.4207
alpha	4.6542	4.6790	4.6709	4.6869	4.6869	4.6947	4.7023	4.7097	4.7170	4.6947	4.7097	4.6947
util living area	0.9825	0.9758	0.9553	0.9002	0.7819	0.5784	0.4270	0.4441	0.6995	0.8998	0.9667	0.9848 (86)
MIT	20.0108	20.1156	20.3442	20.6344	20.8639	20.9744	20.9950	20.9942	20.9388	20.6968	20.3340	20.0021 (87)
Th 2	20.0039	20.0100	20.0080	20.0119	20.0119	20.0138	20.0156	20.0174	20.0191	20.0138	20.0174	20.0138 (88)
util rest of house	0.9777	0.9693	0.9427	0.8719	0.7230	0.4881	0.3217	0.3352	0.6136	0.8649	0.9561	0.9806 (89)
MIT 2	19.1265	19.2340	19.4547	19.7303	19.9263	20.0032	20.0145	20.0160	19.9892	19.7932	19.4553	19.1261 (90)
Living area fraction	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (91)
MIT	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	595.8027	625.9054	644.5262	630.6288	536.1357	375.5742	243.0749	242.4726	403.7957	523.3935	560.2970	570.5694	(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	1139.5295	1108.8341	995.0662	816.7851	597.7804	384.2994	244.1717	243.7644	427.1478	671.4951	914.4596	1119.0347	(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	404.5327	324.5280	260.8018	134.0325	45.8637	0.0000	0.0000	0.0000	0.0000	110.1876	254.9971	408.0581	(98)
Space heating												1943.0015	(98)
RHI space heating demand												1943	(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	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					4.7500
Infiltration rate					0.4020 (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) =	0.3417 (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	0.4357	0.4271	0.4186	0.3759	0.3673	0.3246	0.3246	0.3161	0.3417	0.3673	0.3844	0.4015 (22b)
	0.5949	0.5912	0.5876	0.5706	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5739	0.5806 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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) = 15591.5880 (34)
216.3095 (35)
5.4607 (36)
(33) + (36) = 45.0517 (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	35.8012	35.5795	35.3621	34.3410	34.1500	33.2606	33.2606	33.0959	33.6032	34.1500	34.5364	34.9405 (38)
Heat transfer coeff	80.8530	80.6312	80.4138	79.3927	79.2017	78.3124	78.3124	78.1477	78.6549	79.2017	79.5881	79.9922 (39)
Average = Sum(39)m / 12 =												79.3918 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1217	1.1186	1.1156	1.1015	1.0988	1.0865	1.0865	1.0842	1.0912	1.0988	1.1042	1.1098 (40)
HLP (average)												1.1014 (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	53.5663	53.7137	53.8589	54.5516	54.6831	55.3041	55.3041	55.4207	55.0633	54.6831	54.4176	54.1427
alpha	4.5711	4.5809	4.5906	4.6368	4.6455	4.6869	4.6869	4.6947	4.6709	4.6455	4.6278	4.6095
util living area	0.9866	0.9795	0.9640	0.9234	0.8313	0.6653	0.5030	0.5449	0.7694	0.9302	0.9769	0.9887 (86)
MIT	19.8817	20.0183	20.2435	20.5431	20.7983	20.9486	20.9888	20.9838	20.8962	20.5906	20.1910	19.8550 (87)
Th 2	19.9831	19.9856	19.9881	19.9996	20.0018	20.0119	20.0119	20.0138	20.0080	20.0018	19.9974	19.9929 (88)
util rest of house	0.9830	0.9739	0.9539	0.9009	0.7827	0.5806	0.3956	0.4362	0.6938	0.9052	0.9697	0.9857 (89)
MIT 2	18.9822	19.1188	19.3411	19.6364	19.8650	19.9871	20.0087	20.0087	19.9508	19.6873	19.2998	18.9637 (90)
Living area fraction	19.1808	19.3173	19.5403	19.8366	20.0710	20.1993	20.2250	20.2239	fLA = Living area / (4) =			0.2207 (91)
MIT	19.1808	19.3173	19.5403	19.8366	20.0710	20.1993	20.2250	20.2239	20.1595	19.8866	19.4965	19.1605 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1808	19.3173	19.5403	19.8366	20.0710	20.1993	20.2250	20.2239	20.1595	19.8866	19.4965	19.1605 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9793	0.9693	0.9484	0.8967	0.7865	0.5976	0.4193	0.4601	0.7065	0.9017	0.9651	0.9824	(94)	
Useful gains	583.4384	622.7718	640.3545	631.6117	567.3502	418.9256	280.9378	294.3008	433.7426	529.1719	549.9369	561.5173	(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	1203.1544	1162.4859	1048.6187	868.2830	662.9949	438.4946	283.8843	298.8321	476.6090	735.5182	986.6137	1196.7205	(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	461.0687	362.6879	303.7486	170.4034	71.1597	0.0000	0.0000	0.0000	0.0000	153.5217	314.4073	472.5912	(98)	
Space heating												2309.5884	(98)	
Space heating per m2												(98) / (4) =	32.0420	(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													2552.0314 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	461.0687	362.6879	303.7486	170.4034	71.1597	0.0000	0.0000	0.0000	0.0000	153.5217	314.4073	472.5912	(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)	509.4682	400.7601	335.6338	188.2910	78.6295	0.0000	0.0000	0.0000	0.0000	169.6372	347.4114	522.2003	(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	89.3649	89.2723	89.0770	88.6376	87.8428	86.6000	86.6000	86.6000	86.6000	88.5004	89.1227	86.6000	(216)
Fuel for water heating, kWh/month	202.6733	178.5957	187.4512	168.1432	165.7327	149.4407	142.7925	157.6993	157.7422	174.6677	184.3123	197.4674	(219)
Water heating fuel used												2066.7181	(219)
Annual totals kWh/year													
Space heating fuel - main system												2552.0314	(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												4400.7420	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2552.0314	3.4800	88.8107 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2066.7181	3.4800	71.9218 (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			251.9773 (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] =	0.9039 (257)
SAP value		87.3904
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2552.0314	0.2160	551.2388 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2066.7181	0.2160	446.4111 (264)
Space and water heating			997.6499 (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			884.5040 (272)
CO2 emissions per m2			12.2700 (273)
EI value			89.8767
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

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Calculation Type: New Build (As Built)



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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	$3.48 / 0.8814 = 3.948$, stars = 4
Water heating environmental impact	$0.216 / 0.8814 = 0.2451$, 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					4.7500
Infiltration rate					0.4020 (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)	=	0.3417 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3588	0.3332	0.3417	0.3246	0.3246	0.3161	0.3075	0.2990	0.2905	0.3161	0.2990	0.3161 (22b)
Effective ac	0.5644	0.5555	0.5584	0.5527	0.5527	0.5500	0.5473	0.5447	0.5422	0.5500	0.5447	0.5500 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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) = 15591.5880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 216.3095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.4607 (36)
Total fabric heat loss (33) + (36) = 45.0517 (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	33.9633	33.4297	33.6032	33.2606	33.2606	33.0959	32.9356	32.7797	32.6282	33.0959	32.7797	33.0959 (38)
Heat transfer coeff	79.0150	78.4814	78.6549	78.3124	78.3124	78.1477	77.9874	77.8315	77.6799	78.1477	77.8315	78.1477 (39)
Average = Sum(39)m / 12 =												78.2124 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0962	1.0888	1.0912	1.0865	1.0865	1.0842	1.0820	1.0798	1.0777	1.0842	1.0798	1.0842 (40)
HLP (average)												1.0851 (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)

	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 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 (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	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	54.8123	55.1850	55.0633	55.3041	55.3041	55.4207	55.5346	55.6458	55.7544	55.4207	55.6458	55.4207
alpha	4.6542	4.6790	4.6709	4.6869	4.6869	4.6947	4.7023	4.7097	4.7170	4.6947	4.7097	4.6947
util living area	0.9825	0.9758	0.9553	0.9002	0.7819	0.5784	0.4270	0.4441	0.6995	0.8998	0.9667	0.9848 (86)
MIT	20.0108	20.1156	20.3442	20.6344	20.8639	20.9744	20.9950	20.9942	20.9388	20.6968	20.3340	20.0021 (87)
Th 2	20.0039	20.0100	20.0080	20.0119	20.0119	20.0138	20.0156	20.0174	20.0191	20.0138	20.0174	20.0138 (88)
util rest of house	0.9777	0.9693	0.9427	0.8719	0.7230	0.4881	0.3217	0.3352	0.6136	0.8649	0.9561	0.9806 (89)
MIT 2	19.1265	19.2340	19.4547	19.7303	19.9263	20.0032	20.0145	20.0160	19.9892	19.7932	19.4553	19.1261 (90)
Living area fraction	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (91)
MIT	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9736	0.9645	0.9373	0.8692	0.7309	0.5074	0.3451	0.3594	0.6304	0.8640	0.9512	0.9768	(94)
Useful gains	595.8027	625.9054	644.5262	630.6288	536.1357	375.5742	243.0749	242.4726	403.7957	523.3935	560.2970	570.5694	(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	1139.5295	1108.8341	995.0662	816.7851	597.7804	384.2994	244.1717	243.7644	427.1478	671.4951	914.4596	1119.0347	(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	404.5327	324.5280	260.8018	134.0325	45.8637	0.0000	0.0000	0.0000	0.0000	110.1876	254.9971	408.0581	(98)
Space heating													(98)
Space heating per m2													(98) / (4) =

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													2146.9630 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	404.5327	324.5280	260.8018	134.0325	45.8637	0.0000	0.0000	0.0000	0.0000	110.1876	254.9971	408.0581	(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)	446.9975	358.5945	288.1788	148.1022	50.6781	0.0000	0.0000	0.0000	0.0000	121.7542	281.7647	450.8930	(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	89.2569	89.1770	88.9366	88.4039	87.5034	86.6000	86.6000	86.6000	86.6000	88.1815	88.9309	86.6000	(216)
Fuel for water heating, kWh/month	202.9187	178.7867	187.7471	168.5878	166.3756	149.4407	142.7925	157.6993	157.7422	175.2993	184.7098	197.7312	(219)
Water heating fuel used												2069.8309	(219)
Annual totals kWh/year													
Space heating fuel - main system												2146.9630	(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	(233)
Total delivered energy for all uses												3923.6685	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2146.9630	7.6100	163.3839 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2069.8309	7.6100	157.5141 (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			334.7947 (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	2146.9630	0.2160	463.7440 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2069.8309	0.2160	447.0835 (264)
Space and water heating			910.8275 (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			758.6954 (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	2146.9630	1.2200	2619.2949 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2069.8309	1.2200	2525.1937 (264)
Space and water heating			5144.4885 (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			4244.5937 (272)
Primary energy kWh/m2/year			58.8873 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(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	-186 kg (24.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£59 2.59 kg/m²	B 89	A 92
Total Savings	£59 2.59 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

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	£426	£351	£75
Space heating	£292	£292	£0
Water heating	£158	£98	£59
Lighting	£105	£105	£0
Generated (PV)	-£219	-£219	£0
Total cost of fuels	£335	£276	£59
Total cost of uses	£336	£276	£59
Delivered energy	54 kWh/m²	41 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	59 kWh/m²	44 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	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					4.7500
Infiltration rate					0.4020 (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)	=	0.3417 (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	0.4357	0.4271	0.4186	0.3759	0.3673	0.3246	0.3246	0.3161	0.3417	0.3673	0.3844	0.4015 (22b)
Effective ac	0.5949	0.5912	0.5876	0.5706	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5739	0.5806 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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) = 15591.5880 (34)
216.3095 (35)
5.4607 (36)
(33) + (36) = 45.0517 (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	35.8012	35.5795	35.3621	34.3410	34.1500	33.2606	33.2606	33.0959	33.6032	34.1500	34.5364	34.9405 (38)
Heat transfer coeff	80.8530	80.6312	80.4138	79.3927	79.2017	78.3124	78.3124	78.1477	78.6549	79.2017	79.5881	79.9922 (39)
Average = Sum(39)m / 12 =												79.3918 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1217	1.1186	1.1156	1.1015	1.0988	1.0865	1.0865	1.0842	1.0912	1.0988	1.1042	1.1098 (40)
HLP (average)												1.1014 (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													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-23.9909	-40.0339	-68.1824	-91.3778	-112.8896	-110.9885	-109.5217	-95.6897	-74.9442	-51.1781	-28.4567	-827.3298	(H17)
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)
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	53.5663	53.7137	53.8589	54.5516	54.6831	55.3041	55.3041	55.4207	55.0633	54.6831	54.4176	54.1427
alpha	4.5711	4.5809	4.5906	4.6368	4.6455	4.6869	4.6869	4.6947	4.6709	4.6455	4.6278	4.6095
util living area	0.9866	0.9795	0.9640	0.9234	0.8313	0.6653	0.5030	0.5449	0.7694	0.9302	0.9769	0.9887 (86)
MIT	19.8817	20.0183	20.2435	20.5431	20.7983	20.9486	20.9888	20.9838	20.8962	20.5906	20.1910	19.8550 (87)
Th 2	19.9831	19.9856	19.9881	19.9996	20.0018	20.0119	20.0119	20.0138	20.0080	20.0018	19.9974	19.9929 (88)
util rest of house	0.9830	0.9739	0.9539	0.9009	0.7827	0.5806	0.3956	0.4362	0.6938	0.9052	0.9697	0.9857 (89)
MIT 2	18.9822	19.1188	19.3411	19.6364	19.8650	19.9871	20.0087	20.0087	19.9508	19.6873	19.2998	18.9637 (90)
Living area fraction									fLA = Living area / (4) =			0.2207 (91)
MIT	19.1808	19.3173	19.5403	19.8366	20.0710	20.1993	20.2250	20.2239	20.1595	19.8866	19.4965	19.1605 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1808	19.3173	19.5403	19.8366	20.0710	20.1993	20.2250	20.2239	20.1595	19.8866	19.4965	19.1605 (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	0.9793	0.9693	0.9484	0.8967	0.7865	0.5976	0.4193	0.4601	0.7065	0.9017	0.9651	0.9824	(94)
Useful gains	583.4384	622.7718	640.3545	631.6117	567.3502	418.9256	280.9378	294.3008	433.7426	529.1719	549.9369	561.5173	(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	1203.1544	1162.4859	1048.6187	868.2830	662.9949	438.4946	283.8843	298.8321	476.6090	735.5182	986.6137	1196.7205	(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	461.0687	362.6879	303.7486	170.4034	71.1597	0.0000	0.0000	0.0000	0.0000	153.5217	314.4073	472.5912	(98)
Space heating												2309.5884	(98)
Space heating per m2											(98) / (4) =	32.0420	(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													2552.0314	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	461.0687	362.6879	303.7486	170.4034	71.1597	0.0000	0.0000	0.0000	0.0000	153.5217	314.4073	472.5912	(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)	509.4682	400.7601	335.6338	188.2910	78.6295	0.0000	0.0000	0.0000	0.0000	169.6372	347.4114	522.2003	(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	89.4758	89.5017	89.5107	89.4812	89.2349	86.6000	86.6000	86.6000	86.6000	88.8889	89.2871	89.4975	(217)	
Fuel for water heating, kWh/month	175.6095	133.4082	110.3707	64.4385	36.6389	21.2785	16.3240	47.2032	71.2016	116.3289	152.1019	174.8310	(219)	
Water heating fuel used												1119.7347	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2552.0314	(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												3503.7586	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2552.0314	3.4800	88.8107	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1119.7347	3.4800	38.9668	(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			225.6173	(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] =	0.8094	(257)
SAP value			88.7095	
SAP rating (Section 12)			89	(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	2552.0314	0.2160	551.2388 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1119.7347	0.2160	241.8627 (264)
Space and water heating			793.1015 (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			705.9056 (272)
CO2 emissions per m2			9.7900 (273)
EI value			91.9208
EI rating			92 (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	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					4.7500
Infiltration rate					0.4020 (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)	=	0.3417 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3588	0.3332	0.3417	0.3246	0.3246	0.3161	0.3075	0.2990	0.2905	0.3161	0.2990	0.3161 (22b)
Effective ac	0.5644	0.5555	0.5584	0.5527	0.5527	0.5500	0.5473	0.5447	0.5422	0.5500	0.5447	0.5500 (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	0.1100	3.9644	140.0000	5045.6000 (28a)
Brick and Block	70.7600	10.5700	60.1900	0.2400	14.4456	42.2200	2541.2218 (29a)
Cladding & Block	14.9100	2.2000	12.7100	0.2400	3.0504	42.2200	536.6162 (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)			157.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.5911		(33)
Party Wall 1			42.7700	0.0000	0.0000	110.0000	4704.7000 (32)
Ground Floor Stud			63.8200			9.0000	574.3800 (32c)
First Floor			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) = 15591.5880 (34)
216.3095 (35)
5.4607 (36)
(33) + (36) = 45.0517 (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	33.9633	33.4297	33.6032	33.2606	33.2606	33.0959	32.9356	32.7797	32.6282	33.0959	32.7797	33.0959 (38)
Heat transfer coeff	79.0150	78.4814	78.6549	78.3124	78.3124	78.1477	77.9874	77.8315	77.6799	78.1477	77.8315	78.1477 (39)
Average = Sum(39)m / 12 =												78.2124 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0962	1.0888	1.0912	1.0865	1.0865	1.0842	1.0820	1.0798	1.0777	1.0842	1.0798	1.0842 (40)
HLP (average)												1.0851 (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 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		Specific data or Table 6b		Specific data or Table 6c		FF 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	54.8123	55.1850	55.0633	55.3041	55.3041	55.4207	55.5346	55.6458	55.7544	55.4207	55.6458	55.4207
alpha	4.6542	4.6790	4.6709	4.6869	4.6869	4.6947	4.7023	4.7097	4.7170	4.6947	4.7097	4.6947
util living area	0.9825	0.9758	0.9553	0.9002	0.7819	0.5784	0.4270	0.4441	0.6995	0.8998	0.9667	0.9848 (86)
MIT	20.0108	20.1156	20.3442	20.6344	20.8639	20.9744	20.9950	20.9942	20.9388	20.6968	20.3340	20.0021 (87)
Th 2	20.0039	20.0100	20.0080	20.0119	20.0119	20.0138	20.0156	20.0174	20.0191	20.0138	20.0174	20.0138 (88)
util rest of house	0.9777	0.9693	0.9427	0.8719	0.7230	0.4881	0.3217	0.3352	0.6136	0.8649	0.9561	0.9806 (89)
MIT 2	19.1265	19.2340	19.4547	19.7303	19.9263	20.0032	20.0145	20.0160	19.9892	19.7932	19.4553	19.1261 (90)
Living area fraction												0.2207 (91)
MIT	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3217	19.4286	19.6510	19.9298	20.1333	20.2176	20.2309	20.2320	20.1988	19.9926	19.6492	19.3195 (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	0.9736	0.9645	0.9373	0.8692	0.7309	0.5074	0.3451	0.3594	0.6304	0.8640	0.9512	0.9768	(94)
Useful gains	595.8027	625.9054	644.5262	630.6288	536.1357	375.5742	243.0749	242.4726	403.7957	523.3935	560.2970	570.5694	(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	1139.5295	1108.8341	995.0662	816.7851	597.7804	384.2994	244.1717	243.7644	427.1478	671.4951	914.4596	1119.0347	(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	404.5327	324.5280	260.8018	134.0325	45.8637	0.0000	0.0000	0.0000	0.0000	110.1876	254.9971	408.0581	(98)
Space heating												1943.0015	(98)
Space heating per m2												26.9562	(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													2146.9630	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	404.5327	324.5280	260.8018	134.0325	45.8637	0.0000	0.0000	0.0000	0.0000	110.1876	254.9971	408.0581	(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)	446.9975	358.5945	288.1788	148.1022	50.6781	0.0000	0.0000	0.0000	0.0000	121.7542	281.7647	450.8930	(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	89.3945	89.4153	89.3956	89.3033	88.7104	86.6000	86.6000	86.6000	86.6000	88.6047	89.1365	89.3993	(217)	
Fuel for water heating, kWh/month	171.3070	133.8148	110.2895	63.5754	41.9518	15.7746	11.9374	40.5800	66.0459	112.5006	147.1576	171.7441	(219)	
Water heating fuel used												1086.6786	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2146.9630	(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													2990.5162	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2146.9630	7.6100	163.3839	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1086.6786	7.6100	82.6962	(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			275.5168	(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	2146.9630	0.2160	463.7440	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1086.6786	0.2160	234.7226	(264)
Space and water heating			698.4666	(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			572.2845	(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	2146.9630	1.2200	2619.2949 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1086.6786	1.2200	1325.7478 (264)
Space and water heating			3945.0427 (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			3198.6479 (272)
Primary energy kWh/m2/year			44.3764 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 32	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	1 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.40	TER	19.48
Environmental	90 B	% DER<TER	26.07		
CO ₂ Emissions (t/year)	0.76	DFEE	44.34	TFEE	54.34
General Requirements Compliance	Pass	% DFEE<TFEE	18.40		

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 32	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	1 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.40	TER	19.48
Environmental	90 B	% DER<TER	26.07		
CO ₂ Emissions (t/year)	0.76	DFEE	44.34	TFEE	54.34
General Requirements Compliance	Pass	% DFEE<TFEE	18.40		

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 32	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	1 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.40	TER	19.48
Environmental	90 B	% DER<TER	26.07		
CO ₂ Emissions (t/year)	0.76	DFEE	44.34	TFEE	54.34
General Requirements Compliance	Pass	% DFEE<TFEE	18.40		

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 32	Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E
Project	1 Nuthatch Way, BOTLEY, SO32 2UH		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.40	TER	19.48
Environmental	90 B	% DER<TER	26.07		
CO ₂ Emissions (t/year)	0.76	DFEE	44.34	TFEE	54.34
General Requirements Compliance	Pass	% DFEE<TFEE	18.40		

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 = 16.97 m, Wall thickness = 300.00 mm, Soil: Clay

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

Floor height above ground: h = 0.000 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Unheated space: None

Total thickness: 450 mm

U-value: 0.11 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 32			Issued on Date	22/02/2024
Assessment Reference	As Built	Prop Type Ref	Block E		
Property	1 Nuthatch Way, BOTLEY, SO32 2UH				
SAP Rating	87 B	DER	14.40	TER	19.48
Environmental	90 B	% DER<TER	26.07		
CO ₂ Emissions (t/year)	0.76	DFEE	44.34	TFEE	54.34
General Requirements Compliance	Pass	% DFEE<TFEE	18.40		
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, End-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:		16.93 m	36.04 m²	2.39 m		
	1st Storey:		16.93 m	36.04 m²	2.67 m		
7.0 Living Area	15.91			m²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	216.31			kJ/m²K			
9.0 External Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Brick and Block	Cavity Wall	Other		0.24	42.22	70.76	60.19
Cladding & Block	Cavity Wall	Other		0.24	42.22	14.91	12.71
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill		0.00	110.00	42.77	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m²K)	Area (m²)	
Ground Floor Stud	Plasterboard on timber frame				9.00	63.82	
First Floor	Plasterboard on timber frame				9.00	63.03	
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	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	0.11	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	6.35	0.021	No	Knauf P5
Independently assessed	E4 Jamb	22.50	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	16.93	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	16.93	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.58	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.50	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.10	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	10.10	0.036	No	Knauf P25 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.50	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.50	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.50	0.035	No	Knauf P29 Halved

Y-value 0.035 W/m²K

18.0 Pressure Testing

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				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

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 89	