



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 4 Robert Place
West End, Southampton, SO30 3JY

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

Report Issue Date: 02/08/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 20				Issued on Date	02/08/2022
Assessment Reference	As Built	Prop Type Ref	Fh			
Property	4 Robert Place, West End, Southampton, SO30 3JY					
SAP Rating	89 B	DER	12.51	TER	16.06	
Environmental	88 B	% DER<TER	22.08			
CO ₂ Emissions (t/year)	1.44	DFEE	45.94	TFEE	58.24	
General Requirements Compliance	Pass	% DFEE<TFEE	21.11			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.06	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.51	kgCO ₂ /m ²	Pass
	-3.55 (-22.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.24	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.94	kWh/m ² /yr	
	-12.3 (-21.1%)	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	3.98 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 18 S NG

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.33

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

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

16.84 m², No overhang

Windows facing East

0.96 m², No overhang

Windows facing South

9.54 m², Overhang twice as wide as window, ratio 1.16

Windows facing West

2.17 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

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.016	W/m ² K
Air permeability	4.0	m ³ /m ² h
Photovoltaic array	0.97	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 20	Issued on Date	02/08/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Property	4 Robert Place, West End, Southampton, SO30 3JY		
SAP Rating	89 B	DER	12.51
Environmental	88 B	TER	16.06
CO ₂ Emissions (t/year)	1.44	% DER<TER	22.08
General Requirements Compliance	Pass	DFEE	45.94
		TFEE	58.24
		% DFEE<TFEE	21.11
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	2.52	0.19	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	9.15	0.64	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.54	0.23	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	5.54	0.31	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	15.21	0.32	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	50.10	0.80	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.022	40.57	0.89	Knauf P10
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	40.57	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	25.68	1.54	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	15.01	0.66	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	30.30	1.18	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	10.10	-0.92	Knauf P24

Total: **5.92** W/mK:
Y-Value: **0.016** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	88 B	% DER<TER	22.08		
CO ₂ Emissions (t/year)	1.44	DFEE	45.94	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	21.11		
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 156 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) 16.06 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.51 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (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: 3.98 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 18 S NG

Efficiency: 89.5% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.33 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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: 16.84 m², No overhang
Windows facing East: 0.96 m², No overhang
Windows facing South: 9.54 m², Overhang twice as wide as window, ratio 1.16
Windows facing West: 2.17 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
Thermal bridging y-value 0.016 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 0.97 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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1265 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3255 (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) =	0.3011 (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	0.3839	0.3764	0.3689	0.3312	0.3237	0.2861	0.2861	0.2785	0.3011	0.3237	0.3388	0.3538 (22b)
Effective ac	0.5737	0.5708	0.5680	0.5549	0.5524	0.5409	0.5409	0.5388	0.5453	0.5524	0.5574	0.5626 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030 (29a)
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190 (30)
Total net area of external elements Aum(A, m ²)			361.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			27.3300			9.0000	245.9700 (32c)
FF Stud			176.9400			9.0000	1592.4600 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.0900			18.0000	1405.6200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24967.2520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 159.8620 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9204 (36)
Total fabric heat loss (33) + (36) = 100.9223 (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	74.8077	74.4345	74.0687	72.3506	72.0292	70.5327	70.5327	70.2556	71.1091	72.0292	72.6795	73.3593 (38)
Heat transfer coeff	175.7300	175.3568	174.9910	173.2729	172.9515	171.4550	171.4550	171.1779	172.0314	172.9515	173.6018	174.2816 (39)
Average = Sum(39)m / 12 =												173.2714 (39)
HLP	1.1252	1.1228	1.1204	1.1094	1.1074	1.0978	1.0978	1.0960	1.1015	1.1074	1.1115	1.1159 (40)
HLP (average)												1.1094 (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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5179	110.3536	106.1893	102.0250	97.8607	93.6965	93.6965	97.8607	102.0250	106.1893	110.3536	114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (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	25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179	24.6702 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0493 195.7003 205.4938 184.1636 180.4395 161.1795 154.7482 169.8722 169.5927 190.9694 201.9910 216.6907 (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	222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907 (64)
Total per year (kWh/year) = Sum(64)m =												2252.8903 (64)
Heat gains from water heating, kWh/month												
98.2455 87.1218 92.7408 84.8609 84.4102 77.2187 75.8678 80.8966 80.0161 87.9114 90.7885 96.4637 (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	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
29.5759 26.2691 21.3634 16.1735 12.0899 10.2068 11.0288 14.3356 19.2413 24.4312 28.5148 30.3979 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
327.1676 330.5625 322.0073 303.7942 280.8035 259.1955 244.7600 241.3650 249.9202 268.1333 291.1240 312.7321 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 37.7173 (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)												
-117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 (71)												
Water heating gains (Table 5)												
132.0504 129.6455 124.6516 117.8624 113.4546 107.2482 101.9729 108.7320 111.1335 118.1605 126.0952 129.6556 (72)												
Total internal gains	558.9457	556.6290	538.1742	507.9820	476.4999	446.8023	427.9135	434.5845	450.4468	480.8768	515.8859	542.9374 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	16.8400	10.6334	0.6300	0.7000	0.7700	54.7250 (74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622 (76)
South	9.5400	46.7521	0.6300	0.7000	0.7700	136.3079 (78)
West	2.1700	19.6403	0.6300	0.7000	0.7700	13.0250 (80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	768.7659	921.2003	1060.7747	1203.0971	1304.1191	1291.4988	1232.5835	1135.8861	1031.5584	889.7598	768.3931	721.7912 (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	39.4659	39.5499	39.6326	40.0256	40.1000	40.4499	40.4499	40.5154	40.3144	40.1000	39.9498	39.7939
alpha	3.6311	3.6367	3.6422	3.6684	3.6733	3.6967	3.6967	3.7010	3.6876	3.6733	3.6633	3.6529
util living area	0.9943	0.9885	0.9753	0.9400	0.8598	0.7188	0.5691	0.6265	0.8381	0.9604	0.9896	0.9955 (86)
MIT	19.1630	19.3801	19.7265	20.1793	20.5858	20.8560	20.9549	20.9354	20.7254	20.1972	19.5963	19.1255 (87)
Th 2	19.9803	19.9823	19.9842	19.9931	19.9948	20.0026	20.0026	20.0041	19.9996	19.9948	19.9914	19.9879 (88)
util rest of house	0.9930	0.9858	0.9693	0.9245	0.8218	0.6421	0.4571	0.5157	0.7802	0.9473	0.9868	0.9944 (89)
MIT 2	17.5107	17.8280	18.3317	18.9850	19.5429	19.8815	19.9777	19.9651	19.7376	19.0210	18.1506	17.4606 (90)
Living area fraction									fLA = Living area / (4) =			0.1800 (91)
MIT	17.8082	18.1075	18.5828	19.2000	19.7307	20.0569	20.1537	20.1398	19.9155	19.2328	18.4109	17.7604 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8082	18.1075	18.5828	19.2000	19.7307	20.0569	20.1537	20.1398	19.9155	19.2328	18.4109	17.7604 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9887	0.9786	0.9579	0.9088	0.8101	0.6467	0.4751	0.5320	0.7745	0.9338	0.9802	0.9908 (94)
Ext temp.	760.0514	901.5152	1016.0955	1093.4189	1056.4081	835.2232	585.6489	604.2913	798.9040	830.8156	753.1599	715.1809 (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	2373.7948	2316.0240	2114.3810	1784.7153	1388.9179	935.6202	609.2934	640.1702	1000.4416	1493.0478	1963.5927	2363.3232 (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	1200.6251	950.5499	817.1244	497.7334	247.3873	0.0000	0.0000	0.0000	0.0000	492.7007	871.5116	1226.2179 (98)
Space heating per m2												6303.8503 (98)
												(98) / (4) = 40.3627 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)																0.0000 (201)
Fraction of space heat from main system(s)																1.0000 (202)
Efficiency of main space heating system 1 (in %)																90.5000 (206)
Efficiency of secondary/supplementary heating system, %																0.0000 (208)
Space heating requirement																6965.5804 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Space heating requirement	1200.6251	950.5499	817.1244	497.7334	247.3873	0.0000	0.0000	0.0000	0.0000	492.7007	871.5116	1226.2179	(98)			
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)			
Space heating fuel (main heating system)	1326.6575	1050.3314	902.8999	549.9817	273.3561	0.0000	0.0000	0.0000	0.0000	544.4207	962.9962	1354.9369	(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	222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907	(64)			
Efficiency of water heater (217)m	88.6449	88.4746	88.1255	87.3372	85.6560	79.8000	79.8000	79.8000	79.8000	87.2328	88.2729	88.7136	(216)			
Fuel for water heating, kWh/month	250.4932	221.1938	233.1831	210.8649	210.6560	201.9793	193.9200	212.8724	212.5222	218.9193	228.8255	244.2587	(219)			
Water heating fuel used												2639.6885	(219)			
Annual totals kWh/year																
Space heating fuel - main system												6965.5804	(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)												522.3196	(232)			
Energy saving/generation technologies (Appendices M ,N and Q)																
PV Unit 0 (0.80 + 0.97 + 1068 + 1.00) =										-828.8227		-828.8227	(233)			
Total delivered energy for all uses												9373.7658	(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	6965.5804	0.2160	1504.5654 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2639.6885	0.2160	570.1727 (264)
Space and water heating			2074.7381 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.3196	0.5190	271.0839 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total CO2, kg/year			1954.5880 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5100 (273)

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

DER		12.5100	ZC1
Total Floor Area		156.1800	
Assumed number of occupants		2.9435	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		12.4134	ZC2
CO2 emissions from cooking, equation (L16)		1.2143	ZC3
Total CO2 emissions		26.1377	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		26.1377	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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
														Air changes per hour			
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000	/ (5) =	0.1012 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3512 (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) =	0.3249 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.4142	0.4061	0.3980	0.3574	0.3493	0.3086	0.3086	0.3005	0.3249	0.3493	0.3655	0.3817 (22b)					
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729 (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)			29.5100	1.3258	39.1231		(27)					
Ground Floor			78.2900	0.1300	10.1777		(28a)					
Brick and Block	205.2800	31.6300	173.6500	0.1800	31.2570		(29a)					
Pitched Roof	78.0900		78.0900	0.1300	10.1517		(30)					
Total net area of external elements Aum(A, m2)			361.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.8295		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1041 (36)					
Total fabric heat loss						(33) + (36) =	107.9336 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 76.3845	Feb 75.9501	Mar 75.5243	Apr 73.5243	May 73.1501	Jun 71.4081	Jul 71.4081	Aug 71.0855	Sep 72.0791	Oct 73.1501	Nov 73.9071	Dec 74.6985 (38)
Heat transfer coeff	184.3181	183.8837	183.4579	181.4579	181.0837	179.3417	179.3417	179.0192	180.0127	181.0837	181.8407	182.6321 (39)
Average = Sum(39)m / 12 =												181.4561 (39)
HLP	Jan 1.1802	Feb 1.1774	Mar 1.1747	Apr 1.1619	May 1.1595	Jun 1.1483	Jul 1.1483	Aug 1.1462	Sep 1.1526	Oct 1.1595	Nov 1.1643	Dec 1.1694 (40)
HLP (average)												1.1618 (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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
Daily hot water use	Jan 114.5179	Feb 110.3536	Mar 106.1893	Apr 102.0250	May 97.8607	Jun 93.6965	Jul 93.6965	Aug 97.8607	Sep 102.0250	Oct 106.1893	Nov 110.3536	Dec 114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179		24.6702 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7258 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.9319 (55)
Total storage loss	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (56)
If cylinder contains dedicated solar storage	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.9787	195.6365	205.4232	184.0952	180.3689	161.1111	154.6775	169.8016	169.5243	190.8987	201.9226	216.6201 (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	221.9787	195.6365	205.4232	184.0952	180.3689	161.1111	154.6775	169.8016	169.5243	190.8987	201.9226	216.6201 (64)
Heat gains from water heating, kWh/month	98.1889	87.0707	92.6843	84.8062	84.3537	77.1640	75.8113	80.8401	79.9614	87.8549	90.7338	96.4072 (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
(66)m	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5759	26.2691	21.3634	16.1735	12.0899	10.2068	11.0288	14.3356	19.2413	24.4312	28.5148	30.3979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.1676	330.5625	322.0073	303.7942	280.8035	259.1955	244.7600	241.3650	249.9202	268.1333	291.1240	312.7321	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	(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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	(71)
Water heating gains (Table 5)	131.9744	129.5695	124.5756	117.7864	113.3786	107.1722	101.8969	108.6560	111.0575	118.0845	126.0192	129.5796	(72)
Total internal gains	558.8697	556.5530	538.0982	507.9060	476.4239	446.7264	427.8376	434.5085	450.3709	480.8009	515.8099	542.8614	(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					16.8400	10.6334	0.6300	0.7000	0.7700		54.7250 (74)	
East					0.9600	19.6403	0.6300	0.7000	0.7700		5.7622 (76)	
South					9.5400	46.7521	0.6300	0.7000	0.7700		136.3079 (78)	
West					2.1700	19.6403	0.6300	0.7000	0.7700		13.0250 (80)	
Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	768.6899	921.1244	1060.6988	1203.0212	1304.0431	1291.4228	1232.5076	1135.8102	1031.4825	889.6839	768.3171	721.7152 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.8430	58.9820	59.1189	59.7705	59.8940	60.4758	60.4758	60.5848	60.2504	59.8940	59.6447	59.3862
alpha	4.9229	4.9321	4.9413	4.9847	4.9929	5.0317	5.0317	5.0390	5.0167	4.9929	4.9763	4.9591
util living area	0.9992	0.9978	0.9936	0.9768	0.9197	0.7815	0.6140	0.6790	0.9008	0.9874	0.9981	0.9994 (86)
MIT	19.6185	19.7785	20.0384	20.3877	20.7090	20.9166	20.9806	20.9685	20.8119	20.3968	19.9440	19.5937 (87)
Th 2	19.9359	19.9381	19.9403	19.9506	19.9526	19.9616	19.9616	19.9633	19.9581	19.9526	19.9487	19.9446 (88)
util rest of house	0.9989	0.9970	0.9911	0.9671	0.8844	0.6927	0.4822	0.5477	0.8429	0.9805	0.9973	0.9992 (89)
MIT 2	18.0841	18.3196	18.7001	19.2109	19.6527	19.9026	19.9541	19.9494	19.7951	19.2305	18.5694	18.0539 (90)
Living area fraction									fLA =	Living area / (4) =		
MIT	18.3603	18.5823	18.9411	19.4227	19.8429	20.0851	20.1389	20.1329	19.9782	19.4405	18.8169	18.3311 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3603	18.5823	18.9411	19.4227	19.8429	20.0851	20.1389	20.1329	19.9782	19.4405	18.8169	18.3311 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9955	0.9877	0.9605	0.8799	0.7045	0.5059	0.5709	0.8443	0.9756	0.9960	0.9987	(94)
Ext temp.	767.3256	917.0020	1047.6880	1155.5320	1147.3915	909.8093	623.5512	648.4530	870.8324	868.0015	765.2412	720.7780	(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	2591.5762	2515.9487	2282.4163	1909.4352	1474.5384	983.7155	634.6682	668.2537	1058.1521	1600.8701	2130.6050	2580.7925	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1357.2425	1074.4922	918.6379	542.8103	243.3973	0.0000	0.0000	0.0000	0.0000	545.2542	983.0619	1383.8508	(98)
Space heating												7048.7471	(98)
Space heating per m2										(98) / (4) =		45.1322	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7538.7670 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1357.2425	1074.4922	918.6379	542.8103	243.3973	0.0000	0.0000	0.0000	0.0000	545.2542	983.0619	1383.8508	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1451.5962	1149.1895	982.5004	580.5458	260.3180	0.0000	0.0000	0.0000	0.0000	583.1596	1051.4031	1480.0544	(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	221.9787	195.6365	205.4232	184.0952	180.3689	161.1111	154.6775	169.8016	169.5243	190.8987	201.9226	216.6201	(64)
Efficiency of water heater (217)m	88.8259	88.6687	88.3354	87.5277	85.6139	79.8000	79.8000	79.8000	79.8000	87.4590	88.4784	88.8869	(216)
Fuel for water heating, kWh/month	249.9032	220.6376	232.5491	210.3279	210.6771	201.8936	193.8315	212.7839	212.4365	218.2723	228.2168	243.7031	(219)
Water heating fuel used												2635.2326	(219)
Annual totals kWh/year													
Space heating fuel - main system												7538.7670	(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)												522.3196	(232)
Total delivered energy for all uses												10771.3192	(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	7538.7670	0.2160	1628.3737 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2635.2326	0.2160	569.2102 (264)
Space and water heating			2197.5839 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.3196	0.5190	271.0839 (268)
Total CO2, kg/m2/year			2507.5928 (272)
Emissions per m2 for space and water heating			14.0708 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7357 (272b)
Emissions per m2 for pumps and fans			0.2492 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0708 * 1.00) + 1.7357 + 0.2492, rounded to 2 d.p.			16.0600 (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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1012 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3002 (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) =		0.2777 (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	0.3541	0.3471	0.3402	0.3055	0.2985	0.2638	0.2638	0.2569	0.2777	0.2985	0.3124	0.3263 (22b)
Effective ac	0.5627	0.5603	0.5579	0.5467	0.5446	0.5348	0.5348	0.5330	0.5386	0.5446	0.5488	0.5532 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030 (29a)
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190 (30)
Total net area of external elements Aum(A, m ²)			361.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			27.3300			9.0000	245.9700 (32c)
FF Stud			176.9400			9.0000	1592.4600 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.0900			9.0000	702.8100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24264.4420 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 155.3620 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9204 (36)
Total fabric heat loss (33) + (36) = 100.9223 (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	73.3715	73.0541	72.7430	71.2816	71.0082	69.7354	69.7354	69.4997	70.2257	71.0082	71.5613	72.1396 (38)
Heat transfer coeff	174.2939	173.9764	173.6653	172.2040	171.9305	170.6577	170.6577	170.4220	171.1480	171.9305	172.4837	173.0619 (39)
Average = Sum(39)m / 12 =												172.2026 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1160	1.1139	1.1120	1.1026	1.1008	1.0927	1.0927	1.0912	1.0958	1.1008	1.1044	1.1081 (40)
HLP (average)												1.1026 (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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5179	110.3536	106.1893	102.0250	97.8607	93.6965	93.6965	97.8607	102.0250	106.1893	110.3536	114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (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	36.0882	31.5630	32.5701	28.3954	27.2461	23.5113	21.7867	25.0005	25.2991	29.4837	32.1838	34.9495 (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	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5759	26.2691	21.3634	16.1735	12.0899	10.2068	11.0288	14.3356	19.2413	24.4312	28.5148	30.3979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.1676	330.5625	322.0073	303.7942	280.8035	259.1955	244.7600	241.3650	249.9202	268.1333	291.1240	312.7321	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	(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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	(71)
Water heating gains (Table 5)	48.5056	46.9687	43.7771	39.4381	36.6211	32.6546	29.2832	33.6029	35.1377	39.6286	44.6997	46.9751	(72)
Total internal gains	472.4010	470.9522	454.2997	426.5577	396.6664	369.2087	352.2238	356.4554	371.4510	399.3450	431.4904	457.2570	(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			16.8400		10.6334		0.6300		0.7000		0.7700		54.7250 (74)
East			0.9600		19.6403		0.6300		0.7000		0.7700		5.7622 (76)
South			9.5400		46.7521		0.6300		0.7000		0.7700		136.3079 (78)
West			2.1700		19.6403		0.6300		0.7000		0.7700		13.0250 (80)
Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538	(83)
Total gains	682.2211	835.5235	976.9002	1121.6729	1224.2856	1213.9052	1156.8938	1057.7570	952.5626	808.2280	683.9976	636.1107	(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	38.6710	38.7416	38.8110	39.1403	39.2026	39.4950	39.4950	39.5496	39.3818	39.2026	39.0769	38.9463	
alpha	3.5781	3.5828	3.5874	3.6094	3.6135	3.6330	3.6330	3.6366	3.6255	3.6135	3.6051	3.5964	
util living area	0.9957	0.9908	0.9792	0.9476	0.8739	0.7410	0.5943	0.6552	0.8591	0.9681	0.9922	0.9967	(86)
MIT	19.0681	19.2907	19.6466	20.1131	20.5401	20.8321	20.9448	20.9207	20.6845	20.1259	19.5073	19.0276	(87)
Th 2	19.9878	19.9895	19.9911	19.9987	20.0001	20.0068	20.0068	20.0080	20.0042	20.0001	19.9972	19.9942	(88)
util rest of house	0.9948	0.9887	0.9743	0.9340	0.8389	0.6665	0.4811	0.5445	0.8063	0.9574	0.9901	0.9959	(89)
MIT 2	18.2080	18.4309	18.7853	19.2484	19.6524	19.9078	19.9852	19.9741	19.7932	19.2679	18.6535	18.1724	(90)
Living area fraction									fLA = Living area / (4) =			0.1800	(91)
MIT	18.3629	18.5857	18.9404	19.4041	19.8123	20.0743	20.1580	20.1445	19.9537	19.4224	18.8072	18.3264	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3629	18.5857	18.9404	19.4041	19.8123	20.0743	20.1580	20.1445	19.9537	19.4224	18.8072	18.3264	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	677.1379	822.6881	945.0237	1036.2994	1017.5813	815.9439	577.9886	593.5728	765.0258	767.1584	674.8042	632.3892	(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	2451.0755	2380.9938	2160.4661	1808.8413	1394.7459	934.2245	607.1994	638.1510	1001.8479	1516.8360	2019.3026	2444.7410	(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	1319.8096	1047.1814	904.2892	556.2301	280.6104	0.0000	0.0000	0.0000	0.0000	557.7601	968.0389	1348.3897	(98)
Space heating												6982.3094	(98)
Space heating per m2												(98) / (4) =	44.7068 (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	1604.1827	1262.8672	1295.2074	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7697	0.8410	0.8041	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1234.6684	1062.0562	1041.4853	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1546.8114	1477.1653	1363.8649	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	224.7430	308.8412	239.8504	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												773.4345 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	56.1857	77.2103	59.9626	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												193.3586 (107)
Space cooling per m2												1.2380 (108)
Energy for space heating												44.7068 (99)
Energy for space cooling												1.2380 (108)
Total												45.9449 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1012 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3512 (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) =	0.3249 (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	0.4142	0.4061	0.3980	0.3574	0.3493	0.3086	0.3086	0.3005	0.3249	0.3493	0.3655	0.3817 (22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			29.5100	1.3258	39.1231		(27)
Ground Floor			78.2900	0.1300	10.1777		(28a)
Brick and Block	205.2800	31.6300	173.6500	0.1800	31.2570		(29a)
Pitched Roof	78.0900		78.0900	0.1300	10.1517		(30)
Total net area of external elements Aum(A, m ²)			361.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.8295		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1041 (36)
Total fabric heat loss						(33) + (36) =	107.9336 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	76.3845	75.9501	75.5243	73.5243	73.1501	71.4081	71.4081	71.0855	72.0791	73.1501	73.9071	74.6985 (38)
Heat transfer coeff	184.3181	183.8837	183.4579	181.4579	181.0837	179.3417	179.3417	179.0192	180.0127	181.0837	181.8407	182.6321 (39)
Average = Sum(39)m / 12 =												181.4561 (39)
HLP	1.1802	1.1774	1.1747	1.1619	1.1595	1.1483	1.1483	1.1462	1.1526	1.1595	1.1643	1.1694 (40)
HLP (average)												1.1618 (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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
Daily hot water use	114.5179	110.3536	106.1893	102.0250	97.8607	93.6965	93.6965	97.8607	102.0250	106.1893	110.3536	114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												

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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	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	0.0000 (59)
	36.0882	31.5630	32.5701	28.3954	27.2461	23.5113	21.7867	25.0005	25.2991	29.4837	32.1838	34.9495	(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	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	147.1730	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5759	26.2691	21.3634	16.1735	12.0899	10.2068	11.0288	14.3356	19.2413	24.4312	28.5148	30.3979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.1676	330.5625	322.0073	303.7942	280.8035	259.1955	244.7600	241.3650	249.9202	268.1333	291.1240	312.7321	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	37.7173	(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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	(71)
Water heating gains (Table 5)	48.5056	46.9687	43.7771	39.4381	36.6211	32.6546	29.2832	33.6029	35.1377	39.6286	44.6997	46.9751	(72)
Total internal gains	472.4010	470.9522	454.2997	426.5577	396.6664	369.2087	352.2238	356.4554	371.4510	399.3450	431.4904	457.2570	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	16.8400	10.6334	0.6300	0.7000	0.7700	54.7250	(74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(76)
South	9.5400	46.7521	0.6300	0.7000	0.7700	136.3079	(78)
West	2.1700	19.6403	0.6300	0.7000	0.7700	13.0250	(80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538	(83)
Total gains	682.2211	835.5235	976.9002	1121.6729	1224.2856	1213.9052	1156.8938	1057.7570	952.5626	808.2280	683.9976	636.1107	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	58.8430	58.9820	59.1189	59.7705	59.8940	60.4758	60.4758	60.5848	60.2504	59.8940	59.6447	59.3862		
alpha	4.9229	4.9321	4.9413	4.9847	4.9929	5.0317	5.0317	5.0390	5.0167	4.9929	4.9763	4.9591		
util living area	0.9995	0.9986	0.9955	0.9825	0.9348	0.8100	0.6470	0.7159	0.9228	0.9916	0.9989	0.9997	(86)	
MIT	19.5670	19.7278	19.9897	20.3438	20.6761	20.9010	20.9756	20.9601	20.7818	20.3506	19.8938	19.5425	(87)	
Th 2	19.9359	19.9381	19.9403	19.9506	19.9526	19.9616	19.9616	19.9633	19.9581	19.9526	19.9487	19.9446	(88)	
util rest of house	0.9994	0.9981	0.9938	0.9749	0.9042	0.7246	0.5115	0.5834	0.8732	0.9868	0.9984	0.9996	(89)	
MIT 2	18.6201	18.7825	19.0454	19.4036	19.7200	19.9123	19.9549	19.9507	19.8242	19.4147	18.9570	18.6026	(90)	
Living area fraction									fLA = Living area / (4) =			0.1800	(91)	
MIT	18.7906	18.9527	19.2154	19.5729	19.8921	20.0903	20.1387	20.1325	19.9966	19.5832	19.1256	18.7718	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7906	18.9527	19.2154	19.5729	19.8921	20.0903	20.1387	20.1325	19.9966	19.5832	19.1256	18.7718	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	681.6073	833.3637	969.1594	1089.4252	1104.3317	894.1816	620.2859	642.2522	833.9374	795.6645	682.5495	635.7102	(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	2670.8740	2584.0663	2332.7434	1936.6734	1483.4639	984.6393	634.6329	668.1861	1061.4640	1626.7114	2186.7500	2661.2767	(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	1480.0144	1176.4722	1014.5065	610.0187	282.0743	0.0000	0.0000	0.0000	0.0000	618.2989	1083.0244	1507.0215	(98)	
Space heating												7771.4308	(98)	
Space heating per m2												(98) / (4) =	49.7594	(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	1685.8123	1327.1288	1360.5455	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7964	0.8755	0.8354	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1342.5230	1161.8850	1136.6327	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1546.8114	1477.1653	1363.8649	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	147.0877	234.5686	169.0608	0.0000	0.0000	0.0000	0.0000	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												550.7170 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	36.7719	58.6421	42.2652	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												137.6793 (107)
Space cooling per m2												0.8815 (108)
Energy for space heating												49.7594 (99)
Energy for space cooling												0.8815 (108)
Total												50.6410 (109)
Target Fabric Energy Efficiency (TFEE)												58.2 (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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (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							5 * 10 =	50.0000 (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) =						50.0000 / (5) =	0.1265 (8)				
Pressure test							Yes					
Measured/design AP50							3.9800					
Infiltration rate							0.3255	(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) =	0.3011 (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	0.3538	0.3312	0.3312	0.3011	0.3087	0.2936	0.2936	0.2861	0.2861	0.3087	0.3011	0.3087 (22b)
Effective ac	0.5626	0.5549	0.5549	0.5453	0.5476	0.5431	0.5431	0.5409	0.5409	0.5476	0.5453	0.5476 (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)			29.5100	1.1450	33.7901			(27)					
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600	(28a)					
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030	(29a)					
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190	(30)					
Total net area of external elements Aum(A, m2)			361.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019			(33)					
GF Block			75.9400			75.0000	5695.5000	(32c)					
GF Stud			27.3300			9.0000	245.9700	(32c)					
FF Stud			176.9400			9.0000	1592.4600	(32c)					
Internal Floor 1			78.2900			18.0000	1409.2200	(32d)					
Internal Ceiling 1			78.0900			18.0000	1405.6200	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24967.2520	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.8620	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9204	(36)					
Total fabric heat loss						(33) + (36) =	100.9223	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 73.3593	Feb 72.3506	Mar 72.3506	Apr 71.1091	May 71.4084	Jun 70.8172	Jul 70.8172	Aug 70.5327	Sep 70.5327	Oct 71.4084	Nov 71.1091	Dec 71.4084	(38)
Heat transfer coeff	174.2816	173.2729	173.2729	172.0314	172.3307	171.7396	171.7396	171.4550	171.4550	172.3307	172.0314	172.3307	(39)
Average = Sum(39)m / 12 =												172.3560	(39)
HLP	Jan 1.1159	Feb 1.1094	Mar 1.1094	Apr 1.1015	May 1.1034	Jun 1.0996	Jul 1.0996	Aug 1.0978	Sep 1.0978	Oct 1.1034	Nov 1.1015	Dec 1.1034	(40)
HLP (average)												1.1036	(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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
Daily hot water use	Jan 114.5179	Feb 110.3536	Mar 106.1893	Apr 102.0250	May 97.8607	Jun 93.6965	Jul 93.6965	Aug 97.8607	Sep 102.0250	Oct 106.1893	Nov 110.3536	Dec 114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179	24.6702 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0493 195.7003 205.4938 184.1636 180.4395 161.1795 154.7482 169.8722 169.5927 190.9694 201.9910 216.6907 (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	222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907 (64)
RHI water heating demand												2252.8903 (64)
Heat gains from water heating, kWh/month	98.2455	87.1218	92.7408	84.8609	84.4102	77.2187	75.8678	80.8966	80.0161	87.9114	90.7885	96.4637 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.9397	65.6726	53.4086	40.4337	30.2247	25.5170	27.5720	35.8391	48.1031	61.0780	71.2870	75.9948 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.3098	493.3769	480.6079	453.4242	419.1097	386.8589	365.3134	360.2462	373.0152	400.1989	434.5135	466.7643 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042 (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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384 (71)
Water heating gains (Table 5)	132.0504	129.6455	124.6516	117.8624	113.4546	107.2482	101.9729	108.7320	111.1335	118.1605	126.0952	129.6556 (72)
Total internal gains	811.7733	806.1685	776.1415	729.1937	680.2624	637.0974	612.3317	622.2907	649.7253	696.9108	749.3691	789.8880 (73)

6. Solar gains

[Jan]												
Area												
m2												
Solar flux												
Table 6a												
W/m2												
Specific data												
g												
or Table 6b												
Specific data												
or Table 6c												
FF												
Access												
factor												
Table 6d												
Gains												
W												
North												69.3155 (74)
East												7.3855 (76)
South												164.9798 (78)
West												16.6944 (80)
Solar gains	258.3753	383.3287	563.3614	758.9623	854.9770	967.1587	884.6351	801.3833	658.1368	464.9751	310.1617	208.3596 (83)
Total gains	1070.1486	1189.4971	1339.5029	1488.1561	1535.2394	1604.2561	1496.9668	1423.6740	1307.8620	1161.8859	1059.5308	998.2476 (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	39.7939	40.0256	40.0256	40.3144	40.2444	40.3829	40.3829	40.4499	40.4499	40.2444	40.3144	40.2444
Feb	3.6529	3.6684	3.6684	3.6876	3.6830	3.6922	3.6922	3.6967	3.6967	3.6830	3.6876	3.6830
util living area	0.9788	0.9683	0.9391	0.8670	0.7369	0.5178	0.3720	0.3783	0.6528	0.8802	0.9604	0.9824 (86)
MIT	19.6116	19.7701	20.0958	20.5019	20.8041	20.9615	20.9916	20.9914	20.9094	20.5650	20.0500	19.5905 (87)
Th 2	19.9879	19.9931	19.9931	19.9996	19.9980	20.0011	20.0011	20.0026	20.0026	19.9980	19.9996	19.9980 (88)
util rest of house	0.9740	0.9612	0.9251	0.8363	0.6767	0.4270	0.2626	0.2638	0.5626	0.8439	0.9497	0.9783 (89)
MIT 2	18.1671	18.3983	18.8627	19.4277	19.8113	19.9770	19.9985	20.0001	19.9360	19.5236	18.8087	18.1438 (90)
Living area fraction									fLA = Living area / (4) =			0.1800 (91)
MIT	18.4271	18.6453	19.0847	19.6211	19.9901	20.1543	20.1773	20.1786	20.1113	19.7111	19.0322	18.4043 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4271	18.6453	19.0847	19.6211	19.9901	20.1543	20.1773	20.1786	20.1113	19.7111	19.0322	18.4043 (93)

8. Space heating requirement

Utilisation	0.9635	0.9484	0.9092	0.8227	0.6762	0.4415	0.2822	0.2844	0.5732	0.8314	0.9359	0.9691 (94)
Useful gains	1031.0504	1128.1186	1217.8343	1224.2647	1038.1315	708.2638	422.5138	404.9441	749.7157	965.9346	991.6290	967.3572 (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	2235.5339	2191.0923	1989.9892	1637.9246	1187.3684	730.6282	425.4483	407.8150	807.7747	1311.6220	1794.6608	2189.3418 (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	896.1357	714.3183	574.4832	297.8351	111.0323	0.0000	0.0000	0.0000	0.0000	257.1914	578.1829	909.1566 (98)
Space heating												4338.3354 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

4338 (98)

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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1265 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3255 (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) =	0.3011 (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	0.3839	0.3764	0.3689	0.3312	0.3237	0.2861	0.2861	0.2785	0.3011	0.3237	0.3388	0.3538 (22b)
Effective ac	0.5737	0.5708	0.5680	0.5549	0.5524	0.5409	0.5409	0.5388	0.5453	0.5524	0.5574	0.5626 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030 (29a)
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190 (30)
Total net area of external elements Aum(A, m ²)			361.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			27.3300			9.0000	245.9700 (32c)
FF Stud			176.9400			9.0000	1592.4600 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.0900			18.0000	1405.6200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24967.2520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.8620 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9204 (36)
Total fabric heat loss						(33) + (36) =	100.9223 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	74.8077	74.4345	74.0687	72.3506	72.0292	70.5327	70.5327	70.2556	71.1091	72.0292	72.6795	73.3593 (38)
Average = Sum(39)m / 12 =	175.7300	175.3568	174.9910	173.2729	172.9515	171.4550	171.4550	171.1779	172.0314	172.9515	173.6018	174.2816 (39)
												173.2714 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1252	1.1228	1.1204	1.1094	1.1074	1.0978	1.0978	1.0960	1.1015	1.1074	1.1115	1.1159 (40)
HLP (average)												1.1094 (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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5179	110.3536	106.1893	102.0250	97.8607	93.6965	93.6965	97.8607	102.0250	106.1893	110.3536	114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (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	25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179	24.6702 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0493 195.7003 205.4938 184.1636 180.4395 161.1795 154.7482 169.8722 169.5927 190.9694 201.9910 216.6907 (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	222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907 (64)
Total per year (kWh/year) = Sum(64)m =												2252.8903 (64)
Heat gains from water heating, kWh/month	98.2455	87.1218	92.7408	84.8609	84.4102	77.2187	75.8678	80.8966	80.0161	87.9114	90.7885	96.4637 (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	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.9397	65.6726	53.4086	40.4337	30.2247	25.5170	27.5720	35.8391	48.1031	61.0780	71.2870	75.9948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.3098	493.3769	480.6079	453.4242	419.1097	386.8589	365.3134	360.2462	373.0152	400.1989	434.5135	466.7643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	(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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	(71)
Water heating gains (Table 5)	132.0504	129.6455	124.6516	117.8624	113.4546	107.2482	101.9729	108.7320	111.1335	118.1605	126.0952	129.6556	(72)
Total internal gains	811.7733	806.1685	776.1415	729.1937	680.2624	637.0974	612.3317	622.2907	649.7253	696.9108	749.3691	789.8880	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	16.8400	10.6334	0.6300	0.7000	0.7700	54.7250 (74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622 (76)
South	9.5400	46.7521	0.6300	0.7000	0.7700	136.3079 (78)
West	2.1700	19.6403	0.6300	0.7000	0.7700	13.0250 (80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538	(83)
Total gains	1021.5935	1170.7398	1298.7420	1424.3089	1507.8816	1481.7939	1417.0017	1323.5924	1230.8369	1105.7938	1001.8762	968.7417	(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)													
tau	39.4659	39.5499	39.6326	40.0256	40.1000	40.4499	40.4499	40.5154	40.3144	40.1000	39.9498	39.7939	
alpha	3.6311	3.6367	3.6422	3.6684	3.6733	3.6967	3.6967	3.7010	3.6876	3.6733	3.6633	3.6529	
util living area	0.9858	0.9758	0.9554	0.9071	0.8106	0.6568	0.5069	0.5563	0.7722	0.9281	0.9762	0.9882	(86)
MIT	19.3684	19.5764	19.9013	20.3162	20.6717	20.8943	20.9692	20.9564	20.7985	20.3432	19.7811	19.3280	(87)
Th 2	19.9803	19.9823	19.9842	19.9931	19.9948	20.0026	20.0026	20.0041	19.9996	19.9948	19.9914	19.9879	(88)
util rest of house	0.9827	0.9706	0.9455	0.8855	0.7660	0.5788	0.4025	0.4509	0.7052	0.9069	0.9702	0.9856	(89)
MIT 2	17.8089	18.1110	18.5796	19.1705	19.6467	19.9168	19.9863	19.9790	19.8164	19.2202	18.4165	17.7551	(90)
Living area fraction									fLA = Living area / (4) =				0.1800 (91)
MIT	18.0897	18.3749	18.8175	19.3768	19.8312	20.0928	20.1632	20.1550	19.9932	19.4224	18.6622	18.0383	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0897	18.3749	18.8175	19.3768	19.8312	20.0928	20.1632	20.1550	19.9932	19.4224	18.6622	18.0383	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	995.4441	1122.9555	1208.5997	1238.3998	1142.6787	868.8384	595.1300	619.1563	867.4318	985.8808	960.9167	947.7330	(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	2423.2585	2362.9098	2155.4597	1815.3389	1406.3096	941.7721	610.9335	642.7681	1013.8209	1525.8404	2007.2252	2411.7665	(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	1062.2939	833.2493	704.4639	415.3961	196.1414	0.0000	0.0000	0.0000	0.0000	401.7299	753.3421	1089.2409	(98)
Space heating												5455.8574	(98)
Space heating per m ²												34.9331	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)														0.0000	(201)
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														90.5000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														6028.5718	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1062.2939	833.2493	704.4639	415.3961	196.1414	0.0000	0.0000	0.0000	0.0000	401.7299	753.3421	1089.2409	(98)		
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)		
Space heating fuel (main heating system)	1173.8054	920.7175	778.4131	459.0012	216.7308	0.0000	0.0000	0.0000	0.0000	443.9005	832.4222	1203.5811	(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	222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907	(64)		
Efficiency of water heater (217)m	88.4496	88.2494	87.8402	86.9201	85.0366	79.8000	79.8000	79.8000	79.8000	86.7521	88.0050	88.5303	(216)		
Fuel for water heating, kWh/month	251.0463	221.7582	233.9406	211.8769	212.1904	201.9793	193.9200	212.8724	212.5222	220.1323	229.5221	244.7644	(219)		
Water heating fuel used												2646.5250	(219)		
Annual totals kWh/year															
Space heating fuel - main system													6028.5718	(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)														522.3196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 + 0.97 + 1068 + 1.00) =										-828.8227				-828.8227	(233)
Total delivered energy for all uses														8443.5937	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6028.5718	3.4800	209.7943 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2646.5250	3.4800	92.0991 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	522.3196	13.1900	68.8940 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-828.8227	13.1900	-109.3217 (252)
Total energy cost			391.3581 (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] =	0.8170 (257)
SAP value		88.6024
SAP rating (Section 12)		89 (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	6028.5718	0.2160	1302.1715 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2646.5250	0.2160	571.6494 (264)
Space and water heating			1873.8209 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.3196	0.5190	271.0839 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total kg/year			1753.6708 (272)
CO2 emissions per m2			11.2300 (273)
EI value			88.3193
EI rating			88 (274)
EI band			B

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8492 = 4.098$, stars = 4
Water heating environmental impact	$0.216 / 0.8492 = 0.2544$, 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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (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											5 * 10 =	50.0000 (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) =										50.0000 / (5) =	0.1265 (8)
Pressure test											Yes	
Measured/design AP50											3.9800	
Infiltration rate											0.3255 (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) =	0.3011 (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	0.3538	0.3312	0.3312	0.3011	0.3087	0.2936	0.2936	0.2861	0.2861	0.3087	0.3011	0.3087 (22b)
Effective ac	0.5626	0.5549	0.5549	0.5453	0.5476	0.5431	0.5431	0.5409	0.5409	0.5476	0.5453	0.5476 (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)			29.5100	1.1450	33.7901			(27)					
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600	(28a)					
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030	(29a)					
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190	(30)					
Total net area of external elements Aum(A, m2)			361.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019			(33)					
GF Block			75.9400			75.0000	5695.5000	(32c)					
GF Stud			27.3300			9.0000	245.9700	(32c)					
FF Stud			176.9400			9.0000	1592.4600	(32c)					
Internal Floor 1			78.2900			18.0000	1409.2200	(32d)					
Internal Ceiling 1			78.0900			18.0000	1405.6200	(32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			24967.2520	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.8620	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9204	(36)					
Total fabric heat loss						(33) + (36) =	100.9223	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 73.3593	Feb 72.3506	Mar 72.3506	Apr 71.1091	May 71.4084	Jun 70.8172	Jul 70.8172	Aug 70.5327	Sep 70.5327	Oct 71.4084	Nov 71.1091	Dec 71.4084	(38)
Heat transfer coeff	174.2816	173.2729	173.2729	172.0314	172.3307	171.7396	171.7396	171.4550	171.4550	172.3307	172.0314	172.3307	(39)
Average = Sum(39)m / 12 =												172.3560	(39)
HLP	Jan 1.1159	Feb 1.1094	Mar 1.1094	Apr 1.1015	May 1.1034	Jun 1.0996	Jul 1.0996	Aug 1.0978	Sep 1.0978	Oct 1.1034	Nov 1.1015	Dec 1.1034	(40)
HLP (average)												1.1036	(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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
Daily hot water use	Jan 114.5179	Feb 110.3536	Mar 106.1893	Apr 102.0250	May 97.8607	Jun 93.6965	Jul 93.6965	Aug 97.8607	Sep 102.0250	Oct 106.1893	Nov 110.3536	Dec 114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (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												
25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179	24.6702	(46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage												
28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h												
222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907	(64)
Heat gains from water heating, kWh/month												
98.2455	87.1218	92.7408	84.8609	84.4102	77.2187	75.8678	80.8966	80.0161	87.9114	90.7885	96.4637	(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	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.9397	65.6726	53.4086	40.4337	30.2247	25.5170	27.5720	35.8391	48.1031	61.0780	71.2870	75.9948 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.3098	493.3769	480.6079	453.4242	419.1097	386.8589	365.3134	360.2462	373.0152	400.1989	434.5135	466.7643 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042 (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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384 (71)
Water heating gains (Table 5)	132.0504	129.6455	124.6516	117.8624	113.4546	107.2482	101.9729	108.7320	111.1335	118.1605	126.0952	129.6556 (72)
Total internal gains	811.7733	806.1685	776.1415	729.1937	680.2624	637.0974	612.3317	622.2907	649.7253	696.9108	749.3691	789.8880 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	16.8400	13.4684	0.6300	0.7000	0.7700	69.3155 (74)
East	0.9600	25.1733	0.6300	0.7000	0.7700	7.3855 (76)
South	9.5400	56.5862	0.6300	0.7000	0.7700	164.9798 (78)
West	2.1700	25.1733	0.6300	0.7000	0.7700	16.6944 (80)

Solar gains	258.3753	383.3287	563.3614	758.9623	854.9770	967.1587	884.6351	801.3833	658.1368	464.9751	310.1617	208.3596	(83)
Total gains	1070.1486	1189.4971	1339.5029	1488.1561	1535.2394	1604.2561	1496.9668	1423.6740	1307.8620	1161.8859	1059.5308	998.2476	(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	39.7939	40.0256	40.0256	40.3144	40.2444	40.3829	40.3829	40.4499	40.4499	40.2444	40.3144	40.2444
alpha	3.6529	3.6684	3.6684	3.6876	3.6830	3.6922	3.6922	3.6967	3.6967	3.6830	3.6876	3.6830
util living area	0.9788	0.9683	0.9391	0.8670	0.7369	0.5178	0.3720	0.3783	0.6528	0.8802	0.9604	0.9824 (86)
MIT	19.6116	19.7701	20.0958	20.5019	20.8041	20.9615	20.9916	20.9914	20.9094	20.5650	20.0500	19.5905 (87)
Th 2	19.9879	19.9931	19.9931	19.9996	19.9980	20.0011	20.0011	20.0026	20.0026	19.9980	19.9996	19.9980 (88)
util rest of house	0.9740	0.9612	0.9251	0.8363	0.6767	0.4270	0.2626	0.2638	0.5626	0.8439	0.9497	0.9783 (89)
MIT 2	18.1671	18.3983	18.8627	19.4277	19.8113	19.9770	19.9985	20.0001	19.9360	19.5236	18.8087	18.1438 (90)
Living area fraction									fLA = Living area / (4) =			0.1800 (91)
MIT	18.4271	18.6453	19.0847	19.6211	19.9901	20.1543	20.1773	20.1786	20.1113	19.7111	19.0322	18.4043 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4271	18.6453	19.0847	19.6211	19.9901	20.1543	20.1773	20.1786	20.1113	19.7111	19.0322	18.4043 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9635	0.9484	0.9092	0.8227	0.6762	0.4415	0.2822	0.2844	0.5732	0.8314	0.9359	0.9691 (94)
Useful gains	1031.0504	1128.1186	1217.8343	1224.2647	1038.1315	708.2638	422.5138	404.9441	749.7157	965.9346	991.6290	967.3572 (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												
	2235.5339	2191.0923	1989.9892	1637.9246	1187.3684	730.6282	425.4483	407.8150	807.7747	1311.6220	1794.6608	2189.3418 (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												
	896.1357	714.3183	574.4832	297.8351	111.0323	0.0000	0.0000	0.0000	0.0000	257.1914	578.1829	909.1566 (98)
Space heating												4338.3354 (98)
Space heating per m2												27.7778 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)														0.0000 (201)
Fraction of space heat from main system(s)														1.0000 (202)
Efficiency of main space heating system 1 (in %)														90.5000 (206)
Efficiency of secondary/supplementary heating system, %														0.0000 (208)
Space heating requirement														4793.7408 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	896.1357	714.3183	574.4832	297.8351	111.0323	0.0000	0.0000	0.0000	0.0000	257.1914	578.1829	909.1566	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	990.2052	789.3020	634.7881	329.0995	122.6876	0.0000	0.0000	0.0000	0.0000	284.1894	638.8761	1004.5929	(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	222.0493	195.7003	205.4938	184.1636	180.4395	161.1795	154.7482	169.8722	169.5927	190.9694	201.9910	216.6907	(64)	
Efficiency of water heater (217)m	88.1528	87.9636	87.4121	86.0895	83.5636	79.8000	79.8000	79.8000	79.8000	85.6087	87.4637	88.2232	(216)	
Fuel for water heating, kWh/month	251.8915	222.4789	235.0864	213.9211	215.9307	201.9793	193.9200	212.8724	212.5222	223.0725	230.9427	245.6165	(219)	
Water heating fuel used												2660.2342	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4793.7408	(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)													522.3196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.97 * 1184 * 1.00) =										-918.7195			-918.7195	(233)
Total delivered energy for all uses													7132.5751	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4793.7408	3.6300	174.0128 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2660.2342	3.6300	96.5665 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	522.3196	19.4400	101.5389 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-918.7195	19.4400	-178.5991 (252)
Total energy cost			303.0991 (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	4793.7408	0.2160	1035.4480 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2660.2342	0.2160	574.6106 (264)
Space and water heating			1610.0586 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	522.3196	0.5190	271.0839 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	0.5190	-476.8154 (269)
Total kg/year			1443.2520 (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	4793.7408	1.2200	5848.3638 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2660.2342	1.2200	3245.4858 (264)
Space and water heating			9093.8495 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	522.3196	3.0700	1603.5212 (268)
Energy saving/generation technologies			

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PV Unit	-918.7195	3.0700	-2820.4690 (269)
Primary energy kWh/year			8107.1517 (272)
Primary energy kWh/m2/year			51.9090 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 89
Current environmental impact rating:	B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 40	-272 kg (18.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40 1.74 kg/m²	B 90	B 90
Total Savings	£40 1.74 kg/m²		
Potential energy efficiency rating:		B 90	
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 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	£116	£126	-£10
Mains gas	£366	£315	£50
Space heating	£284	£285	-£2
Water heating	£97	£55	£42
Lighting	£102	£102	£0
Generated (PV)	-£179	-£179	£0
Total cost of fuels	£303	£262	£40
Total cost of uses	£304	£263	£40
Delivered energy	46 kWh/m²	37 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	52 kWh/m²	42 kWh/m²	10 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	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1265 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3255 (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) =	0.3011 (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	0.3839	0.3764	0.3689	0.3312	0.3237	0.2861	0.2861	0.2785	0.3011	0.3237	0.3388	0.3538 (22b)
Effective ac	0.5737	0.5708	0.5680	0.5549	0.5524	0.5409	0.5409	0.5388	0.5453	0.5524	0.5574	0.5626 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030 (29a)
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190 (30)
Total net area of external elements Aum(A, m ²)			361.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			27.3300			9.0000	245.9700 (32c)
FF Stud			176.9400			9.0000	1592.4600 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.0900			18.0000	1405.6200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24967.2520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.8620 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9204 (36)
Total fabric heat loss						(33) + (36) =	100.9223 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	74.8077	74.4345	74.0687	72.3506	72.0292	70.5327	70.5327	70.2556	71.1091	72.0292	72.6795	73.3593 (38)
Average = Sum(39)m / 12 =	175.7300	175.3568	174.9910	173.2729	172.9515	171.4550	171.4550	171.1779	172.0314	172.9515	173.6018	174.2816 (39)
												173.2714 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1252	1.1228	1.1204	1.1094	1.1074	1.0978	1.0978	1.0960	1.1015	1.1074	1.1115	1.1159 (40)
HLP (average)												1.1094 (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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5179	110.3536	106.1893	102.0250	97.8607	93.6965	93.6965	97.8607	102.0250	106.1893	110.3536	114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (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	25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179	24.6702 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
211.9469 186.5756 193.9957 167.6335 157.5428 138.7962 131.6188 147.6734 154.4133 179.4713 192.2145 206.5883 (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												1.1072 (H8)
Utilisation factor												0.5947 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												104.1072 (H14)
Volume ratio Veff/V												1.1238 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-948.3956 (H17)
Solar input	-27.5016	-45.8922	-78.1597	-104.7494	-129.4091	-127.2298	-125.5484	-109.6922	-85.9110	-58.6671	-32.6208	-23.0141 (63)
Solar input (sum of months) = Sum (63)m =												-948.3956 (63)
Output from w/h												
184.4454 140.6834 115.8360 62.8840 28.1337 11.5665 6.0705 37.9811 68.5023 120.8041 159.5936 183.5742 (64)												
Total per year (kWh/year) = Sum (64)m =												1120.0747 (64)
Heat gains from water heating, kWh/month												
90.1636 79.8220 83.5423 71.6368 66.0928 59.3121 57.3644 63.1375 67.8726 78.7129 82.9673 88.3818 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
73.9397 65.6726 53.4086 40.4337 30.2247 25.5170 27.5720 35.8391 48.1031 61.0780 71.2870 75.9948 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
488.3098 493.3769 480.6079 453.4242 419.1097 386.8589 365.3134 360.2462 373.0152 400.1989 434.5135 466.7643 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 55.6042 (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)												
-117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 -117.7384 (71)												
Water heating gains (Table 5)												
121.1876 118.7827 112.2880 99.4956 88.8345 82.3779 77.1026 84.8622 94.2675 105.7969 115.2324 118.7928 (72)												
Total internal gains												
800.9105 795.3057 763.7779 710.8270 655.6423 612.2272 587.4614 598.4210 632.8593 684.5472 738.5063 779.0252 (73)												

6. Solar gains

[Jan]												
			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North			16.8400		10.6334		0.6300		0.7000		0.7700	54.7250 (74)
East			0.9600		19.6403		0.6300		0.7000		0.7700	5.7622 (76)
South			9.5400		46.7521		0.6300		0.7000		0.7700	136.3079 (78)
West			2.1700		19.6403		0.6300		0.7000		0.7700	13.0250 (80)
Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	1010.7307	1159.8770	1286.3784	1405.9421	1483.2615	1456.9237	1392.1314	1299.7226	1213.9709	1093.4302	991.0134	957.8790 (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)												
tau	39.4659	39.5499	39.6326	40.0256	40.1000	40.4499	40.5154	40.3144	40.1000	39.9498	39.7939	
alpha	3.6311	3.6367	3.6422	3.6684	3.6733	3.6967	3.6967	3.7010	3.6876	3.6733	3.6633	3.6529
util living area												
0.9862 0.9764 0.9566 0.9100 0.8167 0.6646 0.5146 0.5646 0.7778 0.9302 0.9770 0.9886 (86)												
MIT	19.3598	19.5681	19.8926	20.3055	20.6623	20.8900	20.9676	20.9542	20.7932	20.3354	19.7728	19.3193 (87)
Th 2	19.9803	19.9823	19.9842	19.9931	19.9948	20.0026	20.0026	20.0041	19.9996	19.9948	19.9914	19.9879 (88)
util rest of house												
0.9832 0.9714 0.9469 0.8889 0.7727 0.5865 0.4091 0.4584 0.7114 0.9094 0.9712 0.9861 (89)												
MIT 2	17.7963	18.0991	18.5673	19.1562	19.6356	19.9130	19.9853	19.9776	19.8108	19.2097	18.4046	17.7424 (90)
Living area fraction												
MIT	18.0778	18.3636	18.8059	19.3632	19.8204	20.0889	20.1622	20.1534	19.9877	19.4124	18.6509	18.0263 (92)
Temperature adjustment												0.0000

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 18.0778 18.3636 18.8059 19.3632 19.8204 20.0889 20.1622 20.1534 19.9877 19.4124 18.6509 18.0263 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9602	0.9321	0.8729	0.7641	0.5938	0.4268	0.4752	0.7105	0.8941	0.9603	0.9790	(94)
Useful gains	985.6096	1113.6651	1199.0885	1227.2010	1133.2985	865.1090	594.1036	617.6502	862.4860	977.6800	951.6326	937.7557	(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	2421.1793	2360.9323	2153.4253	1812.9847	1404.4416	941.0977	610.7567	642.5069	1012.8720	1524.1110	2005.2642	2409.6757	(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	1068.0639	838.1635	710.0266	421.7643	201.7305	0.0000	0.0000	0.0000	0.0000	406.5447	758.6147	1095.1085	(98)
Space heating												5500.0168	(98)
Space heating per m2											(98) / (4) =	35.2159	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6077.3666 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1068.0639	838.1635	710.0266	421.7643	201.7305	0.0000	0.0000	0.0000	0.0000	406.5447	758.6147	1095.1085	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1180.1811	926.1476	784.5598	466.0379	222.9067	0.0000	0.0000	0.0000	0.0000	449.2206	838.2483	1210.0647	(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	184.4454	140.6834	115.8360	62.8840	28.1337	11.5665	6.0705	37.9811	68.5023	120.8041	159.5936	183.5742	(64)
Efficiency of water heater (217)m	88.7476	88.7889	88.8294	88.9524	89.0388	79.8000	79.8000	79.8000	79.8000	87.8030	88.4389	88.7908	(216)
Fuel for water heating, kWh/month	207.8313	158.4470	130.4028	70.6940	31.5971	14.4943	7.6071	47.5954	85.8425	137.5854	180.4564	206.7492	(219)
Water heating fuel used												1279.3023	(219)
Annual totals kWh/year													
Space heating fuel - main system												6077.3666	(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)													522.3196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.97 * 1068 * 1.00) =										-828.8227		-828.8227	(233)
Total delivered energy for all uses												7175.1658	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6077.3666	3.4800	211.4924	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1279.3023	3.4800	44.5197	(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	522.3196	13.1900	68.8940	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-828.8227	13.1900	-109.3217	(252)
Total energy cost			352.0718	(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] =	0.7350	(257)
SAP value		89.7466	
SAP rating (Section 12)		90	(258)
SAP band		B	

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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	6077.3666	0.2160	1312.7112 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1279.3023	0.2160	276.3293 (264)
Space and water heating			1589.0405 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	522.3196	0.5190	271.0839 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total kg/year			1494.8404 (272)
CO2 emissions per m2			9.5700 (273)
EI value			90.0433
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.0900 (1b)	x 2.3900 (2b)	= 186.6351 (1b) - (3b)
First floor	78.0900 (1c)	x 2.6700 (2c)	= 208.5003 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 395.1354 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (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) =					50.0000	/ (5) =	0.1265 (8)
Pressure test										Yes							
Measured/design AP50										3.9800							
Infiltration rate										0.3255 (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) =					0.3011 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.3538	0.3312	0.3312	0.3011	0.3087	0.2936	0.2936	0.2861	0.2861	0.3087	0.3011	0.3087	(22b)				
Effective ac	0.5626	0.5549	0.5549	0.5453	0.5476	0.5431	0.5431	0.5409	0.5409	0.5476	0.5453	0.5476	(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)			29.5100	1.1450	33.7901			(27)					
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600	(28a)					
Brick and Block	205.2800	31.6300	173.6500	0.2400	41.6760	42.2200	7331.5030	(29a)					
Pitched Roof	78.0900		78.0900	0.1000	7.8090	9.1000	710.6190	(30)					
Total net area of external elements Aum(A, m2)			361.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.0019			(33)					
GF Block			75.9400			75.0000	5695.5000	(32c)					
GF Stud			27.3300			9.0000	245.9700	(32c)					
FF Stud			176.9400			9.0000	1592.4600	(32c)					
Internal Floor 1			78.2900			18.0000	1409.2200	(32d)					
Internal Ceiling 1			78.0900			18.0000	1405.6200	(32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			24967.2520	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.8620	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9204	(36)					
Total fabric heat loss						(33) + (36) =	100.9223	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 73.3593	Feb 72.3506	Mar 72.3506	Apr 71.1091	May 71.4084	Jun 70.8172	Jul 70.8172	Aug 70.5327	Sep 70.5327	Oct 71.4084	Nov 71.1091	Dec 71.4084	(38)
Heat transfer coeff	174.2816	173.2729	173.2729	172.0314	172.3307	171.7396	171.7396	171.4550	171.4550	172.3307	172.0314	172.3307	(39)
Average = Sum(39)m / 12 =												172.3560	(39)
HLP	Jan 1.1159	Feb 1.1094	Mar 1.1094	Apr 1.1015	May 1.1034	Jun 1.0996	Jul 1.0996	Aug 1.0978	Sep 1.0978	Oct 1.1034	Nov 1.1015	Dec 1.1034	(40)
HLP (average)												1.1036	(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												2.9435 (42)
Average daily hot water use (litres/day)												104.1072 (43)
Daily hot water use	Jan 114.5179	Feb 110.3536	Mar 106.1893	Apr 102.0250	May 97.8607	Jun 93.6965	Jul 93.6965	Aug 97.8607	Sep 102.0250	Oct 106.1893	Nov 110.3536	Dec 114.5179 (44)
Energy conte	169.8267	148.5315	153.2712	133.6256	128.2169	110.6415	102.5256	117.6496	119.0547	138.7468	151.4530	164.4681 (45)
Energy content (annual)										Total = Sum(45)m =		1638.0113 (45)

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

Distribution loss (46)m = 0.15 x (45)m	25.4740	22.2797	22.9907	20.0438	19.2325	16.5962	15.3788	17.6474	17.8582	20.8120	22.7179	24.6702 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
211.9469 186.5756 193.9957 167.6335 157.5428 138.7962 131.6188 147.6734 154.4133 179.4713 192.2145 206.5883 (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												1.2369 (H8)
Utilisation factor												0.5545 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												104.1072 (H14)
Volume ratio Veff/V												1.1238 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-987.7799 (H17)
Solar input	-32.2325	-45.8383	-79.5412	-106.9963	-124.3370	-135.2425	-128.2305	-116.9338	-91.5238	-63.2580	-38.1237	-25.5222 (63)
Solar input (sum of months) = Sum (63)m =												-987.7799 (63)
Output from w/h												
179.7144 140.7373 114.4545 60.6372 33.2059 3.5537 3.3883 30.7395 62.8895 116.2132 154.0907 181.0661 (64)												
Total per year (kWh/year) = Sum (64)m =												1080.6904 (64)
Heat gains from water heating, kWh/month												
90.1636 79.8220 83.5423 71.6368 66.0928 59.3121 57.3644 63.1375 67.8726 78.7129 82.9673 88.3818 (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	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	176.6076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.9397	65.6726	53.4086	40.4337	30.2247	25.5170	27.5720	35.8391	48.1031	61.0780	71.2870	75.9948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.3098	493.3769	480.6079	453.4242	419.1097	386.8589	365.3134	360.2462	373.0152	400.1989	434.5135	466.7643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	55.6042	(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)	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	-117.7384	(71)
Water heating gains (Table 5)	121.1876	118.7827	112.2880	99.4956	88.8345	82.3779	77.1026	84.8622	94.2675	105.7969	115.2324	118.7928	(72)
Total internal gains	800.9105	795.3057	763.7779	710.8270	655.6423	612.2272	587.4614	598.4210	632.8593	684.5472	738.5063	779.0252	(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				16.8400	13.4684	0.6300	0.7000		0.7700		69.3155 (74)	
East				0.9600	25.1733	0.6300	0.7000		0.7700		7.3855 (76)	
South				9.5400	56.5862	0.6300	0.7000		0.7700		164.9798 (78)	
West				2.1700	25.1733	0.6300	0.7000		0.7700		16.6944 (80)	

Solar gains	258.3753	383.3287	563.3614	758.9623	854.9770	967.1587	884.6351	801.3833	658.1368	464.9751	310.1617	208.3596 (83)
Total gains	1059.2858	1178.6343	1327.1393	1469.7893	1510.6193	1579.3859	1472.0965	1399.8043	1290.9960	1149.5223	1048.6680	987.3848 (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	39.7939	40.0256	40.0256	40.3144	40.2444	40.3829	40.3829	40.4499	40.4499	40.2444	40.3144	40.2444
alpha	3.6529	3.6684	3.6684	3.6876	3.6830	3.6922	3.6922	3.6967	3.6967	3.6830	3.6876	3.6830
util living area	0.9794	0.9692	0.9406	0.8707	0.7438	0.5247	0.3779	0.3844	0.6588	0.8831	0.9616	0.9830 (86)
MIT	19.6031	19.7620	20.0876	20.4929	20.7976	20.9598	20.9911	20.9910	20.9065	20.5586	20.0421	19.5819 (87)
Th 2	19.9879	19.9931	19.9931	19.9996	19.9980	20.0011	20.0011	20.0026	20.0026	19.9980	19.9996	19.9980 (88)
util rest of house	0.9747	0.9622	0.9269	0.8405	0.6841	0.4331	0.2669	0.2682	0.5685	0.8474	0.9511	0.9791 (89)
MIT 2	18.1549	18.3868	18.8514	19.4162	19.8043	19.9759	19.9983	19.9999	19.9337	19.5156	18.7977	18.1315 (90)
Living area fraction									fLA = Living area / (4) =			0.1800 (91)
MIT	18.4157	18.6344	19.0740	19.6101	19.9832	20.1530	20.1771	20.1783	20.1089	19.7034	19.0217	18.3926 (92)
Temperature adjustment												0.0000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

adjusted MIT 18.4157 18.6344 19.0740 19.6101 19.9832 20.1530 20.1771 20.1783 20.1089 19.7034 19.0217 18.3926 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9644	0.9496	0.9110	0.8267	0.6831	0.4477	0.2869	0.2891	0.5789	0.8347	0.9375	0.9700	(94)
Useful gains	1021.6138	1119.2015	1209.0690	1215.0180	1031.8800	707.0138	422.3124	404.7449	747.4057	959.4864	983.1209	957.7268	(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	2233.5383	2189.2043	1988.1297	1636.0285	1186.1814	730.4124	425.4128	407.7796	807.3602	1310.2962	1792.8662	2187.3279	(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	901.6718	719.0418	579.6211	303.1275	114.8003	0.0000	0.0000	0.0000	0.0000	261.0025	583.0166	914.8232	(98)
Space heating												4377.1049	(98)
Space heating per m2											(98) / (4) =	28.0260	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4836.5801 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	901.6718	719.0418	579.6211	303.1275	114.8003	0.0000	0.0000	0.0000	0.0000	261.0025	583.0166	914.8232	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	996.3225	794.5214	640.4653	334.9476	126.8511	0.0000	0.0000	0.0000	0.0000	288.4006	644.2173	1010.8544	(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	179.7144	140.7373	114.4545	60.6372	33.2059	3.5537	3.3883	30.7395	62.8895	116.2132	154.0907	181.0661	(64)
Efficiency of water heater (217)m	88.5273	88.5563	88.5422	88.5214	87.8570	79.8000	79.8000	79.8000	79.8000	86.9098	88.0324	88.5385	(216)
Fuel for water heating, kWh/month	203.0045	158.9241	129.2654	68.5000	37.7953	4.4533	4.2460	38.5207	78.8089	133.7170	175.0386	204.5055	(219)
Water heating fuel used												1236.7793	(219)
Annual totals kWh/year													
Space heating fuel - main system												4836.5801	(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)												522.3196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.97 * 1184 * 1.00) =										-918.7195		-918.7195	(233)
Total delivered energy for all uses												5801.9594	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4836.5801	3.6300	175.5679	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1236.7793	3.6300	44.8951	(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	522.3196	19.4400	101.5389	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit		-918.7195	-178.5991	(252)
Total energy cost			262.7028	(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	4836.5801	0.2160	1044.7013	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1236.7793	0.2160	267.1443	(264)
Space and water heating			1311.8456	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	522.3196	0.5190	271.0839 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	0.5190	-476.8154 (269)
Total kg/year			1170.9890 (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	4836.5801	1.2200	5900.6277 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1236.7793	1.2200	1508.8707 (264)
Space and water heating			7409.4984 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	522.3196	3.0700	1603.5212 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	3.0700	-2820.4690 (269)
Primary energy kWh/year			6576.3006 (272)
Primary energy kWh/m2/year			42.1072 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 20	Issued on Date	02/08/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Project	4 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.51	TER	16.06
Environmental	88 B	% DER<TER	22.08		
CO ₂ Emissions (t/year)	1.44	DFEE	45.94	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	21.11		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	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 20	Issued on Date	02/08/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Project	4 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.51	TER	16.06
Environmental	88 B	% DER<TER	22.08		
CO ₂ Emissions (t/year)	1.44	DFEE	45.94	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	21.11		

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

Wall 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 20	Issued on Date	02/08/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Project	4 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.51	TER	16.06
Environmental	88 B	% DER<TER	22.08		
CO ₂ Emissions (t/year)	1.44	DFEE	45.94	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	21.11		

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

Building Elements

Floor 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 20	Issued on Date	02/08/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Property	4 Robert Place, West End, Southampton, SO30 3JY		

SAP Rating	89 B	DER	12.51	TER	16.06
Environmental	88 B	% DER<TER	22.08		
CO ₂ Emissions (t/year)	1.44	DFEE	45.94	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	21.11		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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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, 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:	40.57 m	78.09 m ²	2.39 m
	1st Storey:	40.57 m	78.09 m ²	2.67 m

7.0 Living Area	28.12	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	159.86	kJ/m ² K

9.0 External Walls							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	
Brick and Block	Cavity Wall	Other	0.24	42.22	205.28	173.65	

9.1 Party Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00		

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
GF Block	Dense block, plasterboard on dabs		75.00	75.94	
GF Stud	Plasterboard on timber frame		9.00	27.33	
FF Stud	Plasterboard on timber frame		9.00	176.94	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	78.09	78.09

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	78.09

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	78.29

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	78.29

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	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 (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Shaded	Window	[1] Brick and Block	South	None	1.16	Yes				1.92	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					7.62	
West Elevation	Window	[1] Brick and Block	West	None	0.00					2.17	
North Elevation	Window	[1] Brick and Block	North	None	0.00					16.84	
East Elevation	Window	[1] Brick and Block	East	None	0.00					0.96	

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)	2.52	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	9.15	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.54	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.54	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	15.21	0.021	No	Knauf P5
Independently assessed	E4 Jamb	50.10	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	40.57	0.022	No	Knauf P10
Independently assessed	E6 Intermediate floor within a dwelling	40.57	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	25.68	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	15.01	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	30.30	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	10.10	-0.091	No	Knauf P24

Y-value	0.016	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	3.98	m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
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	26	
Total number of L.E.L. fittings	26	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	18911	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.5	
In Summer	79.8	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	

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	Hot Water Cylinder			
Cylinder Stat	Yes			
Cylinder In Heated Space	Yes			
Independent Time Control	Yes			
Insulation Type	Measured Loss			
Cylinder Volume	215.00	L		
Loss	1.73	kWh/day		
Pipes insulation	Fully insulated primary pipework			
31.0 Thermal Store	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.97	South	45°	None Or Little	Yes
Recommendations				
Lower cost measures				
None				
Further measures to achieve even higher standards				
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£40	B 90	