



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 33 Shaw Road, West End
Southampton, SO30 3JZ

Contact: Tobias Whiting
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Report Issue Date: 02/03/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 90	Issued on Date	02/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Property	33 Shaw Road, West End, Southampton, SO30 3JZ		
SAP Rating	87 B	DER	14.90
Environmental	89 B	TER	19.71
CO ₂ Emissions (t/year)	0.75	% DER<TER	24.39
General Requirements Compliance	Pass	DfEE	45.23
		TfEE	55.70
		% DfEE<TfEE	18.80
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.71	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.90	kgCO ₂ /m ²	Pass
	-4.81 (-24.4%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	55.70	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	45.23	kWh/m ² /yr	
	-10.5 (-18.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (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	4.23 (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

7.49 m², No overhang

Windows facing East

1.32 m², No overhang

Windows facing South

3.43 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

4.23 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.65

kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	87 B	DER	14.90	TER	19.71
Environmental	89 B	% DER<TER	24.39		
CO ₂ Emissions (t/year)	0.75	DFEE	45.23	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	18.80		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.098	1.26	0.12	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.053	3.76	0.20	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	3.60	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.060	1.51	0.09	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.034	7.61	0.26	CD0027
External wall	E4 Jamb	Independently assessed	0.039	27.30	1.06	CD0028
External wall	E5 Ground floor (normal)	Independently assessed	0.037	16.78	0.62	Knauf P7
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.78	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.060	8.41	0.50	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	8.46	0.46	CD0031
External wall	E16 Corner (normal)	Independently assessed	0.050	10.10	0.51	CD0035
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.10	0.61	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.46	1.35	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.46	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.049	8.46	0.41	CD0020

Total: **6.35** W/mK:
Y-Value: **0.041** W/m²K:

FULL SAP CALCULATION PRINTOUT

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CO ₂ Emissions (t/year)	0.75	DFEE	45.23	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	18.80		
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 70 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.90 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.2 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	0.12 (max. 0.25)	0.12 (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: 4.23 (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: 7.49 m², No overhang
Windows facing East: 1.32 m², No overhang
Windows facing South: 3.43 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 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 0.65 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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.2300
Infiltration rate					0.4365 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4038 (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	0.5148	0.5047	0.4946	0.4442	0.4341	0.3836	0.3836	0.3735	0.4038	0.4341	0.4543	0.4744 (22b)
Effective ac	0.6325	0.6274	0.6223	0.5986	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126 (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		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.3100			9.0000	740.7900 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11774.5240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3530 (36)
Total fabric heat loss (33) + (36) = 47.3609 (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	37.1039	36.8020	36.5061	35.1163	34.8563	33.6458	33.6458	33.4217	34.1121	34.8563	35.3823	35.9323 (38)
Heat transfer coeff	84.4648	84.1629	83.8670	82.4772	82.2172	81.0068	81.0068	80.7826	81.4730	82.2172	82.7432	83.2932 (39)
Average = Sum(39)m / 12 =												82.4760 (39)
HLP	1.2022	1.1979	1.1937	1.1739	1.1702	1.1530	1.1530	1.1498	1.1596	1.1702	1.1777	1.1855 (40)
HLP (average)												1.1739 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (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	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1703.3310 (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	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	348.9929	346.9897	334.5953	314.6711	294.5432	275.0836	262.4070	268.0804	278.2877	298.4122	321.5150	338.7447	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)			
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	430.2642	489.2669	541.4015	594.4117	631.6072	620.7583	591.0316	551.8468	509.8093	458.7445	419.5121	407.8989 (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	38.7227	38.8615	38.9987	39.6558	39.7812	40.3757	40.3757	40.4877	40.1446	39.7812	39.5283	39.2673	
alpha	3.5815	3.5908	3.5999	3.6437	3.6521	3.6917	3.6917	3.6992	3.6763	3.6521	3.6352	3.6178	
util living area	0.9901	0.9834	0.9691	0.9327	0.8530	0.7111	0.5623	0.6130	0.8228	0.9495	0.9836	0.9918	(86)
MIT	19.2427	19.4386	19.7634	20.2028	20.5937	20.8608	20.9564	20.9398	20.7426	20.2454	19.6758	19.2172	(87)
Th 2	19.9183	19.9217	19.9251	19.9409	19.9439	19.9578	19.9578	19.9604	19.9525	19.9439	19.9379	19.9316	(88)
util rest of house	0.9877	0.9795	0.9615	0.9149	0.8118	0.6302	0.4457	0.4977	0.7591	0.9326	0.9791	0.9899	(89)
MIT 2	18.3222	18.5190	18.8423	19.2817	19.6471	19.8804	19.9423	19.9369	19.7905	19.3316	18.7680	18.3069	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	18.5150	18.7117	19.0353	19.4747	19.8454	20.0858	20.1548	20.1471	19.9900	19.5230	18.9582	18.4976	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5150	18.7117	19.0353	19.4747	19.8454	20.0858	20.1548	20.1471	19.9900	19.5230	18.9582	18.4976	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9836	0.9736	0.9533	0.9053	0.8074	0.6411	0.4690	0.5200	0.7618	0.9240	0.9734	0.9863	(94)
Useful gains	423.2050	476.3527	516.1216	538.1006	509.9640	397.9503	277.2060	286.9388	388.3495	423.8760	408.3538	402.3002	(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	1200.6708	1162.4292	1051.2960	872.1692	669.6916	444.3901	287.9600	302.6967	479.8728	733.6262	981.1869	1190.8930	(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	578.4345	461.0434	398.1697	240.5294	118.8374	0.0000	0.0000	0.0000	0.0000	230.4542	412.4398	586.7131	(98)
Space heating												3026.6216	(98)
Space heating per m2												(98) / (4) =	43.0774 (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													3336.9587 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.4345	461.0434	398.1697	240.5294	118.8374	0.0000	0.0000	0.0000	0.0000	230.4542	412.4398	586.7131	(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)	637.7448	508.3169	438.9964	265.1923	131.0225	0.0000	0.0000	0.0000	0.0000	254.0840	454.7297	646.8722	(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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703	(64)
Efficiency of water heater (217)m	90.0467	89.9963	89.8917	89.6534	89.1867	87.9000	87.9000	87.9000	87.9000	89.6007	89.9205	87.9000	(216)
Fuel for water heating, kWh/month	189.4479	166.6450	174.2183	155.2051	151.8817	136.2303	129.4443	143.9639	144.3172	161.1085	171.4855	184.3852	(219)
Water heating fuel used												1908.3328	(219)
Annual totals kWh/year													
Space heating fuel - main system												3336.9587	(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)												319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1080 * 1.00) =										-561.3528		-561.3528	(233)
Total delivered energy for all uses												5078.9112	(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	3336.9587	0.2160	720.7831 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1908.3328	0.2160	412.1999 (264)
Space and water heating			1132.9830 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-561.3528	0.5190	-291.3421 (269)
Total CO2, kg/year			1046.6315 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9000 (273)

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

DER			14.9000 ZC1
Total Floor Area		TFA	70.2600
Assumed number of occupants		N	2.2524
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6913 ZC2
CO2 emissions from cooking, equation (L16)			2.4631 ZC3
Total CO2 emissions			34.0544 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			34.0544 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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1688 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4188 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3874 (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	0.4939	0.4842	0.4745	0.4261	0.4164	0.3680	0.3680	0.3583	0.3874	0.4164	0.4358	0.4551 (22b)
Effective ac	0.6220	0.6172	0.6126	0.5908	0.5867	0.5677	0.5677	0.5642	0.5750	0.5867	0.5950	0.6036 (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 Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			12.2400	1.3258	16.2273		(27)					
Ground Floor			35.1300	0.1300	4.5669		(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.1800	12.6990		(29a)					
Pitched Roof	35.1300		35.1300	0.1300	4.5669		(30)					
Total net area of external elements Aum(A, m2)			155.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.1801		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1560 (36)					
Total fabric heat loss						(33) + (36) =	49.3361 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.4843	Feb 36.2065	Mar 35.9342	Apr 34.6552	May 34.4159	Jun 33.3019	Jul 33.3019	Aug 33.0956	Sep 33.7310	Oct 34.4159	Nov 34.9000	Dec 35.4061 (38)
Heat transfer coeff	85.8204	85.5426	85.2703	83.9912	83.7519	82.6380	82.6380	82.4317	83.0670	83.7519	84.2360	84.7422 (39)
Average = Sum(39)m / 12 =												83.9901 (39)
HLP	Jan 1.2215	Feb 1.2175	Mar 1.2136	Apr 1.1954	May 1.1920	Jun 1.1762	Jul 1.1762	Aug 1.1732	Sep 1.1823	Oct 1.1920	Nov 1.1989	Dec 1.2061 (40)
HLP (average)												1.1954 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	49.1572	42.7855	45.5822	42.3819	42.0071	38.9222	40.2196	42.0071	42.3819	45.5822	45.8417	49.1572 (61)
Solar input	192.2113	167.9015	174.6907	154.9418	150.0110	132.1213	126.5823	141.1096	142.6680	162.4559	173.4185	187.6975 (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	192.2113	167.9015	174.6907	154.9418	150.0110	132.1213	126.5823	141.1096	142.6680	162.4559	173.4185	187.6975 (64)
	59.8548	52.2975	54.3241	48.0216	46.4131	40.7193	38.7705	43.4534	43.9406	50.2561	53.8797	58.3539 (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	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	80.4500	77.8236	73.0163	66.6967	62.3832	56.5545	52.1109	58.4050	61.0286	67.5485	74.8329	78.4327	(72)
Total internal gains	356.2576	353.6590	340.6715	320.1555	299.4333	279.3804	266.7083	272.9746	283.7784	304.4947	328.1878	346.0118	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			7.4900		10.6334		0.6300		0.7000		0.7700		24.3403 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			3.4300		46.7521		0.6300		0.7000		0.7700		49.0080 (78)
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)
Total gains	437.5289	495.9362	547.4778	599.8962	636.4972	625.0552	595.3329	556.7410	515.3000	464.8270	426.1850	415.1660	(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	56.8532	57.0379	57.2200	58.0914	58.2574	59.0427	59.0427	59.1904	58.7377	58.2574	57.9226	57.5766	
alpha	4.7902	4.8025	4.8147	4.8728	4.8838	4.9362	4.9362	4.9460	4.9158	4.8838	4.8615	4.8384	
util living area	0.9976	0.9952	0.9889	0.9671	0.9019	0.7554	0.5887	0.6449	0.8719	0.9777	0.9953	0.9982	(86)
MIT	19.6848	19.8332	20.0816	20.4218	20.7283	20.9246	20.9826	20.9732	20.8354	20.4474	20.0107	19.6646	(87)
Th 2	19.9029	19.9060	19.9091	19.9237	19.9264	19.9391	19.9391	19.9415	19.9342	19.9264	19.9209	19.9151	(88)
util rest of house	0.9968	0.9936	0.9848	0.9539	0.8612	0.6633	0.4579	0.5139	0.8045	0.9663	0.9934	0.9976	(89)
MIT 2	18.1579	18.3764	18.7396	19.2370	19.6527	19.8872	19.9326	19.9301	19.7978	19.2815	18.6467	18.1369	(90)
Living area fraction	18.4778	18.6816	19.0208	19.4852	19.8781	20.1046	20.1525	20.1486	20.0152	19.5257	18.9325	18.4569	(92)
Temperature adjustment	18.4778	18.6816	19.0208	19.4852	19.8781	20.1046	20.1525	20.1486	20.0152	19.5257	18.9325	18.4569	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	435.4355	491.4156	536.5493	568.0449	546.7339	424.4775	288.9659	301.2983	417.7026	446.4356	422.2356	413.6113	(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	1216.7437	1178.9161	1067.6509	889.0655	684.9284	454.8861	293.5747	309.0071	491.3576	747.5485	996.7212	1208.1626	(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	581.2933	462.0003	395.1396	231.1348	102.8167	0.0000	0.0000	0.0000	0.0000	224.0280	413.6296	591.1461	(98)
Space heating												3001.1886	(98)
Space heating per m2												42.7155	(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													3213.2640 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	581.2933	462.0003	395.1396	231.1348	102.8167	0.0000	0.0000	0.0000	0.0000	224.0280	413.6296	591.1461	(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)	622.3697	494.6470	423.0617	247.4677	110.0821	0.0000	0.0000	0.0000	0.0000	239.8587	442.8583	632.9188	(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	192.2113	167.9015	174.6907	154.9418	150.0110	132.1213	126.5823	141.1096	142.6680	162.4559	173.4185	187.6975	(64)
Efficiency of water heater (217)m	87.6602	87.4675	87.0437	86.0561	84.1221	80.3000	80.3000	80.3000	80.3000	85.8605	87.1614	80.3000	(216)
Fuel for water heating, kWh/month	219.2687	191.9587	200.6932	180.0475	178.3253	164.5346	157.6367	175.7280	177.6687	189.2091	198.9624	213.9236	(219)
Water heating fuel used												2247.9566	(219)
Annual totals kWh/year													
Space heating fuel - main system												3213.2640	(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)												319.9724	(232)
Total delivered energy for all uses												5856.1930	(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	3213.2640	0.2160	694.0650 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2247.9566	0.2160	485.5586 (264)
Space and water heating			1179.6236 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Total CO2, kg/m2/year			1384.6143 (272)
Emissions per m2 for space and water heating			16.7894 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3636 (272b)
Emissions per m2 for pumps and fans			0.5540 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7894 * 1.00) + 2.3636 + 0.5540, rounded to 2 d.p.			19.7100 (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1688 (8)
Pressure test					Yes
Measured/design AP50					4.2300
Infiltration rate					0.3803 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3517 (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	0.4485	0.4397	0.4309	0.3869	0.3781	0.3342	0.3342	0.3254	0.3517	0.3781	0.3957	0.4133 (22b)
Effective ac	0.6006	0.5967	0.5928	0.5749	0.5715	0.5558	0.5558	0.5529	0.5619	0.5715	0.5783	0.5854 (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		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.3100			9.0000	740.7900 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			9.0000	316.1700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11458.3540 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 163.0850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3530 (36)
Total fabric heat loss (33) + (36) = 47.3609 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.2293	35.0002	34.7757	33.7210	33.5237	32.6051	32.6051	32.4350	32.9590	33.5237	33.9229	34.3402 (38)
Heat transfer coeff	82.5902	82.3611	82.1366	81.0819	80.8846	79.9660	79.9660	79.7959	80.3199	80.8846	81.2838	81.7011 (39)
Average = Sum(39)m / 12 =												81.0810 (39)
HLP	1.1755	1.1722	1.1690	1.1540	1.1512	1.1381	1.1381	1.1357	1.1432	1.1512	1.1569	1.1628 (40)
HLP (average)												1.1540 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.3990	26.5871	27.4356	23.9190	22.9508	19.8048	18.3521	21.0593	21.3108	24.8357	27.1101	29.4398 (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	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	40.8589	39.5642	36.8757	33.2208	30.8479	27.5067	24.6668	28.3055	29.5983	33.3813	37.6529	39.5696	(72)
Total internal gains	313.6664	312.3996	301.5310	283.6796	264.8980	247.3326	236.2642	239.8751	249.3481	267.3275	288.0078	304.1488	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)
East	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)
South	3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)
Total gains	394.9378	454.6768	508.3372	563.4202	601.9619	593.0073	564.8888	523.6415	480.8697	427.6598	386.0049	373.3030	(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	38.5382	38.6454	38.7510	39.2551	39.3508	39.8028	39.8028	39.8877	39.6275	39.3508	39.1576	38.9576	
alpha	3.5692	3.5764	3.5834	3.6170	3.6234	3.6535	3.6535	3.6592	3.6418	3.6234	3.6105	3.5972	
util living area	0.9918	0.9856	0.9723	0.9379	0.8615	0.7239	0.5760	0.6304	0.8365	0.9557	0.9863	0.9933	(86)
MIT	19.1912	19.3908	19.7219	20.1665	20.5694	20.8475	20.9511	20.9316	20.7194	20.2030	19.6215	19.1593	(87)
Th 2	19.9397	19.9423	19.9448	19.9570	19.9592	19.9698	19.9698	19.9718	19.9657	19.9592	19.9546	19.9498	(88)
util rest of house	0.9898	0.9823	0.9655	0.9216	0.8225	0.6451	0.4598	0.5158	0.7765	0.9408	0.9825	0.9917	(89)
MIT 2	18.2899	18.4900	18.8194	19.2622	19.6406	19.8832	19.9518	19.9442	19.7852	19.3057	18.7298	18.2657	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	18.4787	18.6787	19.0085	19.4517	19.8352	20.0852	20.1612	20.1511	19.9809	19.4937	18.9166	18.4530	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4787	18.6787	19.0085	19.4517	19.8352	20.0852	20.1612	20.1511	19.9809	19.4937	18.9166	18.4530	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9862	0.9769	0.9577	0.9118	0.8172	0.6548	0.4828	0.5375	0.7775	0.9323	0.9774	0.9886	(94)
Ext temp.	389.4913	444.1715	486.8488	513.7376	491.8990	388.3198	272.7104	281.4354	373.8793	398.6953	377.2851	369.0443	(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	1171.0209	1134.8284	1027.4016	855.5492	658.0126	438.6305	284.7713	299.3199	472.3565	719.3618	960.5009	1164.4825	(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	581.4580	464.1215	402.1713	246.1043	123.5885	0.0000	0.0000	0.0000	0.0000	238.5759	419.9154	591.8061	(98)
Space heating per m2												3067.7409	(98)
										(98) / (4) =		43.6627	(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	751.6808	591.7488	606.4492	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7979	0.8641	0.8357	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	599.7803	511.3404	506.8170	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	776.9995	742.4568	695.6632	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	127.5978	171.9507	140.5016	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												440.0501 (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	31.8995	42.9877	35.1254	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												110.0125 (107)
Space cooling per m2												1.5658 (108)
Energy for space heating												43.6627 (99)
Energy for space cooling												1.5658 (108)
Total												45.2285 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.2 (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1688 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4188 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3874 (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	0.4939	0.4842	0.4745	0.4261	0.4164	0.3680	0.3680	0.3583	0.3874	0.4164	0.4358	0.4551 (22b)
Effective ac	0.6220	0.6172	0.6126	0.5908	0.5867	0.5677	0.5677	0.5642	0.5750	0.5867	0.5950	0.6036 (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 Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			12.2400	1.3258	16.2273		(27)					
Ground Floor			35.1300	0.1300	4.5669		(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.1800	12.6990		(29a)					
Pitched Roof	35.1300		35.1300	0.1300	4.5669		(30)					
Total net area of external elements Aum(A, m2)			155.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.1801		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1560 (36)					
Total fabric heat loss						(33) + (36) =	49.3361 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.4843	Feb 36.2065	Mar 35.9342	Apr 34.6552	May 34.4159	Jun 33.3019	Jul 33.3019	Aug 33.0956	Sep 33.7310	Oct 34.4159	Nov 34.9000	Dec 35.4061 (38)
Heat transfer coeff	85.8204	85.5426	85.2703	83.9912	83.7519	82.6380	82.6380	82.4317	83.0670	83.7519	84.2360	84.7422 (39)
Average = Sum(39)m / 12 =												83.9901 (39)
HLP	Jan 1.2215	Feb 1.2175	Mar 1.2136	Apr 1.1954	May 1.1920	Jun 1.1762	Jul 1.1762	Aug 1.1732	Sep 1.1823	Oct 1.1920	Nov 1.1989	Dec 1.2061 (40)
HLP (average)												1.1954 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (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												

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Calculation Type: New Build (As Built)

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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)
	30.3990	26.5871	27.4356	23.9190	22.9508	19.8048	18.3521	21.0593	21.3108	24.8357	27.1101	29.4398 (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	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210	112.6210 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1182	16.0924	13.0872	9.9079	7.4062	6.2527	6.7562	8.7820	11.7872	14.9665	17.4681	18.6217 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9031	199.9567	194.7817	183.7646	169.8576	156.7869	148.0549	146.0013	151.1763	162.1934	176.1004	189.1711 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621	34.2621 (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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968 (71)
Water heating gains (Table 5)	40.8589	39.5642	36.8757	33.2208	30.8479	27.5067	24.6668	28.3055	29.5983	33.3813	37.6529	39.5696 (72)
Total internal gains	313.6664	312.3996	301.5310	283.6796	264.8980	247.3326	236.2642	239.8751	249.3481	267.3275	288.0078	304.1488 (73)

6. Solar gains												

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North			7.4900		10.6334		0.6300		0.7000		0.7700	24.3403 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700	7.9231 (76)
South			3.4300		46.7521		0.6300		0.7000		0.7700	49.0080 (78)

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	394.9378	454.6768	508.3372	563.4202	601.9619	593.0073	564.8888	523.6415	480.8697	427.6598	386.0049	373.3030 (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	56.8532	57.0379	57.2200	58.0914	58.2574	59.0427	59.0427	59.1904	58.7377	58.2574	57.9226	57.5766
alpha	4.7902	4.8025	4.8147	4.8728	4.8838	4.9362	4.9362	4.9460	4.9158	4.8838	4.8615	4.8384
util living area	0.9985	0.9967	0.9918	0.9740	0.9173	0.7807	0.6156	0.6767	0.8949	0.9840	0.9970	0.9989 (86)
MIT	19.6292	19.7798	20.0324	20.3802	20.6993	20.9123	20.9789	20.9669	20.8102	20.4028	19.9586	19.6096 (87)
Th 2	19.9029	19.9060	19.9091	19.9237	19.9264	19.9391	19.9391	19.9415	19.9342	19.9264	19.9209	19.9151 (88)
util rest of house	0.9980	0.9956	0.9887	0.9632	0.8808	0.6905	0.4811	0.5433	0.8342	0.9754	0.9957	0.9985 (89)
MIT 2	18.6560	18.8087	19.0624	19.4156	19.7158	19.8969	19.9336	19.9316	19.8232	19.4436	18.9992	18.6462 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8599	19.0122	19.2656	19.6177	19.9218	20.1096	20.1526	20.1485	20.0300	19.6445	19.2002	18.8480 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8599	19.0122	19.2656	19.6177	19.9218	20.1096	20.1526	20.1485	20.0300	19.6445	19.2002	18.8480 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9972	0.9943	0.9862	0.9593	0.8807	0.7067	0.5096	0.5715	0.8408	0.9724	0.9944	0.9979 (94)
Ext temp.	393.8515	452.0627	501.3234	540.4670	530.1208	419.0654	287.8856	299.2491	404.3186	415.8364	383.8607	372.5226 (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	1249.5385	1207.1924	1088.5251	900.1954	688.5956	455.3048	293.5764	308.9965	492.5886	757.4977	1019.2733	1241.3061 (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	636.6311	507.4472	436.8781	259.0044	117.9052	0.0000	0.0000	0.0000	0.0000	254.1960	457.4971	646.3750 (98)
Space heating per m2	(98) / (4) =											47.1952 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	776.7968	611.5209	626.4806	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8316	0.9010	0.8722	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	646.0230	551.0033	546.4270	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	776.9995	742.4568	695.6632	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	94.3031	142.4414	111.0318	0.0000	0.0000	0.0000	0.0000 (104)
												347.7762 (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	23.5758	35.6104	27.7579	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.9441 (107)
Space cooling per m2												1.2375 (108)
Energy for space heating												47.1952 (99)
Energy for space cooling												1.2375 (108)
Total												48.4327 (109)
Target Fabric Energy Efficiency (TFEE)												55.7 (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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.2300
Infiltration rate					0.4365 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4038 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.4744	0.4442	0.4442	0.4038	0.4139	0.3937	0.3937	0.3836	0.3836	0.4139	0.4038	0.4139 (22b)
Effective ac	0.6126	0.5986	0.5986	0.5815	0.5856	0.5775	0.5775	0.5736	0.5736	0.5856	0.5815	0.5856 (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		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.3100			9.0000	740.7900 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11774.5240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3530 (36)
Total fabric heat loss (33) + (36) = 47.3609 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.9323	35.1163	35.1163	34.1121	34.3542	33.8760	33.8760	33.6458	33.6458	34.3542	34.1121	34.3542 (38)
Heat transfer coeff	83.2932	82.4772	82.4772	81.4730	81.7151	81.2369	81.2369	81.0068	81.0068	81.7151	81.4730	81.7151 (39)
Average = Sum(39)m / 12 =												81.7355 (39)
HLP	1.1855	1.1739	1.1739	1.1596	1.1630	1.1562	1.1562	1.1530	1.1530	1.1630	1.1596	1.1630 (40)
HLP (average)												1.1633 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (45)

Distribution loss (46)m = 0.15 x (45)m												
	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month												
	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
								Total per year (kWh/year) = Sum(64)m =				1703.3310 (64)
RHI water heating demand												1703 (64)
Heat gains from water heating, kWh/month												
	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)

[illegible]

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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.2300
Infiltration rate					0.4365 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4038 (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	0.5148	0.5047	0.4946	0.4442	0.4341	0.3836	0.3836	0.3735	0.4038	0.4341	0.4543	0.4744 (22b)
Effective ac	0.6325	0.6274	0.6223	0.5986	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126 (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		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.3100			9.0000	740.7900 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11774.5240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3530 (36)
Total fabric heat loss (33) + (36) = 47.3609 (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	37.1039	36.8020	36.5061	35.1163	34.8563	33.6458	33.6458	33.4217	34.1121	34.8563	35.3823	35.9323 (38)
Heat transfer coeff	84.4648	84.1629	83.8670	82.4772	82.2172	81.0068	81.0068	80.7826	81.4730	82.2172	82.7432	83.2932 (39)
Average = Sum(39)m / 12 =												82.4760 (39)
HLP	1.2022	1.1979	1.1937	1.1739	1.1702	1.1530	1.1530	1.1498	1.1596	1.1702	1.1777	1.1855 (40)
HLP (average)												1.1739 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy content	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)	Total = Sum(45)m =											1379.7836 (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	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1703.3310 (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	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			7.4900		10.6334		0.6300		0.7000		0.7700		24.3403 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			3.4300		46.7521		0.6300		0.7000		0.7700		49.0080 (78)
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972		69.1542 (83)
Total gains	593.9452	650.9206	695.9987	738.8135	765.4068	746.3898	713.1175	675.9599	640.9791	600.1096	571.4794		568.0343 (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	38.7227	38.8615	38.9987	39.6558	39.7812	40.3757	40.3757	40.4877	40.1446	39.7812	39.5283	39.2673	
alpha	3.5815	3.5908	3.5999	3.6437	3.6521	3.6917	3.6917	3.6992	3.6763	3.6521	3.6352	3.6178	
util living area	0.9734	0.9613	0.9379	0.8846	0.7846	0.6271	0.4797	0.5209	0.7319	0.8987	0.9588	0.9769	(86)
MIT	19.5142	19.6969	19.9925	20.3810	20.7049	20.9090	20.9741	20.9648	20.8322	20.4320	19.9187	19.4867	(87)
Th 2	19.9183	19.9217	19.9251	19.9409	19.9439	19.9578	19.9578	19.9604	19.9525	19.9439	19.9379	19.9316	(88)
util rest of house	0.9676	0.9530	0.9241	0.8582	0.7350	0.5458	0.3746	0.4149	0.6582	0.8700	0.9486	0.9719	(89)
MIT 2	18.5894	18.7712	19.0616	19.4439	19.7367	19.9097	19.9491	19.9475	19.8534	19.5011	19.0039	18.5727	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	18.7832	18.9651	19.2567	19.6402	19.9395	20.1191	20.1638	20.1606	20.0585	19.6962	19.1956	18.7641	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7832	18.9651	19.2567	19.6402	19.9395	20.1191	20.1638	20.1606	20.0585	19.6962	19.1956	18.7641	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	570.0994	614.3587	635.9491	627.6655	562.3939	417.3686	282.5055	294.9067	427.1578	517.2967	536.9333	548.0264	(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	1223.3189	1183.7625	1069.8626	885.8258	677.4292	447.0817	288.6933	303.7939	485.4540	747.8612	1000.8263	1213.0942	(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	485.9953	382.6394	322.8316	185.8754	85.5863	0.0000	0.0000	0.0000	0.0000	171.5400	334.0030	494.8104	(98)
Space heating												2463.2814	(98)
Space heating per m2												(98) / (4) =	35.0595 (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													2715.8560 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.9953	382.6394	322.8316	185.8754	85.5863	0.0000	0.0000	0.0000	0.0000	171.5400	334.0030	494.8104	(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)	535.8273	421.8736	355.9334	204.9343	94.3620	0.0000	0.0000	0.0000	0.0000	189.1290	368.2502	545.5462	(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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703	(64)
Efficiency of water heater (217)m	89.9555	89.8937	89.7660	89.4797	88.9634	87.9000	87.9000	87.9000	87.9000	89.3987	89.7965	87.9000	(216)
Fuel for water heating, kWh/month	189.6400	166.8353	174.4623	155.5062	152.2629	136.2303	129.4443	143.9639	144.3172	161.4727	171.7223	184.5641	(219)
Water heating fuel used												1910.4215	(219)
Annual totals kWh/year													
Space heating fuel - main system												2715.8560	(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)												319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1080 * 1.00) =										-561.3528		-561.3528	(233)
Total delivered energy for all uses												4459.8971	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2715.8560	3.4800	94.5118 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1910.4215	3.4800	66.4827 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	319.9724	13.1900	42.2044 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-561.3528	13.1900	-74.0424 (252)
Total energy cost			259.0489 (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] =	0.9440 (257)
SAP value		86.8318
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2715.8560	0.2160	586.6249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1910.4215	0.2160	412.6510 (264)
Space and water heating			999.2759 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-561.3528	0.5190	-291.3421 (269)
Total kg/year			912.9245 (272)
CO2 emissions per m2			12.9900 (273)
EI value			89.3864
EI rating			89 (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	$3.48 / 0.8907 = 3.907$, stars = 4
Water heating environmental impact	$0.216 / 0.8907 = 0.2425$, 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	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.2300
Infiltration rate					0.4365 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4038 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.4744	0.4442	0.4442	0.4038	0.4139	0.3937	0.3937	0.3836	0.3836	0.4139	0.4038	0.4139 (22b)
Effective ac	0.6126	0.5986	0.5986	0.5815	0.5856	0.5775	0.5775	0.5736	0.5736	0.5856	0.5815	0.5856 (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		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.3100			9.0000	740.7900 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11774.5240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3530 (36)
Total fabric heat loss (33) + (36) = 47.3609 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.9323	35.1163	35.1163	34.1121	34.3542	33.8760	33.8760	33.6458	33.6458	34.3542	34.1121	34.3542 (38)
Heat transfer coeff	83.2932	82.4772	82.4772	81.4730	81.7151	81.2369	81.2369	81.0068	81.0068	81.7151	81.4730	81.7151 (39)
Average = Sum(39)m / 12 =												81.7355 (39)
HLP	1.1855	1.1739	1.1739	1.1596	1.1630	1.1562	1.1562	1.1530	1.1530	1.1630	1.1596	1.1630 (40)
HLP (average)												1.1633 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (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	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1703.3310 (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	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				7.4900	13.4684	0.6300	0.7000	0.7700		30.8298 (74)		
East				1.3200	25.1733	0.6300	0.7000	0.7700		10.1551 (76)		
South				3.4300	56.5862	0.6300	0.7000	0.7700		59.3166 (78)		

Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253 (83)
Total gains	612.9754	658.6838	712.9574	765.6261	777.5898	797.5198	746.7709	717.5652	672.6683	622.7072	594.1489	579.6055 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.2673	39.6558	39.6558	40.1446	40.0257	40.2613	40.2613	40.3757	40.3757	40.0257	40.1446	40.0257	
alpha	3.6178	3.6437	3.6437	3.6763	3.6684	3.6841	3.6841	3.6917	3.6917	3.6684	3.6763	3.6684	
util living area	0.9627	0.9503	0.9174	0.8403	0.7075	0.4960	0.3537	0.3558	0.6135	0.8422	0.9362	0.9671	(86)
MIT	19.7587	19.9015	20.1892	20.5586	20.8281	20.9662	20.9928	20.9930	20.9260	20.6345	20.1811	19.7571	(87)
Th 2	19.9316	19.9409	19.9409	19.9525	19.9497	19.9552	19.9552	19.9578	19.9578	19.9497	19.9525	19.9497	(88)
util rest of house	0.9543	0.9393	0.8988	0.8043	0.6428	0.4036	0.2443	0.2426	0.5201	0.7973	0.9196	0.9596	(89)
MIT 2	18.8406	18.9865	19.2633	19.6154	19.8418	19.9415	19.9538	19.9565	19.9229	19.6884	19.2697	18.8536	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	19.0329	19.1782	19.4572	19.8130	20.0485	20.1562	20.1715	20.1737	20.1330	19.8867	19.4607	19.0429	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0329	19.1782	19.4572	19.8130	20.0485	20.1562	20.1715	20.1737	20.1330	19.8867	19.4607	19.0429	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9453	0.9296	0.8887	0.7989	0.6494	0.4220	0.2673	0.2664	0.5368	0.7942	0.9101	0.9513	(94)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1118.8709	1086.8983	977.9524	791.3486	567.7938	345.7611	200.7732	192.2826	383.4079	636.2869	884.8498	1090.3177	(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	401.3137	318.9218	256.2063	129.3494	46.7297	0.0000	0.0000	0.0000	0.0000	105.4556	247.7803	400.9594	(98)
Space heating												1906.7161	(98)
Space heating per m2												27.1380	(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												2102.2228	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	401.3137	318.9218	256.2063	129.3494	46.7297	0.0000	0.0000	0.0000	0.0000	105.4556	247.7803	400.9594	(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)	442.4627	351.6227	282.4766	142.6124	51.5212	0.0000	0.0000	0.0000	0.0000	116.2685	273.1867	442.0721	(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	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703	(64)
Efficiency of water heater (217)m	89.8463	89.7852	89.6170	89.2270	88.6016	87.9000	87.9000	87.9000	87.9000	89.0606	89.6051	87.9000	(216)
Fuel for water heating, kWh/month	189.8704	167.0369	174.7522	155.9467	152.8847	136.2303	129.4443	143.9639	144.3172	162.0856	172.0892	184.8067	(219)
Water heating fuel used												1913.4281	(219)
Annual totals kWh/year													
Space heating fuel - main system												2102.2228	(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)												319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1206 * 1.00) =										-627.1253		-627.1253	(233)
Total delivered energy for all uses												3783.4979	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2102.2228	3.6300	76.3107 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.4281	3.6300	69.4574 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	319.9724	19.4400	62.2026 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-627.1253	19.4400	-121.9132 (252)
Total energy cost			195.6376 (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	2102.2228	0.2160	454.0801 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.4281	0.2160	413.3005 (264)
Space and water heating			867.3806 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-627.1253	0.5190	-325.4780 (269)
Total kg/year			746.8932 (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	2102.2228	1.2200	2564.7118 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.4281	1.2200	2334.3822 (264)
Space and water heating			4899.0940 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	319.9724	3.0700	982.3153 (268)
Energy saving/generation technologies			
PV Unit	-627.1253	3.0700	-1925.2747 (269)
Primary energy kWh/year			4186.3846 (272)
Primary energy kWh/m2/year			59.5842 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 25	-182 kg (24.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£25	2.60 kg/m²	B 88
Total Savings	£25	2.60 kg/m²	B 91

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 491 TEST (28 Feb 2022)
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	£77	£87	-£10
Mains gas	£241	£206	£35
Space heating	£186	£186	£0
Water heating	£69	£44	£25
Lighting	£62	£62	£0
Generated (PV)	-£122	-£122	£0
Total cost of fuels	£196	£171	£25
Total cost of uses	£195	£170	£25
Delivered energy	54 kWh/m²	41 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	60 kWh/m²	45 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (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) = 0.2250 (8)
Pressure test					Yes
Measured/design AP50					4.2300
Infiltration rate					0.4365 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4038 (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	0.5148	0.5047	0.4946	0.4442	0.4341	0.3836	0.3836	0.3735	0.4038	0.4341	0.4543	0.4744 (22b)
Effective ac	0.6325	0.6274	0.6223	0.5986	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126 (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		(26)
Windows (Uw = 1.20)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200 (28a)
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210 (29a)
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830 (30)
Total net area of external elements Aum(A, m ²)			155.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079		(33)
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000 (32)
GF Stud			58.6700			9.0000	528.0300 (32c)
First Floor			82.3100			9.0000	740.7900 (32c)
Internal Floor 1			35.1300			18.0000	632.3400 (32d)
Internal Ceiling 1			35.1300			18.0000	632.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11774.5240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 167.5850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3530 (36)
Total fabric heat loss (33) + (36) = 47.3609 (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	37.1039	36.8020	36.5061	35.1163	34.8563	33.6458	33.6458	33.4217	34.1121	34.8563	35.3823	35.9323 (38)
Heat transfer coeff	84.4648	84.1629	83.8670	82.4772	82.2172	81.0068	81.0068	80.7826	81.4730	82.2172	82.7432	83.2932 (39)
Average = Sum(39)m / 12 =												82.4760 (39)
HLP	1.2022	1.1979	1.1937	1.1739	1.1702	1.1530	1.1530	1.1498	1.1596	1.1702	1.1777	1.1855 (40)
HLP (average)												1.1739 (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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4645	92.9567	89.4489	85.9411	82.4333	78.9255	78.9255	82.4333	85.9411	89.4489	92.9567	96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (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	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (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												1.3144 (H8)
Utilisation factor												0.5327 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6950 (H14)
Volume ratio Veff/V												0.8552 (H15)
Solar storage volume factor												0.9687 (H16)
Solar input	-23.8634	-39.8211	-67.8200	-90.8921	-112.2895	-110.3985	-108.9395	-95.1810	-74.5458	-50.9060	-28.3054	-822.9321 (H17)
Solar input (sum of months) = Sum (63)m =												-822.9321 (63)
Output from w/h	146.7282	110.1533	88.7878	48.2545	23.1687	9.3479	4.8420	31.3633	52.3090	93.4484	125.8952	146.1008 (64)
Total per year (kWh/year) = Sum (64)m =												880.3989 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (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	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)				
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)				
South				3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)				
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)
Total gains	593.9452	650.9206	695.9987	738.8135	765.4068	746.3898	713.1175	675.9599	640.9791	600.1096	571.4794	568.0343	(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	38.7227	38.8615	38.9987	39.6558	39.7812	40.3757	40.3757	40.4877	40.1446	39.7812	39.5283	39.2673	
alpha	3.5815	3.5908	3.5999	3.6437	3.6521	3.6917	3.6917	3.6992	3.6763	3.6521	3.6352	3.6178	
util living area	0.9734	0.9613	0.9379	0.8846	0.7846	0.6271	0.4797	0.5209	0.7319	0.8987	0.9588	0.9769	(86)
MIT	19.5142	19.6969	19.9925	20.3810	20.7049	20.9090	20.9741	20.9648	20.8322	20.4320	19.9187	19.4867	(87)
Th 2	19.9183	19.9217	19.9251	19.9409	19.9439	19.9578	19.9578	19.9604	19.9525	19.9439	19.9379	19.9316	(88)
util rest of house	0.9676	0.9530	0.9241	0.8582	0.7350	0.5458	0.3746	0.4149	0.6582	0.8700	0.9486	0.9719	(89)
MIT 2	18.5894	18.7712	19.0616	19.4439	19.7367	19.9097	19.9491	19.9475	19.8534	19.5011	19.0039	18.5727	(90)
Living area fraction									fLA = Living area / (4) =			0.2095	(91)
MIT	18.7832	18.9651	19.2567	19.6402	19.9395	20.1191	20.1638	20.1606	20.0585	19.6962	19.1956	18.7641	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7832	18.9651	19.2567	19.6402	19.9395	20.1191	20.1638	20.1606	20.0585	19.6962	19.1956	18.7641	(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	0.9599	0.9438	0.9137	0.8496	0.7348	0.5592	0.3962	0.4363	0.6664	0.8620	0.9395	0.9648	(94)
Useful gains	570.0994	614.3587	635.9491	627.6655	562.3939	417.3686	282.5055	294.9067	427.1578	517.2967	536.9333	548.0264	(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	1223.3189	1183.7625	1069.8626	885.8258	677.4292	447.0817	288.6933	303.7939	485.4540	747.8612	1000.8263	1213.0942	(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	485.9953	382.6394	322.8316	185.8754	85.5863	0.0000	0.0000	0.0000	0.0000	171.5400	334.0030	494.8104	(98)
Space heating												2463.2814	(98)
Space heating per m2												35.0595	(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													2715.8560	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	485.9953	382.6394	322.8316	185.8754	85.5863	0.0000	0.0000	0.0000	0.0000	171.5400	334.0030	494.8104	(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)	535.8273	421.8736	355.9334	204.9343	94.3620	0.0000	0.0000	0.0000	0.0000	189.1290	368.2502	545.5462	(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	146.7282	110.1533	88.7878	48.2545	23.1687	9.3479	4.8420	31.3633	52.3090	93.4484	125.8952	146.1008	(64)	
Efficiency of water heater	90.0349	90.0587	90.0810	90.1084	90.0886	87.9000	87.9000	87.9000	87.9000	89.6924	89.9159	90.0461	(217)	
Fuel for water heating, kWh/month	162.9681	122.3127	98.5644	53.5515	25.7176	10.6347	5.5085	35.6806	59.5096	104.1876	140.0144	162.2510	(219)	
Water heating fuel used												980.9008	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2715.8560	(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)													319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.65 * 1080 * 1.00) =										-561.3528		-561.3528	(233)	
Total delivered energy for all uses													3580.3765	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2715.8560	3.4800	94.5118	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	980.9008	3.4800	34.1353	(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	319.9724	13.1900	42.2044	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-561.3528	13.1900	-74.0424	(252)
Total energy cost			233.2966	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.8501	(257)
SAP value			88.1409	
SAP rating (Section 12)			88	(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	2715.8560	0.2160	586.6249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	980.9008	0.2160	211.8746 (264)
Space and water heating			798.4995 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	319.9724	0.5190	166.0657 (268)
Energy saving/generation technologies			
PV Unit	-561.3528	0.5190	-291.3421 (269)
Total kg/year			738.0981 (272)
CO2 emissions per m2			10.5100 (273)
EI value			91.4190
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.1300 (1b)	x 2.3900 (2b)	= 83.9607 (1b) - (3b)
First floor	35.1300 (1c)	x 2.6700 (2c)	= 93.7971 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.7578 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
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) =	0.2250 (8)
Pressure test											Yes	
Measured/design AP50											4.2300	
Infiltration rate											0.4365	(18)
Number of sides sheltered											1	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.4038 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.4744	0.4442	0.4442	0.4038	0.4139	0.3937	0.3937	0.3836	0.3836	0.4139	0.4038	0.4139 (22b)
Effective ac	0.6126	0.5986	0.5986	0.5815	0.5856	0.5775	0.5775	0.5736	0.5736	0.5856	0.5815	0.5856 (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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			12.2400	1.1450	14.0153			(27)					
Ground Floor			35.1300	0.1200	4.2156	84.0000	2950.9200	(28a)					
Brick and Block	84.9100	14.3600	70.5500	0.2400	16.9320	42.2200	2978.6210	(29a)					
Pitched Roof	35.1300		35.1300	0.1000	3.5130	9.1000	319.6830	(30)					
Total net area of external elements Aum(A, m2)			155.1700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0079			(33)					
Party Wall 1			42.7400	0.0000	0.0000	70.0000	2991.8000	(32)					
GF Stud			58.6700			9.0000	528.0300	(32c)					
First Floor			82.3100			9.0000	740.7900	(32c)					
Internal Floor 1			35.1300			18.0000	632.3400	(32d)					
Internal Ceiling 1			35.1300			18.0000	632.3400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11774.5240	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							167.5850	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3530	(36)					
Total fabric heat loss						(33) + (36) =	47.3609	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.9323	Feb 35.1163	Mar 35.1163	Apr 34.1121	May 34.3542	Jun 33.8760	Jul 33.8760	Aug 33.6458	Sep 33.6458	Oct 34.3542	Nov 34.1121	Dec 34.3542	(38)
Heat transfer coeff	83.2932	82.4772	82.4772	81.4730	81.7151	81.2369	81.2369	81.0068	81.0068	81.7151	81.4730	81.7151	(39)
Average = Sum(39)m / 12 =												81.7355	(39)
HLP	Jan 1.1855	Feb 1.1739	Mar 1.1739	Apr 1.1596	May 1.1630	Jun 1.1562	Jul 1.1562	Aug 1.1530	Sep 1.1530	Oct 1.1630	Nov 1.1596	Dec 1.1630	(40)
HLP (average)												1.1633	(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												2.2524 (42)
Average daily hot water use (litres/day)												87.6950 (43)
Daily hot water use	Jan 96.4645	Feb 92.9567	Mar 89.4489	Apr 85.9411	May 82.4333	Jun 78.9255	Jul 78.9255	Aug 82.4333	Sep 85.9411	Oct 89.4489	Nov 92.9567	Dec 96.4645 (44)
Energy conte	143.0540	125.1160	129.1085	112.5599	108.0039	93.1992	86.3627	99.1025	100.2861	116.8738	127.5769	138.5402 (45)
Energy content (annual)										Total = Sum(45)m =		1379.7836 (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	21.4581	18.7674	19.3663	16.8840	16.2006	13.9799	12.9544	14.8654	15.0429	17.5311	19.1365	20.7810 (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	27.5375	24.8584	27.4993	26.5866	27.4543	26.5472	27.4188	27.4418	26.5687	27.4807	26.6238	27.5301 (61)
Total heat required for water heating calculated for each month	170.5916	149.9744	156.6078	139.1466	135.4582	119.7464	113.7815	126.5443	126.8548	144.3544	154.2007	166.0703 (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												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4684 (H8)
Utilisation factor												0.4939 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6950 (H14)
Volume ratio Veff/V												0.8552 (H15)
Solar storage volume factor												0.9687 (H16)
Solar input	-27.8138	-39.5544	-68.6370	-92.3284	-107.2918	-116.7024	-110.6517	-100.9036	-78.9770	-54.5861	-32.8974	-852.3671 (H17)
Solar input (sum of months) = Sum (63)m =												-852.3671 (63)
Output from w/h	142.7778	110.4200	87.9707	46.8182	28.1664	3.0440	3.1299	25.6407	47.8778	89.7683	121.3032	144.0469 (64)
Total per year (kWh/year) = Sum (64)m =												850.9639 (64)
Heat gains from water heating, kWh/month	54.4499	47.8157	49.8034	44.0728	42.7749	37.6255	35.5703	39.8120	39.9873	45.7307	49.0753	52.9472 (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	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	135.1452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2954	40.2310	32.7180	24.7697	18.5156	15.6317	16.8906	21.9550	29.4679	37.4163	43.6704	46.5543	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3778	298.4429	290.7190	274.2756	253.5188	234.0103	220.9775	217.9124	225.6363	242.0797	262.8365	282.3449	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	50.7669	(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)	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	-90.0968	(71)
Water heating gains (Table 5)	73.1853	71.1543	66.9400	61.2123	57.4931	52.2577	47.8096	53.5108	55.5379	61.4660	68.1601	71.1655	(72)
Total internal gains	512.6738	508.6435	489.1924	459.0729	428.3429	400.7150	384.4929	392.1935	409.4575	439.7773	473.4823	498.8801	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.4900	13.4684	0.6300	0.7000	0.7700	30.8298 (74)			
East				1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)			
South				3.4300	56.5862	0.6300	0.7000	0.7700	59.3166 (78)			
Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253 (83)
Total gains	612.9754	658.6838	712.9574	765.6261	777.5898	797.5198	746.7709	717.5652	672.6683	622.7072	594.1489	579.6055 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.2673	39.6558	39.6558	40.1446	40.0257	40.2613	40.2613	40.3757	40.3757	40.0257	40.1446	40.0257
alpha	3.6178	3.6437	3.6437	3.6763	3.6684	3.6841	3.6841	3.6917	3.6917	3.6684	3.6763	3.6684
util living area	0.9627	0.9503	0.9174	0.8403	0.7075	0.4960	0.3537	0.3558	0.6135	0.8422	0.9362	0.9671 (86)
MIT	19.7587	19.9015	20.1892	20.5586	20.8281	20.9662	20.9928	20.9930	20.9260	20.6345	20.1811	19.7571 (87)
Th 2	19.9316	19.9409	19.9409	19.9525	19.9497	19.9552	19.9552	19.9578	19.9578	19.9497	19.9525	19.9497 (88)
util rest of house	0.9543	0.9393	0.8988	0.8043	0.6428	0.4036	0.2443	0.2426	0.5201	0.7973	0.9196	0.9596 (89)
MIT 2	18.8406	18.9865	19.2633	19.6154	19.8418	19.9415	19.9538	19.9565	19.9229	19.6884	19.2697	18.8536 (90)
Living area fraction										fLA = Living area / (4) =		0.2095 (91)
MIT	19.0329	19.1782	19.4572	19.8130	20.0485	20.1562	20.1715	20.1737	20.1330	19.8867	19.4607	19.0429 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0329	19.1782	19.4572	19.8130	20.0485	20.1562	20.1715	20.1737	20.1330	19.8867	19.4607	19.0429 (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	0.9453	0.9296	0.8887	0.7989	0.6494	0.4220	0.2673	0.2664	0.5368	0.7942	0.9101	0.9513	(94)
Useful gains	579.4709	612.3124	633.5891	611.6965	504.9850	336.5673	199.6092	191.1912	361.1188	494.5455	540.7105	551.3938	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1118.8709	1086.8983	977.9524	791.3486	567.7938	345.7611	200.7732	192.2826	383.4079	636.2869	884.8498	1090.3177	(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	401.3137	318.9218	256.2063	129.3494	46.7297	0.0000	0.0000	0.0000	0.0000	105.4556	247.7803	400.9594	(98)
Space heating												1906.7161	(98)
Space heating per m2												27.1380	(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													2102.2228	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	401.3137	318.9218	256.2063	129.3494	46.7297	0.0000	0.0000	0.0000	0.0000	105.4556	247.7803	400.9594	(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)	442.4627	351.6227	282.4766	142.6124	51.5212	0.0000	0.0000	0.0000	0.0000	116.2685	273.1867	442.0721	(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	142.7778	110.4200	87.9707	46.8182	28.1664	3.0440	3.1299	25.6407	47.8778	89.7683	121.3032	144.0469	(64)	
Efficiency of water heater	89.9481	89.9630	89.9675	89.9386	89.6263	87.9000	87.9000	87.9000	87.9000	89.3907	89.7603	89.9428	(217)	
Fuel for water heating, kWh/month	158.7335	122.7394	97.7806	52.0557	31.4264	3.4631	3.5607	29.1703	54.4685	100.4225	135.1413	160.1540	(219)	
Water heating fuel used												949.1160	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2102.2228	(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)													319.9724	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.65 * 1206 * 1.00) =										-627.1253		-627.1253	(233)	
Total delivered energy for all uses												2869.1859	(238)	

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2102.2228	3.6300	76.3107	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.1160	3.6300	34.4529	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	319.9724	19.4400	62.2026	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-627.1253	19.4400	-121.9132	(252)
Total energy cost			170.3531	(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	2102.2228	0.2160	454.0801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	949.1160	0.2160	205.0091	(264)
Space and water heating			659.0892	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	319.9724	0.5190	166.0657	(268)
Energy saving/generation technologies				
PV Unit	-627.1253	0.5190	-325.4780	(269)
Total kg/year			564.5518	(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	2102.2228	1.2200	2564.7118	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	949.1160	1.2200	1157.9215	(264)
Space and water heating			3722.6333	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	319.9724	3.0700	982.3153	(268)
Energy saving/generation technologies				
PV Unit	-627.1253	3.0700	-1925.2747	(269)
Primary energy kWh/year			3163.4239	(272)
Primary energy kWh/m2/year			45.0245	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 90	Issued on Date	02/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Project	33 Shaw Road, West End, Southampton, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.90	TER	19.71
Environmental	89 B	% DER<TER	24.39		
CO ₂ Emissions (t/year)	0.75	DFEE	45.23	TREE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	18.80		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.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 (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 11.200 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 90	Issued on Date	02/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Project	33 Shaw Road, West End, Southampton, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.90	TER	19.71
Environmental	89 B	% DER<TER	24.39		
CO ₂ Emissions (t/year)	0.75	DFEE	45.23	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	18.80		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000001

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 0647 Plot 90	Issued on Date	02/03/2022
Assessment Reference	As Built	Prop Type Ref	O (H/A - S/O+)
Project	33 Shaw Road, West End, Southampton, SO30 3JZ		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	14.90	TER	19.71
Environmental	89 B	% DER<TER	24.39		
CO ₂ Emissions (t/year)	0.75	DFEE	45.23	TFEE	55.70
General Requirements Compliance	Pass	% DFEE<TFEE	18.80		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

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	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 90	Issued on Date	02/03/2022
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Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	16.78 m	35.13 m ²	2.39 m
	1st Storey:	16.78 m	35.13 m ²	2.67 m

7.0 Living Area	14.72	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	167.59	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	84.91	70.55

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 on both sides, dense blocks, cavity or cavity fill	0.00	70.00	42.74

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
GF Stud	Plasterboard on timber frame		9.00	58.67
First Floor	Plasterboard on timber frame		9.00	82.31

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	Other	0.10	9.10	35.13	35.13

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	35.13

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	0.12	84.00	35.13

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.13

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	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					3.43	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.49	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.26	0.098	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.76	0.053	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.60	0.043	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.060	No	Birtley Supatherm
Independently assessed	E3 Sill	7.61	0.034	No	CD0027
Independently assessed	E4 Jamb	27.30	0.039	No	CD0028
Independently assessed	E5 Ground floor (normal)	16.78	0.037	No	Knauf P7
Independently assessed	E6 Intermediate floor within a dwelling	16.78	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	8.41	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.46	0.054	No	CD0031
Independently assessed	E16 Corner (normal)	10.10	0.050	No	CD0035
Table K1 - Approved	E18 Party wall between dwellings	10.10	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	8.46	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.46	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.46	0.049	No	CD0020

Y-value	0.041	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	
As Built AP ₅₀	4.23	m ³ /(h.m ²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				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	17	
Total number of L.E.L. fittings	17	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1		Database	
Description		Gas Combi	
Percentage of Heat		100	%
Database Ref. No.		17515	
Fuel Type		Mains gas	
Main Heating		BGW	
SAP Code		104	
In Winter		90.7	
In Summer		87.9	
Controls		CBE Programmer, room thermostat and TRVs	
PCDF Controls		0	
Delayed Start Stat		No	
Sap Code		2106	
Flue Type		Balanced	
Fan Assisted Flue		Yes	
Is MHS Pumped		Pump in heated space	
Heat Emitter		Radiators	
Flow Temperature		Normal (> 45°C)	
Combi boiler type		Standard Combi	
Combi keep hot type		Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£25	B 88	