



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 4, Fieldfare Crescent
Botley, Southampton, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 25/09/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 16			Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D		
Property	4, Fieldfare Crescent, Botley, Southampton, SO32 2TW				
SAP Rating	88 B	DER	13.46	TER	18.31
Environmental	90 B	% DER<TER	26.49		
CO ₂ Emissions (t/year)	0.81	DFEE	43.11	TFEE	52.73
General Requirements Compliance	Pass	% DFEE<TFEE	18.25		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.31	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.46	kgCO ₂ /m ²	Pass
	-4.85 (-26.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.73	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.11	kWh/m ² /yr	
	-9.6 (-18.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.95 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.42 m², No overhang

Windows facing East

4.29 m², No overhang

Windows facing West

7.49 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

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.11	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.035	W/m ² K
Photovoltaic array	0.94	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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Environmental	90 B	TER	18.31
CO ₂ Emissions (t/year)	0.81	% DER<TER	26.49
General Requirements Compliance	Pass	DFEE	43.11
		TFEE	52.73
		% DFEE<TFEE	18.25
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	0.093	0.48	0.04	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.89	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.74	0.27	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	2.71	0.18	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	1.77	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	8.07	0.17	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	29.40	0.47	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	18.38	1.14	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.38	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.69	0.58	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.78	0.39	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.10	0.39	Knauf P23
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.062	10.10	0.63	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.78	1.40	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.78	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.78	0.31	Knauf P29 Halved

Total: **6.23** W/mK:
Y-Value: **0.035** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 85 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.31 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.46 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 43.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.95 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.42 m², No overhang
Windows facing East: 4.29 m², No overhang
Windows facing West: 7.49 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 0.94 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1870 (8)
Pressure test										Yes							
Measured/design AP50										4.9500							
Infiltration rate										0.4345 (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) =					0.3693 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22)				
Adj infilt rate	0.4709	0.4617	0.4524	0.4063	0.3970	0.3509	0.3509	0.3416	0.3693	0.3970	0.4155	0.4340	(22a)				
Effective ac	0.6109	0.6066	0.6024	0.5825	0.5788	0.5616	0.5616	0.5584	0.5682	0.5788	0.5863	0.5942	(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)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (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

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.1171	Feb 42.8132	Mar 42.5154	Apr 41.1163	May 40.8545	Jun 39.6359	Jul 39.6359	Aug 39.4103	Sep 40.1053	Oct 40.8545	Nov 41.3841	Dec 41.9377 (38)
Heat transfer coeff	94.3135	94.0096	93.7117	92.3126	92.0508	90.8323	90.8323	90.6066	91.3016	92.0508	92.5804	93.1340 (39)
Average = Sum(39)m / 12 =												92.3113 (39)
HLP	Jan 1.1156	Feb 1.1120	Mar 1.1085	Apr 1.0919	May 1.0888	Jun 1.0744	Jul 1.0744	Aug 1.0718	Sep 1.0800	Oct 1.0888	Nov 1.0951	Dec 1.1017 (40)
HLP (average)												1.0919 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan 104.0659	Feb 100.2817	Mar 96.4975	Apr 92.7132	May 88.9290	Jun 85.1448	Jul 85.1448	Aug 88.9290	Sep 92.7132	Oct 96.4975	Nov 100.2817	Dec 104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5593	24.8901	27.5314	26.6136	27.4791	26.5677	27.4378	27.4646	26.5927	27.5098	26.6561	27.5512 (61)
Total heat required for water heating calculated for each month	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (64)
Heat gains from water heating, kWh/month	58.2035	51.1017	53.1942	47.0287	45.6109	40.0726	37.8378	42.4143	42.6209	48.8002	52.4260	56.5823 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1812.3640 (64)												

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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3723	18.9827	15.4377	11.6874	8.7364	7.3757	7.9697	10.3593	13.9042	17.6546	20.6055	21.9663 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	78.2305	76.0443	71.4976	65.3177	61.3049	55.6563	50.8573	57.0085	59.1957	65.5916	72.8138	76.0515 (72)
Total internal gains	392.4206	390.2177	376.1466	353.4866	330.4541	308.3422	294.0478	300.2157	311.9273	334.8033	361.0453	380.7463 (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				1.4200	10.6334	0.6300	0.7000	0.7700		4.6146 (74)		
East				4.2900	19.6403	0.6300	0.7000	0.7700		25.7500 (76)		
West				7.4900	19.6403	0.6300	0.7000	0.7700		44.9574 (80)		

Solar gains	75.3219	147.1372	242.7760	356.2894	439.5719	451.4992	429.2065	366.5557	282.9472	174.6241	93.8564	61.9932 (83)
Total gains	467.7425	537.3549	618.9226	709.7761	770.0259	759.8413	723.2542	666.7713	594.8746	509.4274	454.9017	442.7395 (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	51.4855	51.6519	51.8161	52.6014	52.7510	53.4587	53.4587	53.5918	53.1839	52.7510	52.4493	52.1375
alpha	4.4324	4.4435	4.4544	4.5068	4.5167	4.5639	4.5639	4.5728	4.5456	4.5167	4.4966	4.4758
util living area	0.9968	0.9935	0.9834	0.9485	0.8592	0.6967	0.5355	0.5956	0.8424	0.9721	0.9940	0.9975 (86)
MIT	19.5628	19.7292	20.0261	20.4219	20.7465	20.9321	20.9838	20.9743	20.8317	20.3976	19.9133	19.5400 (87)
Th 2	19.9881	19.9910	19.9939	20.0074	20.0100	20.0218	20.0218	20.0240	20.0172	20.0100	20.0048	19.9995 (88)
util rest of house	0.9958	0.9916	0.9784	0.9324	0.8160	0.6135	0.4245	0.4825	0.7781	0.9604	0.9919	0.9968 (89)
MIT 2	18.6740	18.8419	19.1384	19.5338	19.8319	19.9874	20.0168	20.0152	19.9162	19.5186	19.0369	18.6602 (90)
Living area fraction	18.8644	19.0320	19.3286	19.7241	20.0278	20.1898	20.2240	20.2207	20.1123	19.7069	19.2246	18.8487 (92)
MIT	18.8644	19.0320	19.3286	19.7241	20.0278	20.1898	20.2240	20.2207	20.1123	19.7069	19.2246	18.8487 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8644	19.0320	19.3286	19.7241	20.0278	20.1898	20.2240	20.2207	20.1123	19.7069	19.2246	18.8487 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	465.1320	531.5801	602.8925	657.8654	629.0298	477.7984	324.1729	337.6502	467.1297	486.9148	450.2093	440.7938 (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	1373.6197	1328.5431	1202.1892	999.1984	766.5835	507.7299	329.1726	346.1796	548.9306	838.2960	1122.5022	1364.2907 (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	675.9149	535.5591	445.8768	245.7598	102.3399	0.0000	0.0000	0.0000	0.0000	261.4276	484.0509	687.0817 (98)
Space heating												3438.0107 (98)
Space heating per m2												(98) / (4) = 40.6673 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3790.5300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	675.9149	535.5591	445.8768	245.7598	102.3399	0.0000	0.0000	0.0000	0.0000	261.4276	484.0509	687.0817	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	745.2204	590.4731	491.5952	270.9590	112.8334	0.0000	0.0000	0.0000	0.0000	288.2333	533.6835	757.5322	(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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084	(64)
Efficiency of water heater (217)m	90.0915	90.0407	89.9201	89.6267	89.0420	87.9000	87.9000	87.9000	87.9000	89.6432	89.9738	87.9000	(216)
Fuel for water heating, kWh/month	201.8904	177.5478	185.5131	165.1776	161.7144	144.6086	137.2081	152.8741	153.3349	171.3383	182.5932	196.4316	(219)
Water heating fuel used												2030.2320	(219)
Annual totals kWh/year													
Space heating fuel - main system												3790.5300	(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)												377.4413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.94 * 908 * 1.00) =										-682.7064		-682.7064	(233)
Total delivered energy for all uses												5590.4969	(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	3790.5300	0.2160	818.7545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2030.2320	0.2160	438.5301 (264)
Space and water heating			1257.2846 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.4413	0.5190	195.8920 (268)
Energy saving/generation technologies			
PV Unit	-682.7064	0.5190	-354.3246 (269)
Total CO2, kg/year			1137.7770 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4600 (273)

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

DER			13.4600 ZC1
Total Floor Area		TFA	84.5400
Assumed number of occupants		N	2.5434
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.0283 ZC2
CO2 emissions from cooking, equation (L16)			2.1297 ZC3
Total CO2 emissions			31.6180 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			31.6180 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (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) =	0.1403 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3903 (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) =					0.3317 (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	0.4229	0.4147	0.4064	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3898	(22b)				
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5696	0.5760	(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)			13.2000	1.3258	17.5000			(27)					
Ground Floor			42.2700	0.1300	5.4951			(28a)					
Brick and Block	93.0000	15.3200	77.6800	0.1800	13.9824			(29a)					
Pitched Roof	42.2700		42.2700	0.1300	5.4951			(30)					
Total net area of external elements Aum(A, m2)			177.5400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0166			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7230	(36)					
Total fabric heat loss						(33) + (36) =	54.7396	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.6042	Feb 41.3591	Mar 41.1188	Apr 39.9902	May 39.7790	Jun 38.7960	Jul 38.7960	Aug 38.6140	Sep 39.1747	Oct 39.7790	Nov 40.2062	Dec 40.6528	(38)
Heat transfer coeff	96.3438	96.0987	95.8584	94.7298	94.5186	93.5356	93.5356	93.3536	93.9143	94.5186	94.9458	95.3924	(39)
Average = Sum(39)m / 12 =												94.7288	(39)
HLP	Jan 1.1396	Feb 1.1367	Mar 1.1339	Apr 1.1205	May 1.1180	Jun 1.1064	Jul 1.1064	Aug 1.1043	Sep 1.1109	Oct 1.1180	Nov 1.1231	Dec 1.1284	(40)
HLP (average)												1.1205	(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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)											Total = Sum(45)m =	1488.5106 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.1740	45.7216	45.3173	41.9892	43.3889	45.3173	45.7216	49.1740	49.3151	50.9589 (61)
Solar input	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161 (64)
	64.0534	56.3861	58.6049	51.8058	50.0704	43.9279	41.8256	46.8775	47.4031	54.2162	58.0907	62.4342 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3723	18.9827	15.4377	11.6874	8.7364	7.3757	7.9697	10.3593	13.9042	17.6546	20.6055	21.9663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	86.0932	83.9079	78.7700	71.9524	67.2990	61.0110	56.2172	63.0074	65.8377	72.8713	80.6815	83.9170	(72)
Total internal gains	400.2834	398.0813	383.4189	360.1214	336.4481	313.6969	299.4077	306.2146	318.5693	342.0830	368.9130	388.6117	(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				1.4200	10.6334	0.6300	0.7000				0.7700			4.6146 (74)
East				4.2900	19.6403	0.6300	0.7000				0.7700			25.7500 (76)
West				7.4900	19.6403	0.6300	0.7000				0.7700			44.9574 (80)
Solar gains	75.3219	147.1372	242.7760	356.2894	439.5719	451.4992	429.2065	366.5557	282.9472	174.6241	93.8564			61.9932 (83)
Total gains	475.6053	545.2185	626.1950	716.4108	776.0199	765.1960	728.6141	672.7702	601.5165	516.7071	462.7694			450.6050 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9363	61.0917	61.2448	61.9745	62.1130	62.7657	62.7657	62.8881	62.5127	62.1130	61.8335	61.5440	
alpha	5.0624	5.0728	5.0830	5.1316	5.1409	5.1844	5.1844	5.1925	5.1675	5.1409	5.1222	5.1029	
util living area	0.9985	0.9967	0.9904	0.9644	0.8846	0.7212	0.5517	0.6144	0.8674	0.9823	0.9970	0.9989	(86)
MIT	19.7378	19.8822	20.1423	20.4914	20.7848	20.9477	20.9893	20.9820	20.8587	20.4687	20.0417	19.7146	(87)
Th 2	19.9686	19.9710	19.9733	19.9841	19.9861	19.9956	19.9956	19.9974	19.9920	19.9861	19.9820	19.9777	(88)
util rest of house	0.9980	0.9956	0.9868	0.9506	0.8410	0.6314	0.4326	0.4923	0.8010	0.9731	0.9957	0.9985	(89)
MIT 2	18.2815	18.4941	18.8741	19.3805	19.7724	19.9603	19.9916	19.9898	19.8747	19.3571	18.7356	18.2541	(90)
Living area fraction	18.5935	18.7915	19.1458	19.6185	19.9893	20.1718	20.2053	20.2023	20.0855	19.5952	19.0154	18.5670	(91)
MIT	18.5935	18.7915	19.1458	19.6185	19.9893	20.1718	20.2053	20.2023	20.0855	19.5952	19.0154	18.5670	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5935	18.7915	19.1458	19.6185	19.9893	20.1718	20.2053	20.2023	20.0855	19.5952	19.0154	18.5670	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	474.1713	541.7694	615.4604	676.4743	652.7426	496.1454	333.8609	348.7812	486.1530	500.2700	459.9498	449.5674	(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	1377.0896	1334.9504	1212.2023	1015.3590	783.4932	521.1662	337.2275	354.9605	562.1246	850.2156	1131.3144	1370.5025	(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	671.7712	533.0176	443.9760	243.9970	97.2784	0.0000	0.0000	0.0000	0.0000	260.3595	483.3825	685.1757	(98)
Space heating												3418.9579	(98)
Space heating per m2												40.4419	(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													3660.5545 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	671.7712	533.0176	443.9760	243.9970	97.2784	0.0000	0.0000	0.0000	0.0000	260.3595	483.3825	685.1757	(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)	719.2411	570.6826	475.3490	261.2387	104.1525	0.0000	0.0000	0.0000	0.0000	278.7575	517.5401	733.5928	(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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(64)
Efficiency of water heater (217)m	87.8147	87.6067	87.1342	86.0023	83.8157	80.3000	80.3000	80.3000	80.3000	86.0458	87.3364	80.3000	(216)
Fuel for water heating, kWh/month	233.7712	206.6081	216.2828	194.3567	193.0807	177.5000	170.0585	189.5754	191.6690	203.6793	214.0516	228.0098	(219)
Water heating fuel used												2418.6430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3660.5545	(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)												377.4413	(232)
Total delivered energy for all uses												6531.6388	(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	3660.5545	0.2160	790.6798 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2418.6430	0.2160	522.4269 (264)
Space and water heating			1313.1067 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.4413	0.5190	195.8920 (268)
Total CO2, kg/m2/year			1547.9237 (272)
Emissions per m2 for space and water heating			15.5324 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3172 (272b)
Emissions per m2 for pumps and fans			0.4604 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5324 * 1.00) + 2.3172 + 0.4604, rounded to 2 d.p.			18.3100 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (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) = 0.1403 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.3878 (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) =	0.3296 (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	0.4202	0.4120	0.4038	0.3626	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			9.0000	380.4300 (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) = 17100.3596 (34)
202.2754 (35)
6.2299 (36)
(33) + (36) = 51.1963 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.5236	41.2816	41.0444	39.9302	39.7217	38.7513	38.7513	38.5716	39.1251	39.7217	40.1434	40.5843 (38)
Heat transfer coeff	92.7199	92.4779	92.2407	91.1265	90.9180	89.9476	89.9476	89.7679	90.3214	90.9180	91.3397	91.7806 (39)
Average = Sum(39)m / 12 =												91.1255 (39)
HLP	1.0968	1.0939	1.0911	1.0779	1.0754	1.0640	1.0640	1.0618	1.0684	1.0754	1.0804	1.0856 (40)
HLP (average)												1.0779 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3723	18.9827	15.4377	11.6874	8.7364	7.3757	7.9697	10.3593	13.9042	17.6546	20.6055	21.9663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877	(72)
Total internal gains	355.2687	353.8553	341.4305	321.0075	299.4278	279.3601	266.8010	270.7432	281.6623	302.2234	325.8514	344.3825	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Access factor Table 6d	Gains W	
North	1.4200	10.6334	0.6300	0.7000	0.7700	4.6146	(74)
East	4.2900	19.6403	0.6300	0.7000	0.7700	25.7500	(76)
West	7.4900	19.6403	0.6300	0.7000	0.7700	44.9574	(80)

Solar gains	75.3219	147.1372	242.7760	356.2894	439.5719	451.4992	429.2065	366.5557	282.9472	174.6241	93.8564	61.9932	(83)
Total gains	430.5906	500.9925	584.2066	677.2970	738.9997	730.8592	696.0074	637.2988	564.6095	476.8475	419.7078	406.3757	(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	51.2306	51.3647	51.4968	52.1264	52.2460	52.8096	52.8096	52.9154	52.5911	52.2460	52.0047	51.7549	
alpha	4.4154	4.4243	4.4331	4.4751	4.4831	4.5206	4.5206	4.5277	4.5061	4.4831	4.4670	4.4503	
util living area	0.9975	0.9946	0.9855	0.9532	0.8681	0.7100	0.5486	0.6128	0.8563	0.9764	0.9952	0.9980	(86)
MIT	19.5191	19.6882	19.9906	20.3926	20.7287	20.9244	20.9814	20.9701	20.8139	20.3619	19.8685	19.4925	(87)
Th 2	20.0035	20.0058	20.0081	20.0189	20.0209	20.0304	20.0304	20.0321	20.0267	20.0209	20.0168	20.0126	(88)
util rest of house	0.9967	0.9931	0.9812	0.9386	0.8271	0.6281	0.4370	0.4993	0.7959	0.9666	0.9936	0.9975	(89)
MIT 2	18.6445	18.8147	19.1166	19.5172	19.8277	19.9912	20.0245	20.0216	19.9123	19.4949	19.0037	18.6250	(90)
Living area fraction	18.8319	19.0018	19.3039	19.7047	20.0207	20.1911	20.2295	20.2248	20.1055	19.6806	19.1890	18.8108	(91)
Temperature adjustment	18.8319	19.0018	19.3039	19.7047	20.0207	20.1911	20.2295	20.2248	20.1055	19.6806	19.1890	18.8108	(92)
adjusted MIT	18.8319	19.0018	19.3039	19.7047	20.0207	20.1911	20.2295	20.2248	20.1055	19.6806	19.1890	18.8108	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9956	0.9910	0.9772	0.9328	0.8271	0.6427	0.4608	0.5231	0.8016	0.9621	0.9917	0.9966	(94)
Ext temp.	428.6841	496.4895	570.8852	631.8058	611.1960	469.7504	320.7201	333.3936	452.5927	458.7598	416.2334	404.9783	(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	1347.3930	1304.1086	1181.0361	984.5972	756.5038	502.9066	326.4653	343.3463	542.4210	825.5918	1104.2036	1340.9891	(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	683.5195	542.7200	453.9523	254.0098	108.1090	0.0000	0.0000	0.0000	0.0000	272.9230	495.3385	696.3920	(98)
Space heating per m2												3506.9641	(98)
												41.4829	(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	845.5072	665.6121	682.2358	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8631	0.9198	0.8930	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.7249	612.2373	609.2060	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	949.8982	907.2043	840.3340	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	158.5248	219.4554	171.9593	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												549.9395 (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	39.6312	54.8639	42.9898	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												137.4849 (107)
Space cooling per m2												1.6263 (108)
Energy for space heating												41.4829 (99)
Energy for space cooling												1.6263 (108)
Total												43.1092 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.1 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (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) =		0.1403 (8)	
Pressure test										Yes								
Measured/design AP50										5.0000								
Infiltration rate										0.3903 (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) =								0.3317 (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	0.4229	0.4147	0.4064	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3898	(22b)					
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5696	0.5760	(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)			13.2000	1.3258	17.5000			(27)					
Ground Floor			42.2700	0.1300	5.4951			(28a)					
Brick and Block	93.0000	15.3200	77.6800	0.1800	13.9824			(29a)					
Pitched Roof	42.2700		42.2700	0.1300	5.4951			(30)					
Total net area of external elements Aum(A, m2)			177.5400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0166			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7230	(36)					
Total fabric heat loss						(33) + (36) =	54.7396	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.6042	Feb 41.3591	Mar 41.1188	Apr 39.9902	May 39.7790	Jun 38.7960	Jul 38.7960	Aug 38.6140	Sep 39.1747	Oct 39.7790	Nov 40.2062	Dec 40.6528	(38)
Heat transfer coeff	96.3438	96.0987	95.8584	94.7298	94.5186	93.5356	93.5356	93.3536	93.9143	94.5186	94.9458	95.3924	(39)
Average = Sum(39)m / 12 =												94.7288	(39)
HLP	Jan 1.1396	Feb 1.1367	Mar 1.1339	Apr 1.1205	May 1.1180	Jun 1.1064	Jul 1.1064	Aug 1.1043	Sep 1.1109	Oct 1.1180	Nov 1.1231	Dec 1.1284	(40)
HLP (average)												1.1205	(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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan 104.0659	Feb 100.2817	Mar 96.4975	Apr 92.7132	May 88.9290	Jun 85.1448	Jul 85.1448	Aug 88.9290	Sep 92.7132	Oct 96.4975	Nov 100.2817	Dec 104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)												Total = Sum(45)m = 1488.5106 (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	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3723	18.9827	15.4377	11.6874	8.7364	7.3757	7.9697	10.3593	13.9042	17.6546	20.6055	21.9663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877	(72)
Total internal gains	355.2687	353.8553	341.4305	321.0075	299.4278	279.3601	266.8010	270.7432	281.6623	302.2234	325.8514	344.3825	(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				1.4200	10.6334	0.6300	0.7000	0.7700		4.6146 (74)		
East				4.2900	19.6403	0.6300	0.7000	0.7700		25.7500 (76)		
West				7.4900	19.6403	0.6300	0.7000	0.7700		44.9574 (80)		

Solar gains	75.3219	147.1372	242.7760	356.2894	439.5719	451.4992	429.2065	366.5557	282.9472	174.6241	93.8564	61.9932 (83)
Total gains	430.5906	500.9925	584.2066	677.2970	738.9997	730.8592	696.0074	637.2988	564.6095	476.8475	419.7078	406.3757 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9363	61.0917	61.2448	61.9745	62.1130	62.7657	62.7657	62.8881	62.5127	62.1130	61.8335	61.5440	
alpha	5.0624	5.0728	5.0830	5.1316	5.1409	5.1844	5.1844	5.1925	5.1675	5.1409	5.1222	5.1029	
util living area	0.9991	0.9978	0.9929	0.9714	0.9004	0.7448	0.5748	0.6428	0.8897	0.9874	0.9981	0.9993	(86)
MIT	19.6880	19.8337	20.0976	20.4546	20.7613	20.9392	20.9871	20.9779	20.8370	20.4277	19.9943	19.6656	(87)
Th 2	19.9686	19.9710	19.9733	19.9841	19.9861	19.9956	19.9956	19.9974	19.9920	19.9861	19.9820	19.9777	(88)
util rest of house	0.9988	0.9970	0.9902	0.9599	0.8605	0.6557	0.4520	0.5178	0.8293	0.9806	0.9973	0.9991	(89)
MIT 2	18.7671	18.9144	19.1788	19.5375	19.8215	19.9671	19.9923	19.9908	19.8967	19.5173	19.0839	18.7519	(90)
Living area fraction									fLA = Living area / (4) =			0.2142	(91)
MIT	18.9644	19.1113	19.3756	19.7339	20.0228	20.1753	20.2054	20.2023	20.0981	19.7123	19.2789	18.9476	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9644	19.1113	19.3756	19.7339	20.0228	20.1753	20.2054	20.2023	20.0981	19.7123	19.2789	18.9476	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	429.8591	499.0290	577.2628	647.6845	637.1289	491.8521	333.1242	347.2201	472.5186	466.3830	418.2167	405.8639	(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	1412.8218	1365.6875	1234.2380	1026.2957	786.6632	521.4909	337.2322	354.9571	563.3116	861.2827	1156.3344	1406.8135	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	731.3242	582.3945	488.7896	272.6000	111.2535	0.0000	0.0000	0.0000	0.0000	293.8054	531.4447	744.7065	(98)
Space heating												3756.3184	(98)
Space heating per m2												44.4324	(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	879.2349	692.1636	709.4873	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8689	0.9282	0.9004	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	763.9524	642.4887	638.8476	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	949.8982	907.2043	840.3340	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	133.8810	196.9484	149.9059	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												480.7353	(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	33.4702	49.2371	37.4765	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.1838 (107)
Space cooling per m2												1.4216 (108)
Energy for space heating												44.4324 (99)
Energy for space cooling												1.4216 (108)
Total												45.8541 (109)
Target Fabric Energy Efficiency (TFEE)												52.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4345 (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)	=	0.3693 (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	0.3878	0.3601	0.3693	0.3509	0.3509	0.3416	0.3324	0.3232	0.3139	0.3416	0.3232	0.3416 (22b)
Effective ac	0.5752	0.5648	0.5682	0.5616	0.5616	0.5584	0.5552	0.5522	0.5493	0.5584	0.5522	0.5584 (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)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (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) = 17480.7896 (34)
206.7754 (35)
6.2299 (36)
(33) + (36) = 51.1963 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.5988	39.8676	40.1053	39.6359	39.6359	39.4103	39.1906	38.9770	38.7694	39.4103	38.9770	39.4103 (38)
Heat transfer coeff	91.7951	91.0639	91.3016	90.8323	90.8323	90.6066	90.3870	90.1733	89.9657	90.6066	90.1733	90.6066 (39)
Average = Sum(39)m / 12 =												90.6954 (39)
HLP	1.0858	1.0772	1.0800	1.0744	1.0744	1.0718	1.0692	1.0666	1.0642	1.0718	1.0666	1.0718 (40)
HLP (average)												1.0728 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5593	24.8901	27.5314	26.6136	27.4791	26.5677	27.4378	27.4646	26.5927	27.5098	26.6561	27.5512 (61)
Total heat required for water heating calculated for each month	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	58.2035	51.1017	53.1942	47.0287	45.6109	40.0726	37.8378	42.4143	42.6209	48.8002	52.4260	56.5823 (65)
												1812 (64)
												Sum(64)m =
												0.0000 (63)
												Sum(64)m =
												1812.3640 (64)
												1812 (64)

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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4307	47.4567	38.5944	29.2184	21.8411	18.4392	19.9242	25.8982	34.7605	44.1365	51.5138	54.9157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	78.2305	76.0443	71.4976	65.3177	61.3049	55.6563	50.8573	57.0085	59.1957	65.5916	72.8138	76.0515	(72)
Total internal gains	579.6267	575.0081	552.6745	518.1191	482.7456	451.1541	432.7812	441.3649	461.3390	496.1104	534.6933	563.8740	(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			1.4200	13.4839	0.6300	0.7000	0.7700	5.8516 (74)				
East			4.2900	25.1925	0.6300	0.7000	0.7700	33.0294 (76)				
West			7.4900	25.1925	0.6300	0.7000	0.7700	57.6668 (80)				
Solar gains	96.5478	160.5467	266.5780	392.2309	458.5804	511.0340	482.2421	423.0025	327.7122	205.4927	119.9356	78.0924 (83)
Total gains	676.1746	735.5548	819.2524	910.3500	941.3261	962.1880	915.0234	864.3674	789.0512	701.6031	654.6289	641.9664 (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	52.8980	53.3227	53.1839	53.4587	53.4587	53.5918	53.7221	53.8493	53.9736	53.5918	53.8493	53.5918	
alpha	4.5265	4.5548	4.5456	4.5639	4.5639	4.5728	4.5815	4.5900	4.5982	4.5728	4.5900	4.5728	
util living area	0.9840	0.9759	0.9481	0.8717	0.7309	0.5218	0.3822	0.4029	0.6659	0.8963	0.9692	0.9864	(86)
MIT	19.9401	20.0696	20.3450	20.6718	20.8900	20.9812	20.9964	20.9956	20.9458	20.6847	20.2838	19.9318	(87)
Th 2	20.0124	20.0195	20.0172	20.0218	20.0218	20.0240	20.0261	20.0282	20.0302	20.0240	20.0282	20.0240	(88)
util rest of house	0.9798	0.9696	0.9344	0.8396	0.6704	0.4387	0.2893	0.3046	0.5820	0.8617	0.9596	0.9827	(89)
MIT 2	19.0671	19.1998	19.4648	19.7715	19.9536	20.0162	20.0253	20.0271	20.0036	19.7927	19.4185	19.0683	(90)
Living area fraction	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533	(92)
MIT	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533	(93)
Temperature adjustment													0.0000
adjusted MIT	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	659.6948	709.4482	760.5712	762.4248	639.2910	438.8371	282.3003	281.5293	471.9069	603.4383	624.8011	628.4832	(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	1317.6339	1282.7397	1155.2694	950.5039	695.2457	446.0511	283.2090	282.6564	495.3000	777.7448	1055.3784	1291.4432	(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	489.5067	385.2518	293.6555	135.4169	41.6303	0.0000	0.0000	0.0000	0.0000	129.6840	310.0157	493.2423	(98)
Space heating													2278.4032 (98)
RHI space heating demand													2278 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4345 (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) =	0.3693 (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	0.4709	0.4617	0.4524	0.4063	0.3970	0.3509	0.3509	0.3416	0.3693	0.3970	0.4155	0.4340 (22b)
Effective ac	0.6109	0.6066	0.6024	0.5825	0.5788	0.5616	0.5616	0.5584	0.5682	0.5788	0.5863	0.5942 (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)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (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) =	17480.7896 (34)
206.7754 (35)	
6.2299 (36)	
(33) + (36) =	51.1963 (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	43.1171	42.8132	42.5154	41.1163	40.8545	39.6359	39.6359	39.4103	40.1053	40.8545	41.3841	41.9377 (38)
Heat transfer coeff	94.3135	94.0096	93.7117	92.3126	92.0508	90.8323	90.8323	90.6066	91.3016	92.0508	92.5804	93.1340 (39)
Average = Sum(39)m / 12 =												92.3113 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1156	1.1120	1.1085	1.0919	1.0888	1.0744	1.0744	1.0718	1.0800	1.0888	1.0951	1.1017 (40)
HLP (average)												1.0919 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5593	24.8901	27.5314	26.6136	27.4791	26.5677	27.4378	27.4646	26.5927	27.5098	26.6561	27.5512 (61)
Total heat required for water heating calculated for each month	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (64)
Heat gains from water heating, kWh/month	58.2035	51.1017	53.1942	47.0287	45.6109	40.0726	37.8378	42.4143	42.6209	48.8002	52.4260	56.5823 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1812.3640 (64)												

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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4307	47.4567	38.5944	29.2184	21.8411	18.4392	19.9242	25.8982	34.7605	44.1365	51.5138	54.9157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	78.2305	76.0443	71.4976	65.3177	61.3049	55.6563	50.8573	57.0085	59.1957	65.5916	72.8138	76.0515	(72)
Total internal gains	579.6267	575.0081	552.6745	518.1191	482.7456	451.1541	432.7812	441.3649	461.3390	496.1104	534.6933	563.8740	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g	FF		Access		Gains
					W/m2		Specific data or Table 6b	Specific data or Table 6c		factor Table 6d		W
North				1.4200	10.6334		0.6300	0.7000		0.7700		4.6146 (74)
East				4.2900	19.6403		0.6300	0.7000		0.7700		25.7500 (76)
West				7.4900	19.6403		0.6300	0.7000		0.7700		44.9574 (80)

Solar gains	75.3219	147.1372	242.7760	356.2894	439.5719	451.4992	429.2065	366.5557	282.9472	174.6241	93.8564	61.9932 (83)
Total gains	654.9487	722.1453	795.4505	874.4086	922.3175	902.6532	861.9877	807.9205	744.2863	670.7345	628.5497	625.8672 (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	51.4855	51.6519	51.8161	52.6014	52.7510	53.4587	53.4587	53.5918	53.1839	52.7510	52.4493	52.1375	
alpha	4.4324	4.4435	4.4544	4.5068	4.5167	4.5639	4.5639	4.5728	4.5456	4.5167	4.4966	4.4758	
util living area	0.9879	0.9801	0.9597	0.9027	0.7870	0.6103	0.4561	0.5035	0.7455	0.9302	0.9792	0.9900 (86)	
MIT	19.7972	19.9548	20.2270	20.5731	20.8302	20.9602	20.9915	20.9869	20.9018	20.5653	20.1259	19.7714 (87)	
Th 2	19.9881	19.9910	19.9939	20.0074	20.0100	20.0218	20.0218	20.0240	20.0172	20.0100	20.0048	19.9995 (88)	
util rest of house	0.9848	0.9749	0.9489	0.8770	0.7349	0.5294	0.3584	0.4025	0.6700	0.9060	0.9728	0.9874 (89)	
MIT 2	18.9063	19.0640	19.3322	19.6707	19.8964	20.0027	20.0193	20.0198	19.9629	19.6729	19.2455	18.8899 (90)	
Living area fraction									fLA = Living area / (4) =				0.2142 (91)
MIT	19.0971	19.2548	19.5238	19.8640	20.0965	20.2078	20.2276	20.2269	20.1641	19.8641	19.4341	19.0787 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0971	19.2548	19.5238	19.8640	20.0965	20.2078	20.2276	20.2269	20.1641	19.8641	19.4341	19.0787 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9811	0.9701	0.9427	0.8727	0.7399	0.5455	0.3793	0.4240	0.6823	0.9017	0.9681	0.9842 (94)
Useful gains	642.5888	700.5654	749.8926	763.1312	682.4123	492.3676	326.9600	342.5726	507.8288	604.8009	608.5124	615.9556 (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	1395.5673	1349.4899	1220.4870	1012.1146	772.9009	509.3706	329.4988	346.7469	553.6601	852.7687	1141.8953	1385.7140 (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	560.2160	436.0773	350.1222	179.2680	67.3235	0.0000	0.0000	0.0000	0.0000	184.4880	384.0357	572.7003 (98)
Space heating												2734.2310 (98)
Space heating per m2												(98) / (4) = 32.3425 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3014.5876 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	560.2160	436.0773	350.1222	179.2680	67.3235	0.0000	0.0000	0.0000	0.0000	184.4880	384.0357	572.7003	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	617.6582	480.7908	386.0223	197.6494	74.2265	0.0000	0.0000	0.0000	0.0000	203.4047	423.4131	631.4226	(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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084	(64)
Efficiency of water heater (217)m	89.9974	89.9315	89.7772	89.4118	88.7731	87.9000	87.9000	87.9000	87.9000	89.4061	89.8425	87.9000	(216)
Fuel for water heating, kWh/month	202.1015	177.7632	185.8086	165.5746	162.2042	144.6086	137.2081	152.8741	153.3349	171.7927	182.8599	196.6259	(219)
Water heating fuel used												2032.7563	(219)
Annual totals kWh/year													
Space heating fuel - main system												3014.5876	(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)												377.4413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.94 * 908 * 1.00) =										-682.7064		-682.7064	(233)
Total delivered energy for all uses												4817.0788	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3014.5876	3.4800	104.9076 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2032.7563	3.4800	70.7399 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	377.4413	13.1900	49.7845 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-682.7064	13.1900	-90.0490 (252)
Total energy cost			265.2756 (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] =	0.8601 (257)
SAP value		88.0018
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3014.5876	0.2160	651.1509 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2032.7563	0.2160	439.0754 (264)
Space and water heating			1090.2263 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.4413	0.5190	195.8920 (268)
Energy saving/generation technologies			
PV Unit	-682.7064	0.5190	-354.3246 (269)
Total kg/year			970.7187 (272)
CO2 emissions per m2			11.4800 (273)
EI value			89.9586
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8906 = 3.907$, stars = 4
Water heating environmental impact	$0.216 / 0.8906 = 0.2425$, 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4345 (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) =		0.3693 (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	0.3878	0.3601	0.3693	0.3509	0.3509	0.3416	0.3324	0.3232	0.3139	0.3416	0.3232	0.3416 (22b)
Effective ac	0.5752	0.5648	0.5682	0.5616	0.5616	0.5584	0.5552	0.5522	0.5493	0.5584	0.5522	0.5584 (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)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (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) = 17480.7896 (34)
206.7754 (35)
6.2299 (36)
(33) + (36) = 51.1963 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.5988	39.8676	40.1053	39.6359	39.6359	39.4103	39.1906	38.9770	38.7694	39.4103	38.9770	39.4103 (38)
Heat transfer coeff	91.7951	91.0639	91.3016	90.8323	90.8323	90.6066	90.3870	90.1733	89.9657	90.6066	90.1733	90.6066 (39)
Average = Sum(39)m / 12 =												90.6954 (39)
HLP	1.0858	1.0772	1.0800	1.0744	1.0744	1.0718	1.0692	1.0666	1.0642	1.0718	1.0666	1.0718 (40)
HLP (average)												1.0728 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5593	24.8901	27.5314	26.6136	27.4791	26.5677	27.4378	27.4646	26.5927	27.5098	26.6561	27.5512 (61)
Total heat required for water heating calculated for each month	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (64)
Heat gains from water heating, kWh/month	58.2035	51.1017	53.1942	47.0287	45.6109	40.0726	37.8378	42.4143	42.6209	48.8002	52.4260	56.5823 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1812.3640 (64)												

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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4307	47.4567	38.5944	29.2184	21.8411	18.4392	19.9242	25.8982	34.7605	44.1365	51.5138	54.9157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	78.2305	76.0443	71.4976	65.3177	61.3049	55.6563	50.8573	57.0085	59.1957	65.5916	72.8138	76.0515	(72)
Total internal gains	579.6267	575.0081	552.6745	518.1191	482.7456	451.1541	432.7812	441.3649	461.3390	496.1104	534.6933	563.8740	(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				1.4200	13.4839	0.6300	0.7000	0.7700			5.8516 (74)	
East				4.2900	25.1925	0.6300	0.7000	0.7700			33.0294 (76)	
West				7.4900	25.1925	0.6300	0.7000	0.7700			57.6668 (80)	

Solar gains	96.5478	160.5467	266.5780	392.2309	458.5804	511.0340	482.2421	423.0025	327.7122	205.4927	119.9356	78.0924 (83)
Total gains	676.1746	735.5548	819.2524	910.3500	941.3261	962.1880	915.0234	864.3674	789.0512	701.6031	654.6289	641.9664 (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	52.8980	53.3227	53.1839	53.4587	53.4587	53.5918	53.7221	53.8493	53.9736	53.5918	53.8493	53.5918	
alpha	4.5265	4.5548	4.5456	4.5639	4.5639	4.5728	4.5815	4.5900	4.5982	4.5728	4.5900	4.5728	
util living area	0.9840	0.9759	0.9481	0.8717	0.7309	0.5218	0.3822	0.4029	0.6659	0.8963	0.9692	0.9864 (86)	
MIT	19.9401	20.0696	20.3450	20.6718	20.8900	20.9812	20.9964	20.9956	20.9458	20.6847	20.2838	19.9318 (87)	
Th 2	20.0124	20.0195	20.0172	20.0218	20.0218	20.0240	20.0261	20.0282	20.0302	20.0240	20.0282	20.0240 (88)	
util rest of house	0.9798	0.9696	0.9344	0.8396	0.6704	0.4387	0.2883	0.3046	0.5820	0.8617	0.9596	0.9827 (89)	
MIT 2	19.0671	19.1998	19.4648	19.7715	19.9536	20.0162	20.0253	20.0271	20.0036	19.7927	19.4185	19.0683 (90)	
Living area fraction									fLA = Living area / (4) =			0.2142 (91)	
MIT	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9756	0.9645	0.9284	0.8375	0.6791	0.4561	0.3085	0.3257	0.5981	0.8601	0.9544	0.9790 (94)
Useful gains	659.6948	709.4482	760.5712	762.4248	639.2910	438.8371	282.3003	281.5293	471.9069	603.4383	624.8011	628.4832 (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	1317.6339	1282.7397	1155.2694	950.5039	695.2457	446.0511	283.2090	282.6564	495.3000	777.7448	1055.3784	1291.4432 (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	489.5067	385.2518	293.6555	135.4169	41.6303	0.0000	0.0000	0.0000	0.0000	129.6840	310.0157	493.2423 (98)
Space heating												2278.4032 (98)
Space heating per m2										(98) / (4) =		26.9506 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2512.0212	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	489.5067	385.2518	293.6555	135.4169	41.6303	0.0000	0.0000	0.0000	0.0000	129.6840	310.0157	493.2423	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	539.6987	424.7540	323.7657	149.3020	45.8989	0.0000	0.0000	0.0000	0.0000	142.9813	341.8034	543.8173	(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	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084	(64)
Efficiency of water heater (217)m	89.9240	89.8605	89.6653	89.2157	88.5128	87.9000	87.9000	87.9000	87.9000	89.1601	89.7102	87.9000	(216)
Fuel for water heating, kWh/month	202.2664	177.9037	186.0404	165.9384	162.6812	144.6086	137.2081	152.8741	153.3349	172.2668	183.1297	196.7999	(219)
Water heating fuel used												2035.0522	(219)
Annual totals kWh/year													
Space heating fuel - main system												2512.0212	(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)												377.4413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.94 * 1031 * 1.00) =										-775.3251		-775.3251	(233)
Total delivered energy for all uses												4224.1895	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2512.0212	10.2300	256.9798 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2035.0522	10.2300	208.1858 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	377.4413	36.7200	138.5964 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-775.3251	36.7200	-284.6994 (252)
Total energy cost			449.6026 (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	2512.0212	0.2160	542.5966 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2035.0522	0.2160	439.5713 (264)
Space and water heating			982.1678 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.4413	0.5190	195.8920 (268)
Energy saving/generation technologies			
PV Unit	-775.3251	0.5190	-402.3937 (269)
Total kg/year			814.5911 (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	2512.0212	1.2200	3064.6658 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2035.0522	1.2200	2482.7637 (264)
Space and water heating			5547.4295 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	377.4413	3.0700	1158.7447 (268)
Energy saving/generation technologies			
PV Unit	-775.3251	3.0700	-2380.2481 (269)
Primary energy kWh/year			4556.1760 (272)
Primary energy kWh/m2/year			53.8937 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 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	+ 1.2	-£ 84	-190 kg (23.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£84 2.25 kg/m²	B 89	A 92
Total Savings	£84 2.25 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 526 TEST (30 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£166	£184	-£18
Mains gas	£568	£466	£102
Space heating	£388	£388	£0
Water heating	£208	£124	£84
Lighting	£139	£139	£0
Generated (PV)	-£285	-£285	£0
Total cost of fuels	£449	£365	£84
Total cost of uses	£450	£366	£84
Delivered energy	50 kWh/m²	39 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	54 kWh/m²	41 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4345 (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) =	0.3693 (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	0.4709	0.4617	0.4524	0.4063	0.3970	0.3509	0.3509	0.3416	0.3693	0.3970	0.4155	0.4340 (22b)
Effective ac	0.6109	0.6066	0.6024	0.5825	0.5788	0.5616	0.5616	0.5584	0.5682	0.5788	0.5863	0.5942 (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)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (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) = 17480.7896 (34)
206.7754 (35)
6.2299 (36)
(33) + (36) = 51.1963 (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	43.1171	42.8132	42.5154	41.1163	40.8545	39.6359	39.6359	39.4103	40.1053	40.8545	41.3841	41.9377 (38)
Heat transfer coeff	94.3135	94.0096	93.7117	92.3126	92.0508	90.8323	90.8323	90.6066	91.3016	92.0508	92.5804	93.1340 (39)
Average = Sum(39)m / 12 =												92.3113 (39)
HLP	1.1156	1.1120	1.1085	1.0919	1.0888	1.0744	1.0744	1.0718	1.0800	1.0888	1.0951	1.1017 (40)
HLP (average)												1.0919 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5593	24.8901	27.5314	26.6136	27.4791	26.5677	27.4378	27.4646	26.5927	27.5098	26.6561	27.5512 (61)
Total heat required for water heating calculated for each month	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2184 (H8)
Utilisation factor												0.5599 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.6054 (H14)
Volume ratio Veff/V												0.7928 (H15)
Solar storage volume factor												0.9536 (H16)
Solar input												-851.3931 (H17)
Solar input	-24.6887	-41.1983	-70.1655	-94.0356	-116.1731	-114.2166	-112.7072	-98.4729	-77.1240	-52.6666	-29.2844	-20.6602 (63)
Solar input (sum of months) = Sum (63)m =												-851.3931 (63)
Output from w/h	157.1973	118.6668	96.6482	54.0076	27.8206	12.8944	7.8987	35.9035	57.6574	100.9266	135.0016	156.3482 (64)
Total per year (kWh/year) = Sum (64)m =												960.9708 (64)
Heat gains from water heating, kWh/month	58.2035	51.1017	53.1942	47.0287	45.6109	40.0726	37.8378	42.4143	42.6209	48.8002	52.4260	56.5823 (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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4307	47.4567	38.5944	29.2184	21.8411	18.4392	19.9242	25.8982	34.7605	44.1365	51.5138	54.9157 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	78.2305	76.0443	71.4976	65.3177	61.3049	55.6563	50.8573	57.0085	59.1957	65.5916	72.8138	76.0515 (72)
Total internal gains	579.6267	575.0081	552.6745	518.1191	482.7456	451.1541	432.7812	441.3649	461.3390	496.1104	534.6933	563.8740 (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				1.4200	10.6334		0.6300	0.7000	0.7700		4.6146 (74)	
East				4.2900	19.6403		0.6300	0.7000	0.7700		25.7500 (76)	
West				7.4900	19.6403		0.6300	0.7000	0.7700		44.9574 (80)	
Solar gains	75.3219	147.1372	242.7760	356.2894	439.5719	451.4992	429.2065	366.5557	282.9472	174.6241	93.8564	61.9932 (83)
Total gains	654.9487	722.1453	795.4505	874.4086	922.3175	902.6532	861.9877	807.9205	744.2863	670.7345	628.5497	625.8672 (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	51.4855	51.6519	51.8161	52.6014	52.7510	53.4587	53.4587	53.5918	53.1839	52.7510	52.4493	52.1375
alpha	4.4324	4.4435	4.4544	4.5068	4.5167	4.5639	4.5639	4.5728	4.5456	4.5167	4.4966	4.4758
util living area	0.9879	0.9801	0.9597	0.9027	0.7870	0.6103	0.4561	0.5035	0.7455	0.9302	0.9792	0.9900 (86)
MIT	19.7972	19.9548	20.2270	20.5731	20.8302	20.9602	20.9915	20.9869	20.9018	20.5653	20.1259	19.7714 (87)
Th 2	19.9881	19.9910	19.9939	20.0074	20.0100	20.0218	20.0218	20.0240	20.0172	20.0100	20.0048	19.9995 (88)
util rest of house	0.9848	0.9749	0.9489	0.8770	0.7349	0.5294	0.3584	0.4025	0.6700	0.9060	0.9728	0.9874 (89)
MIT 2	18.9063	19.0640	19.3322	19.6707	19.8964	20.0027	20.0193	20.0198	19.9629	19.6729	19.2455	18.8899 (90)
Living area fraction												0.2142 (91)
MIT	19.0971	19.2548	19.5238	19.8640	20.0965	20.2078	20.2276	20.2269	20.1641	19.8641	19.4341	19.0787 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0971	19.2548	19.5238	19.8640	20.0965	20.2078	20.2276	20.2269	20.1641	19.8641	19.4341	19.0787 (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	0.9811	0.9701	0.9427	0.8727	0.7399	0.5455	0.3793	0.4240	0.6823	0.9017	0.9681	0.9842	(94)
Useful gains	642.5888	700.5654	749.8926	763.1312	682.4123	492.3676	326.9600	342.5726	507.8288	604.8009	608.5124	615.9556	(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	1395.5673	1349.4899	1220.4870	1012.1146	772.9009	509.3706	329.4988	346.7469	553.6601	852.7687	1141.8953	1385.7140	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	560.2160	436.0773	350.1222	179.2680	67.3235	0.0000	0.0000	0.0000	0.0000	184.4880	384.0357	572.7003	(98)
Space heating												2734.2310	(98)
Space heating per m2											(98) / (4) =	32.3425	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3014.5876	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	560.2160	436.0773	350.1222	179.2680	67.3235	0.0000	0.0000	0.0000	0.0000	184.4880	384.0357	572.7003	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	617.6582	480.7908	386.0223	197.6494	74.2265	0.0000	0.0000	0.0000	0.0000	203.4047	423.4131	631.4226	(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	157.1973	118.6668	96.6482	54.0076	27.8206	12.8944	7.8987	35.9035	57.6574	100.9266	135.0016	156.3482	(64)	
Efficiency of water heater	90.0713	90.0861	90.0793	90.0360	89.8630	87.9000	87.9000	87.9000	87.9000	89.6897	89.9547	90.0846	(217)	
Fuel for water heating, kWh/month	174.5254	131.7260	107.2923	59.9845	30.9589	14.6693	8.9860	40.8458	65.5943	112.5286	150.0773	173.5571	(219)	
Water heating fuel used												1070.7455	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3014.5876	(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)												377.4413	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.94 * 908 * 1.00) =										-682.7064		-682.7064	(233)	
Total delivered energy for all uses												3905.0680	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3014.5876	3.4800	104.9076	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1070.7455	3.4800	37.2619	(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	377.4413	13.1900	49.7845	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-682.7064	13.1900	-90.0490	(252)
Total energy cost			238.3926	(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] =	0.7729	(257)
SAP value			89.2177	
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	3014.5876	0.2160	651.1509 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1070.7455	0.2160	231.2810 (264)
Space and water heating			882.4320 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	377.4413	0.5190	195.8920 (268)
Energy saving/generation technologies			
PV Unit	-682.7064	0.5190	-354.3246 (269)
Total kg/year			788.8744 (272)
CO2 emissions per m2			9.3300 (273)
EI value			91.8397
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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6700 (2c)	= 112.8609 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8862 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4345 (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) =		0.3693 (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	0.3878	0.3601	0.3693	0.3509	0.3509	0.3416	0.3324	0.3232	0.3139	0.3416	0.3232	0.3416 (22b)
Effective ac	0.5752	0.5648	0.5682	0.5616	0.5616	0.5584	0.5552	0.5522	0.5493	0.5584	0.5522	0.5584 (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)			13.2000	1.1450	15.1145		(27)
Ground Floor			42.2700	0.1100	4.6497	140.0000	5917.8000 (28a)
Brick and Block	93.0000	15.3200	77.6800	0.2400	18.6432	42.2200	3279.6496 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.0000	380.4300 (30)
Total net area of external elements Aum(A, m ²)			177.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9664		(33)
Party Wall 1			44.2400	0.0000	0.0000	110.0000	4866.4000 (32)
Internal Wall 1			60.4800			9.0000	544.3200 (32c)
First Floor Stud			107.8300			9.0000	970.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (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) = 17480.7896 (34)
206.7754 (35)
6.2299 (36)
(33) + (36) = 51.1963 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.5988	39.8676	40.1053	39.6359	39.6359	39.4103	39.1906	38.9770	38.7694	39.4103	38.9770	39.4103 (38)
Heat transfer coeff	91.7951	91.0639	91.3016	90.8323	90.8323	90.6066	90.3870	90.1733	89.9657	90.6066	90.1733	90.6066 (39)
Average = Sum(39)m / 12 =												90.6954 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0858	1.0772	1.0800	1.0744	1.0744	1.0718	1.0692	1.0666	1.0642	1.0718	1.0666	1.0718 (40)
HLP (average)												1.0728 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total = Sum(45)m =		1488.5106 (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

Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5593	24.8901	27.5314	26.6136	27.4791	26.5677	27.4378	27.4646	26.5927	27.5098	26.6561	27.5512 (61)
Total heat required for water heating calculated for each month	181.8860	159.8652	166.8137	148.0432	143.9937	127.1110	120.6059	134.3763	134.7813	153.5932	164.2860	177.0084 (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												1.3636 (H8)
Utilisation factor												0.5197 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.6054 (H14)
Volume ratio Veff/V												0.7928 (H15)
Solar storage volume factor												0.9536 (H16)
Solar input												-884.4470 (H17)
Solar input	-28.8528	-41.0268	-70.5153	-95.1415	-111.7494	-119.3660	-116.8557	-104.5894	-81.8863	-56.6134	-34.1253	-23.7254 (63)
Solar input (sum of months) = Sum (63)m =												-884.4470 (63)
Output from w/h	153.0332	118.8383	96.2984	52.9018	32.2443	7.7450	3.7502	29.7870	52.8951	96.9798	130.1607	153.2830 (64)
Total per year (kWh/year) = Sum (64)m =												927.9169 (64)
Heat gains from water heating, kWh/month	58.2035	51.1017	53.1942	47.0287	45.6109	40.0726	37.8378	42.4143	42.6209	48.8002	52.4260	56.5823 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4307	47.4567	38.5944	29.2184	21.8411	18.4392	19.9242	25.8982	34.7605	44.1365	51.5138	54.9157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	78.2305	76.0443	71.4976	65.3177	61.3049	55.6563	50.8573	57.0085	59.1957	65.5916	72.8138	76.0515	(72)
Total internal gains	579.6267	575.0081	552.6745	518.1191	482.7456	451.1541	432.7812	441.3649	461.3390	496.1104	534.6933	563.8740	(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				1.4200	13.4839	0.6300	0.7000	0.7700	5.8516 (74)			
East				4.2900	25.1925	0.6300	0.7000	0.7700	33.0294 (76)			
West				7.4900	25.1925	0.6300	0.7000	0.7700	57.6668 (80)			
Solar gains	96.5478	160.5467	266.5780	392.2309	458.5804	511.0340	482.2421	423.0025	327.7122	205.4927	119.9356	78.0924 (83)
Total gains	676.1746	735.5548	819.2524	910.3500	941.3261	962.1880	915.0234	864.3674	789.0512	701.6031	654.6289	641.9664 (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	52.8980	53.3227	53.1839	53.4587	53.4587	53.5918	53.7221	53.8493	53.9736	53.5918	53.8493	53.5918
alpha	4.5265	4.5548	4.5456	4.5639	4.5639	4.5728	4.5815	4.5900	4.5982	4.5728	4.5900	4.5728
util living area	0.9840	0.9759	0.9481	0.8717	0.7309	0.5218	0.3822	0.4029	0.6659	0.8963	0.9692	0.9864 (86)
MIT	19.9401	20.0696	20.3450	20.6718	20.8900	20.9812	20.9964	20.9956	20.9458	20.6847	20.2838	19.9318 (87)
Th 2	20.0124	20.0195	20.0172	20.0218	20.0218	20.0240	20.0261	20.0282	20.0302	20.0240	20.0282	20.0240 (88)
util rest of house	0.9798	0.9696	0.9344	0.8396	0.6704	0.4387	0.2883	0.3046	0.5820	0.8617	0.9596	0.9827 (89)
MIT 2	19.0671	19.1998	19.4648	19.7715	19.9536	20.0162	20.0253	20.0271	20.0036	19.7927	19.4185	19.0683 (90)
Living area fraction									fLA = Living area / (4) =			0.2142 (91)
MIT	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2541	19.3861	19.6533	19.9644	20.1542	20.2229	20.2333	20.2346	20.2054	19.9838	19.6039	19.2533 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9645	0.9284	0.8375	0.6791	0.4561	0.3085	0.3257	0.5981	0.8601	0.9544	0.9790	(94)
Useful gains	689.6948	709.4482	760.5712	762.4248	639.2910	438.8371	282.3003	281.5293	471.9069	603.4383	624.8011	628.4832	(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	1317.6339	1282.7397	1155.2694	950.5039	695.2457	446.0511	283.2090	282.6564	495.3000	777.7448	1055.3784	1291.4432	(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	489.5067	385.2518	293.6555	135.4169	41.6303	0.0000	0.0000	0.0000	0.0000	129.6840	310.0157	493.2423	(98)
Space heating												2278.4032	(98)
Space heating per m2												26.9506	(99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2512.0212	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	489.5067	385.2518	293.6555	135.4169	41.6303	0.0000	0.0000	0.0000	0.0000	129.6840	310.0157	493.2423	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	539.6987	424.7540	323.7657	149.3020	45.8989	0.0000	0.0000	0.0000	0.0000	142.9813	341.8034	543.8173	(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	153.0332	118.8383	96.2984	52.9018	32.2443	7.7450	3.7502	29.7870	52.8951	96.9798	130.1607	153.2830	(64)	
Efficiency of water heater	90.0171	90.0240	89.9921	89.8956	89.4562	87.9000	87.9000	87.9000	87.9000	89.4805	89.8536	90.0201	(217)	
Fuel for water heating, kWh/month	170.0047	132.0075	107.0076	58.8480	36.0448	8.8112	4.2665	33.8873	60.1764	108.3810	144.8586	170.2763	(219)	
Water heating fuel used												1034.5700	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2512.0212	(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)													377.4413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.94 * 1031 * 1.00) =										-775.3251		-775.3251	(233)	
Total delivered energy for all uses												3273.7073	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2512.0212	10.2300	256.9798	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1034.5700	10.2300	105.8365	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	377.4413	36.7200	138.5964	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-775.3251	36.7200	-284.6994	(252)
Total energy cost			365.6133	(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	2512.0212	0.2160	542.5966	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1034.5700	0.2160	223.4671	(264)
Space and water heating			766.0637	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	377.4413	0.5190	195.8920	(268)
Energy saving/generation technologies				
PV Unit	-775.3251	0.5190	-402.3937	(269)
Total kg/year			624.4370	(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	2512.0212	1.2200	3064.6658	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1034.5700	1.2200	1262.1754	(264)
Space and water heating			4326.8412	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	377.4413	3.0700	1158.7447	(268)
Energy saving/generation technologies				
PV Unit	-775.3251	3.0700	-2380.2481	(269)
Primary energy kWh/year			3489.0877	(272)
Primary energy kWh/m2/year			41.2714	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 16	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	4, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.46	TER	18.31
Environmental	90 B	% DER<TER	26.49		
CO ₂ Emissions (t/year)	0.81	DFEE	43.11	TFEE	52.73
General Requirements Compliance	Pass	% DFEE<TFEE	18.25		

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 16	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	4, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.46	TER	18.31
Environmental	90 B	% DER<TER	26.49		
CO ₂ Emissions (t/year)	0.81	DFEE	43.11	TFEE	52.73
General Requirements Compliance	Pass	% DFEE<TFEE	18.25		

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 000003

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 16	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Project	4, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.46	TER	18.31
Environmental	90 B	% DER<TER	26.49		
CO ₂ Emissions (t/year)	0.81	DFEE	43.11	TFEE	52.73
General Requirements Compliance	Pass	% DFEE<TFEE	18.25		

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

Building Elements

Floor 000004 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 41.97 m², Perimeter = 18.36 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 16	Issued on Date	25/09/2023
Assessment Reference	As Built	Prop Type Ref	Block D
Property	4, Fieldfare Crescent, Botley, Southampton, SO32 2TW		

SAP Rating	88 B	DER	13.46	TER	18.31
Environmental	90 B	% DER<TER	26.49		
CO ₂ Emissions (t/year)	0.81	DFEE	43.11	TFEE	52.73
General Requirements Compliance	Pass	% DFEE<TFEE	18.25		

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

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

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

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	18.38 m	42.27 m ²	2.39 m
	1st Storey:	18.38 m	42.27 m ²	2.67 m

7.0 Living Area	18.11	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	206.78	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	93.00	77.68

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	44.24

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
Internal Wall 1	Plasterboard on timber frame		9.00	60.48
First Floor Stud	Plasterboard on timber frame		9.00	107.83

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	42.27	42.27

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.27

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.11	140.00	42.27

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.27

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
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 (m ²)	Curtain Closed
Front Elevation	Half Glazed Door	[1] Brick and Block	East							2.12	
Front Elevation	Window	[1] Brick and Block	East	None	0.00					4.29	
Rear Elevation	Window	[1] Brick and Block	West	None	0.00					7.49	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					1.42	

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)	0.48	0.093	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.89	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.74	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.71	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.77	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	8.07	0.021	No	Knauf P5
Independently assessed	E4 Jamb	29.40	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	18.38	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	18.38	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.69	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.78	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.10	0.039	No	Knauf P23
Independently assessed	E25 Staggered party wall between dwellings	10.10	0.062	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.78	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.78	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.78	0.035	No	Knauf P29 Halved

Y-value	0.035	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	Yes	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

As Built AP₅₀

4.95

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows half open

Cross ventilation possible

Yes

Night Ventilation

Yes

Air change rate

4.00

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings

22

Total number of L.E.L. fittings

22

Percentage of L.E.L. fittings

100.00

%

External

External lights fitted

Yes

Light and motion sensor

Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.94	West	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	£84	B 89	