



SAP Report Submission for Building Regulations Compliance

Client: Cheryl Simmonds
Belford Property Holdings Ltd

Project: 3, Belford House, 53 Hampton Road
Forest Gate, E7 0PD

Contact: Gareth John
Myideashed

Report Issue Date: 26/08/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

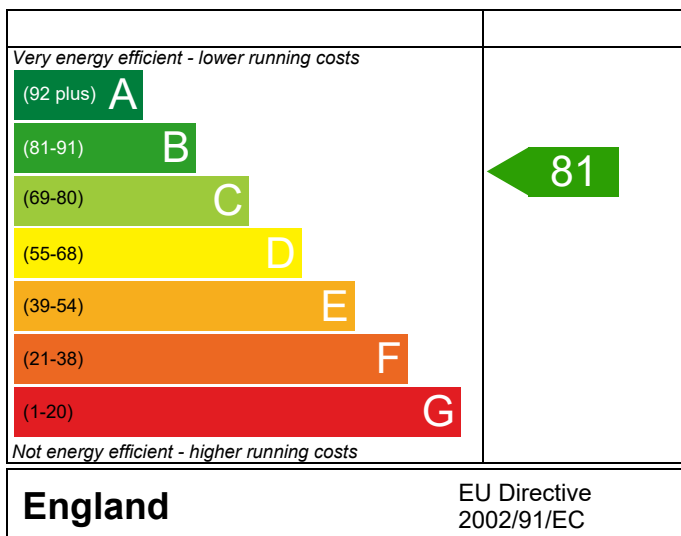
3, Belford House, 53 Hampton Road,
Forest Gate,
E7 0PD

Dwelling type: House, Semi-Detached
Date of assessment: 26/08/2024
Produced by: Iftikhar Ahmed
Total floor area: 88.61 m²
DRRN: 0366-2708-2440

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

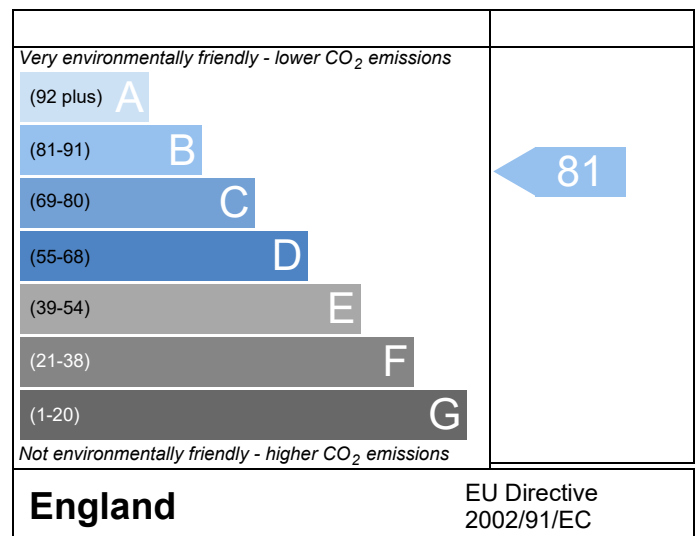
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

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 Designed)

Property Reference	000009-1			Issued on Date	26/08/2024
Assessment Reference	002	Prop Type Ref	Forest Gate Part L1a		
Property	3, Belford House, 53 Hampton Road, Forest Gate, E7 OPD				
SAP Rating	81 B	DER	24.96	TER	33.19
Environmental	81 B	% DER<TER	24.79		
CO ₂ Emissions (t/year)	1.23	DFEE	66.55	TFEE	78.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		
Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk			Assessor ID	D226-0001
Client	Cheryl Simmonds, Forest Gate				

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	33.19	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.96	kgCO ₂ /m ²	Pass
	-8.23 (-24.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	78.82	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	66.55	kWh/m ² /yr	
	-12.3 (-15.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.15 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.93 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Electric storage heaters with radiators or underfloor - Electric
High heat retention storage heaters

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Nominal cylinder loss: 1.61 kWh/day
Permitted by DBSCG 1.89

Pass

Primary pipework insulated

No primary pipework

6 Controls

Space heating controls

Controls for high heat retention storage heaters

Pass

Hot water controls

Cylinderstat

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 (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

10.58 m², No overhang

Windows facing South

3.00 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

Dark-coloured venetian blind, closed 1% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.93 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.09

W/m²K

Window U-value

1.10

W/m²K

Roof window U-value

1.10

W/m²K

Photovoltaic array

4.00

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£110	B 83	B 85	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£110	B 83	B 85	

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CO ₂ Emissions (t/year)	1.23	DFEE	66.55	TFEE	78.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		
Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk			Assessor ID	D226-0001
Client	Cheryl Simmonds, Forest Gate				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 89 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 33.19 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 24.96 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)78.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)66.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.15 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.93 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Electric storage heaters with radiators or underfloor - Electric
High heat retention storage heaters

Secondary heating system: None

5 Cylinder insulation

Hot water storage: Nominal cylinder loss: 1.61 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: No primary pipework

6 Controls

Space heating controls: Controls for high heat retention storage heaters OK

Hot water controls: Cylinderstat 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 (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 10.58 m², No overhang
Windows facing South: 3.00 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured venetian blind, closed 1% of daylight hours

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.11 W/m ² K
Floor U-value	0.09 W/m ² K
Window U-value	1.10 W/m ² K
Roof window U-value	1.10 W/m ² K
Photovoltaic array	4.00 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1270 (8)
Pressure test					Yes
Measured/design AP50					4.9300
Infiltration rate					0.3735 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3175 (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	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731 (22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696 (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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.3472	45.0992	44.8562	43.7146	43.5010	42.5067	42.5067	42.3226	42.8897	43.5010	43.9331	44.3848 (38)
Heat transfer coeff	143.5808	143.3328	143.0898	141.9482	141.7346	140.7404	140.7404	140.5562	141.1233	141.7346	142.1667	142.6184 (39)
Average = Sum(39)m / 12 =												141.9472 (39)
HLP	1.6204	1.6176	1.6148	1.6019	1.5995	1.5883	1.5883	1.5862	1.5926	1.5995	1.6044	1.6095 (40)
HLP (average)												1.6019 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)												Total = Sum(45)m = 1511.9886 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)

Water storage loss:												
Store volume												
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												
Volume factor from Table 2a												
Temperature factor from Table 2b												
Enter (49) or (54) in (55)												
Total storage loss												0.9648 (55)
	29.9084	27.0140	29.9084	28.9436	29.9084	28.9436	29.9084	29.9084	28.9436	29.9084	28.9436	29.9084 (56)
If cylinder contains dedicated solar storage	29.9084	27.0140	29.9084	28.9436	29.9084	28.9436	29.9084	29.9084	28.9436	29.9084	28.9436	29.9084 (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)
Total heat required for water heating calculated for each month												
	186.6693	164.1181	171.3875	152.2885	148.2608	131.0727	124.5460	138.5065	138.8387	157.9805	168.7443	181.7229 (62)
WWHRS	-54.7856	-48.2038	-49.1985	-40.4830	-37.5918	-31.0124	-26.2494	-31.7810	-32.7070	-40.4295	-46.8283	-52.9519 eq. (G10)
Total of WWHRS savings												-492.2216
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	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710 (64)
								Total per year (kWh/year)	=	Sum(64)m =	1371.9144	(64)
Heat gains from water heating, kWh/month	76.0497	67.1983	70.9685	64.1671	63.2789	57.1128	55.3937	60.0356	59.6950	66.5107	69.6386	74.4051 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0839	18.7265	15.2294	11.5297	8.6186	7.2761	7.8621	10.2195	13.7166	17.4164	20.3275	21.6699 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.4971	238.9512	232.7670	219.6014	202.9823	187.3627	176.9278	174.4737	180.6579	193.8235	210.4426	226.0622 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311 (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)	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485 (71)
Water heating gains (Table 5)	102.2174	99.9975	95.3878	89.1209	85.0523	79.3234	74.4540	80.6930	82.9097	89.3961	96.7203	100.0068 (72)
Total internal gains	421.8916	419.7685	405.4774	382.3452	358.7463	336.0554	321.3370	327.4794	339.3774	362.7291	389.5836	409.8321 (73)

[Jan					Area	Solar flux		g	FF		Access	Gains	
					m2	Table 6a	W/m2	Specific data	Specific data		Factor	W	
								or Table 6b	or Table 6c		Table 6d		
North					10.5800	10.6334		0.5700		0.7700		31.1074 (74)	
South					3.0000	46.7521		0.5700		0.7700		38.7818 (78)	
South					6.6300	26.0000		0.5700		0.7000		61.9017 (82)	
West					1.9500	26.6635		0.5700		0.7000		18.6710 (82)	

Solar gains	150.4619	289.5795	476.8730	713.3879	901.7091	937.8932	886.6379	741.2336	558.8571	342.5440	186.4687	124.6180 (83)	
Total gains	572.3535	709.3480	882.3504	1095.7331	1260.4555	1273.9485	1207.9749	1068.7129	898.2345	705.2731	576.0523	534.4501 (84)	

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.8572	42.9314	43.0043	43.3501	43.4154	43.7222	43.7222	43.7794	43.6035	43.4154	43.2835	43.1464
alpha	3.8571	3.8621	3.8670	3.8900	3.8944	3.9148	3.9148	3.9186	3.9069	3.8944	3.8856	3.8764
util living area	0.9970	0.9927	0.9786	0.9291	0.8131	0.6419	0.4937	0.5686	0.8270	0.9696	0.9941	0.9977 (86)
MIT	19.5169	19.6911	19.9971	20.3964	20.7146	20.8795	20.9267	20.9142	20.7635	20.3252	19.8453	19.4867 (87)
Th 2	19.5984	19.6005	19.6025	19.6119	19.6137	19.6219	19.6219	19.6234	19.6187	19.6137	19.6101	19.6064 (88)
util rest of house	0.9959	0.9900	0.9705	0.9022	0.7469	0.5288	0.3482	0.4154	0.7359	0.9531	0.9915	0.9968 (89)
MIT 2	17.6557	17.9108	18.3545	18.9201	19.3254	19.5028	19.5356	19.5320	19.4023	18.8375	18.1438	17.6172 (90)
Living area fraction												0.3169 (91)
MIT	18.2455	18.4750	18.8750	19.3879	19.7657	19.9391	19.9765	19.9700	19.8336	19.3089	18.6830	18.2097 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2455	18.4750	18.8750	19.3879	19.7657	19.9391	19.9765	19.9700	19.8336	19.3089	18.6830	18.2097 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9943	0.9870	0.9649	0.8968	0.7551	0.5567	0.3871	0.4563	0.7527	0.9482	0.9890	0.9956 (94)
Useful gains	569.0825	700.1288	851.3638	982.6831	951.8090	709.2556	467.6533	487.6915	676.0832	668.7311	569.6895	532.0874 (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	2002.3073	1945.7397	1770.7393	1488.7399	1143.1828	751.4269	475.2052	501.7916	809.1481	1234.3554	1646.7146	1998.0354 (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	1066.3193	837.0505	684.0154	364.3608	142.3821	0.0000	0.0000	0.0000	0.0000	420.8244	775.4580	1090.6653 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 5381.0759 (98)
60.7276 (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	1322.9595	1041.4788	1068.2275	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8375	0.8955	0.8560	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1108.0010	932.6025	914.3626	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1475.4078	1402.1964	1257.2040	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	264.5329	349.3779	255.0741	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												868.9848	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	66.1332	87.3445	63.7685	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												217.2462	(107)
Space cooling per m2												2.4517	(108)

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 %)													100.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5381.0759	(211)
Cooling System Energy Efficiency Ratio (see Table 10c)													5.3375	(209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1066.3193	837.0505	684.0154	364.3608	142.3821	0.0000	0.0000	0.0000	0.0000	420.8244	775.4580	1090.6653	(98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)	
Space heating fuel (main heating system)	1066.3193	837.0505	684.0154	364.3608	142.3821	0.0000	0.0000	0.0000	0.0000	420.8244	775.4580	1090.6653	(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	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710	(64)	
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)	
Fuel for water heating, kWh/month	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710	(219)	
Water heating fuel used												1371.9144	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	12.3903	16.3643	11.9473	0.0000	0.0000	0.0000	0.0000	(221)	
Cooling												40.7019	(221)	
Annual totals kWh/year														
Space heating fuel - main system												5381.0759	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												372.3481	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 4.00 * 908 * 1.00) =												-2905.1336	(233)	
Total delivered energy for all uses												4260.9067	(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	5381.0759	0.5190	2792.7784	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1371.9144	0.5190	712.0236	(264)
Space and water heating			3504.8020	(265)
Space cooling	40.7019	0.5190	21.1243	(266)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	372.3481	0.5190	193.2487	(268)
Energy saving/generation technologies				
PV Unit (0.90*35.09 + 0.10*14.87)	-2905.1336	0.5190	-1507.7643	(269)
Total CO2, kg/year			2211.4106	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			24.9600	(273)

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

DER		24.9600	ZC1
Total Floor Area		88.6100	
Assumed number of occupants		2.6062	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.8157	ZC2
CO2 emissions from cooking, equation (L16)		2.0489	ZC3
Total CO2 emissions		42.8246	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Additional allowable electricity generation, kWh/m ² /year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	42.8246	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1270 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3770 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2965	0.3205	0.3445	0.3606	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (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 Semi-glazed door			1.9000	1.2000	2.2800		(26a)
TER Opening Type (Uw = 1.40)			12.4100	1.3258	16.4527		(27)
TER Room Window (Uw = 1.70)			7.8400	1.5918	12.4794		(27a)
Heat Loss Floor 1			61.5000	0.1300	7.9950		(28a)
External Wall 1	99.9200	14.3100	85.6100	0.1800	15.4098		(29a)
Zinc Roof Warm	42.8400	1.7800	41.0600	0.1300	5.3378		(30)
Flat roof Warm	47.2200	6.0600	41.1600	0.1300	5.3508		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.3055		(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)							36.4405 (36)
Total fabric heat loss						(33) + (36) =	101.7460 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.4674	45.2148	44.9671	43.8041	43.5865	42.5735	42.5735	42.3859	42.9637	43.5865	44.0267	44.4869 (38)
Heat transfer coeff	147.2133	146.9607	146.7131	145.5500	145.3324	144.3194	144.3194	144.1318	144.7096	145.3324	145.7726	146.2329 (39)
Average = Sum(39)m / 12 =												145.5490 (39)
HLP	1.6614	1.6585	1.6557	1.6426	1.6401	1.6287	1.6287	1.6266	1.6331	1.6401	1.6451	1.6503 (40)
HLP (average)												1.6426 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)											Total = Sum(45)m =	1511.9886 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)
Water storage loss:												
Store volume												150.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)
Total storage loss	
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)	
If cylinder contains dedicated solar storage	
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (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	
203.3558 179.1898 188.0740 168.4368 164.9473 147.2210 141.2325 155.1930 154.9869 174.6670 184.8926 198.4094 (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	
203.3558 179.1898 188.0740 168.4368 164.9473 147.2210 141.2325 155.1930 154.9869 174.6670 184.8926 198.4094 (64)	
Total per year (kWh/year) = Sum(64)m =	2060.6060 (64)
Heat gains from water heating, kWh/month	
89.3989 79.2557 84.3177 77.0857 76.6281 70.0314 68.7429 73.3848 72.6136 79.8599 82.5572 87.7543 (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 130.3106 130.3106 130.3106 130.3106 130.3106 130.3106 130.3106 130.3106 130.3106 130.3106 130.3106 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
21.0839 18.7265 15.2294 11.5297 8.6186 7.2761 7.8621 10.2195 13.7166 17.4164 20.3275 21.6699 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
236.4971 238.9512 232.7670 219.6014 202.9823 187.3627 176.9278 174.4737 180.6579 193.8235 210.4426 226.0622 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 36.0311 (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)	
-104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 -104.2485 (71)	
Water heating gains (Table 5)	
120.1598 117.9400 113.3303 107.0634 102.9947 97.2658 92.3964 98.6355 100.8522 107.3386 114.6628 117.9493 (72)	
Total internal gains	
442.8340 440.7109 426.4199 403.2877 379.6888 356.9978 342.2795 348.4218 360.3199 383.6716 410.5261 430.7746 (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				9.6700	10.6334	0.6300	0.7000	0.7700	31.4246 (74)			
South				2.7400	46.7521	0.6300	0.7000	0.7700	39.1492 (78)			
South				6.0600	26.0000	0.6300	0.7000	1.0000	62.5356 (82)			
West				1.7800	26.6635	0.6300	0.7000	1.0000	18.8373 (82)			
Solar gains	151.9467	292.4430	481.6016	720.4796	910.6864	947.2360	895.4680	748.6073	564.4046	345.9347	188.3099	125.8471 (83)
Total gains	594.7808	733.1539	908.0215	1123.7673	1290.3752	1304.2338	1237.7475	1097.0291	924.7245	729.6063	598.8360	556.6217 (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 41.7997 41.8715 41.9422 42.2774 42.3407 42.6379 42.6379 42.6934 42.5229 42.3407 42.2128 42.0800	
alpha 3.7866 3.7914 3.7961 3.8185 3.8227 3.8425 3.8425 3.8462 3.8349 3.8227 3.8142 3.8053	
util living area	
0.9965 0.9918 0.9770 0.9265 0.8106 0.6406 0.4930 0.5666 0.8225 0.9671 0.9932 0.9973 (86)	
MIT 19.1910 19.4102 19.7964 20.2997 20.7026 20.9141 20.9758 20.9596 20.7682 20.2159 19.6083 19.1528 (87)	
Th 2 19.5686 19.5707 19.5727 19.5823 19.5840 19.5924 19.5924 19.5939 19.5891 19.5840 19.5804 19.5767 (88)	
util rest of house	
0.9952 0.9889 0.9683 0.8985 0.7432 0.5256 0.3449 0.4109 0.7291 0.9492 0.9903 0.9963 (89)	
MIT 2 17.2172 17.5376 18.0963 18.8058 19.3177 19.5425 19.5853 19.5802 19.4177 18.7103 17.8343 17.1666 (90)	
Living area fraction	
MIT 17.8427 18.1310 18.6351 19.2792 19.7566 19.9771 20.0259 20.0173 19.8457 19.1874 18.3965 17.7960 (91)	
Temperature adjustment	
adjusted MIT 17.8427 18.1310 18.6351 19.2792 19.7566 19.9771 20.0259 20.0173 19.8457 19.1874 18.3965 17.7960 (93)	

8. Space heating requirement

Utilisation	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.9928 0.9844 0.9604 0.8911 0.7525 0.5593 0.3923 0.4606 0.7491 0.9423 0.9865 0.9943 (94)	
Useful gains	590.4883 721.7337 872.0657 1001.3525 971.0078 729.5094 485.5912 505.2826 692.6659 687.5100 590.7313 553.4600 (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	
1993.6679 1944.4390 1780.3714 1510.6910 1170.8859 776.0205 494.4308 521.3687 831.4538 1248.0273 1646.7133 1988.1831 (97)	
Month fracti	1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 1.0000 (97a)
Space heating kWh	
1043.9656 821.6579 675.7795 366.7237 148.7094 0.0000 0.0000 0.0000 0.0000 417.0248 760.3071 1067.4340 (98)	
Space heating	
Space heating per m2	
(98) / (4) =	59.8307 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5670.1625 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1043.9656	821.6579	675.7795	366.7237	148.7094	0.0000	0.0000	0.0000	0.0000	417.0248	760.3071	1067.4340	(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)	1116.5407	878.7785	722.7588	392.2179	159.0474	0.0000	0.0000	0.0000	0.0000	446.0158	813.1626	1141.6406	(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	203.3558	179.1898	188.0740	168.4368	164.9473	147.2210	141.2325	155.1930	154.9869	174.6670	184.8926	198.4094	(64)
Efficiency of water heater (217)m	88.5640	88.3784	87.9330	86.8354	84.5389	79.8000	79.8000	79.8000	79.8000	87.0542	88.1870	88.6371	(216)
Fuel for water heating, kWh/month	229.6146	202.7530	213.8833	193.9725	195.1141	184.4874	176.9831	194.4774	194.2192	200.6416	209.6597	223.8446	(219)
Water heating fuel used												2419.6506	(219)
Annual totals kWh/year													
Space heating fuel - main system												5670.1625	(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)												372.3481	(232)
Total delivered energy for all uses												8537.1612	(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	5670.1625	0.2160	1224.7551 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2419.6506	0.2160	522.6445 (264)
Space and water heating			1747.3996 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.3481	0.5190	193.2487 (268)
Total CO2, kg/m2/year			1979.5733 (272)
Emissions per m2 for space and water heating			19.7201 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.1809 (272b)
Emissions per m2 for pumps and fans			0.4393 (272c)
Target Carbon Dioxide Emission Rate (TER) = (19.7201 * 1.55) + 2.1809 + 0.4393, rounded to 2 d.p.			33.1900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1270 (8)
Pressure test										Yes							
Measured/design AP50										4.9300							
Infiltration rate										0.3735 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3175 (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	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)				
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.3472	Feb 45.0992	Mar 44.8562	Apr 43.7146	May 43.5010	Jun 42.5067	Jul 42.5067	Aug 42.3226	Sep 42.8897	Oct 43.5010	Nov 43.9331	Dec 44.3848 (38)
Heat transfer coeff	143.5808	143.3328	143.0898	141.9482	141.7346	140.7404	140.7404	140.5562	141.1233	141.7346	142.1667	142.6184 (39)
Average = Sum(39)m / 12 =												141.9472 (39)
HLP	Jan 1.6204	Feb 1.6176	Mar 1.6148	Apr 1.6019	May 1.5995	Jun 1.5883	Jul 1.5883	Aug 1.5862	Sep 1.5926	Oct 1.5995	Nov 1.6044	Dec 1.6095 (40)
HLP (average)												1.6019 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	Jan 105.7073	Feb 101.8634	Mar 98.0195	Apr 94.1756	May 90.3317	Jun 86.4878	Jul 86.4878	Aug 90.3317	Sep 94.1756	Oct 98.0195	Nov 101.8634	Dec 105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)												Total = Sum(45)m = 1511.9886 (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)

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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	33.3117	29.1346	30.0643	26.2108	25.1499	21.7024	20.1105	23.0771	23.3527	27.2153	29.7077	32.2606	(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	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0839	18.7265	15.2294	11.5297	8.6186	7.2761	7.8621	10.2195	13.7166	17.4164	20.3275	21.6699	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.4971	238.9512	232.7670	219.6014	202.9823	187.3627	176.9278	174.4737	180.6579	193.8235	210.4426	226.0622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	(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)	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	(71)
Water heating gains (Table 5)	44.7738	43.3551	40.4090	36.4039	33.8036	30.1423	27.0302	31.0176	32.4343	36.5797	41.2606	43.3610	(72)
Total internal gains	364.4480	363.1260	350.4986	329.6282	307.4976	286.8743	273.9133	277.8040	288.9020	309.9128	334.1239	353.1863	(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	10.5800	10.6334	0.5700	0.7000	0.7700	31.1074	(74)
South	3.0000	46.7521	0.5700	0.7000	0.7700	38.7818	(78)
South	6.6300	26.0000	0.5700	0.7000	1.0000	61.9017	(82)
West	1.9500	26.6635	0.5700	0.7000	1.0000	18.6710	(82)

Solar gains	150.4619	289.5795	476.8730	713.3879	901.7091	937.8932	886.6379	741.2336	558.8571	342.5440	186.4687	124.6180	(83)
Total gains	514.9099	652.7055	827.3717	1043.0161	1209.2068	1224.7674	1160.5512	1019.0375	847.7591	652.4567	520.5926	477.8043	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	42.8572	42.9314	43.0043	43.3501	43.4154	43.7222	43.7222	43.7794	43.6035	43.4154	43.2835	43.1464		
alpha	3.8571	3.8621	3.8670	3.8900	3.8944	3.9148	3.9148	3.9186	3.9069	3.8944	3.8856	3.8764		
util living area	0.9979	0.9945	0.9826	0.9382	0.8285	0.6604	0.5113	0.5908	0.8474	0.9762	0.9959	0.9985	(86)	
MIT	19.1608	19.3801	19.7670	20.2763	20.6901	20.9099	20.9746	20.9563	20.7495	20.1799	19.5731	19.1232	(87)	
Th 2	19.5984	19.6005	19.6025	19.6119	19.6137	19.6219	19.6219	19.6234	19.6187	19.6137	19.6101	19.6064	(88)	
util rest of house	0.9972	0.9925	0.9759	0.9139	0.7648	0.5467	0.3619	0.4341	0.7611	0.9629	0.9940	0.9979	(89)	
MIT 2	17.9553	18.1752	18.5595	19.0563	19.4208	19.5854	19.6167	19.6129	19.4877	18.9776	18.3757	17.9237	(90)	
Living area fraction										fLA = Living area / (4) =		0.3169	(91)	
MIT	18.3373	18.5570	18.9421	19.4429	19.8230	20.0051	20.0470	20.0386	19.8876	19.3586	18.7552	18.3039	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.3373	18.5570	18.9421	19.4429	19.8230	20.0051	20.0470	20.0386	19.8876	19.3586	18.7552	18.3039	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	512.9226	646.4179	803.9351	949.3998	938.0046	711.2848	475.7164	493.7428	662.1989	626.0422	516.6070	476.4177	(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	2015.4888	1957.5034	1780.3444	1496.5511	1151.3142	760.7141	485.1317	511.4343	816.7640	1241.3956	1656.9765	2011.4696	(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	1117.9092	881.0494	726.4485	393.9490	158.7023	0.0000	0.0000	0.0000	0.0000	457.8229	821.0661	1142.0786	(98)	
Space heating												5699.0261	(98)	
Space heating per m2												(98) / (4) =	64.3158	(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	1322.9595	1041.4788	1068.2275	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8253	0.8861	0.8424	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1091.8691	922.9005	899.8701	0.0000	0.0000	0.0000	0.0000	(102)	

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1426.2267	1354.7727	1207.5286	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	240.7375	321.3130	228.8980	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												790.9484 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	60.1844	80.3282	57.2245	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												197.7371 (107)
Space cooling per m2												2.2315 (108)
Energy for space heating												64.3158 (99)
Energy for space cooling												2.2315 (108)
Total												66.5474 (109)
Dwelling Fabric Energy Efficiency (DFEE)												66.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1270 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3770 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2965	0.3205	0.3445	0.3606	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (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 Semi-glazed door			1.9000	1.2000	2.2800		(26a)
TER Opening Type (Uw = 1.40)			12.4100	1.3258	16.4527		(27)
TER Room Window (Uw = 1.70)			7.8400	1.5918	12.4794		(27a)
Heat Loss Floor 1			61.5000	0.1300	7.9950		(28a)
External Wall 1	99.9200	14.3100	85.6100	0.1800	15.4098		(29a)
Zinc Roof Warm	42.8400	1.7800	41.0600	0.1300	5.3378		(30)
Flat roof Warm	47.2200	6.0600	41.1600	0.1300	5.3508		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.3055		(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)							36.4405 (36)
Total fabric heat loss						(33) + (36) =	101.7460 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.4674	45.2148	44.9671	43.8041	43.5865	42.5735	42.5735	42.3859	42.9637	43.5865	44.0267	44.4869 (38)
Heat transfer coeff	147.2133	146.9607	146.7131	145.5500	145.3324	144.3194	144.3194	144.1318	144.7096	145.3324	145.7726	146.2329 (39)
Average = Sum(39)m / 12 =												145.5490 (39)
HLP	1.6614	1.6585	1.6557	1.6426	1.6401	1.6287	1.6287	1.6266	1.6331	1.6401	1.6451	1.6503 (40)
HLP (average)												1.6426 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)												1511.9886 (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												

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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 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.3117	29.1346	30.0643	26.2108	25.1499	21.7024	20.1105	23.0771	23.3527	27.2153	29.7077	32.2606 (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	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106	130.3106 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0839	18.7265	15.2294	11.5297	8.6186	7.2761	7.8621	10.2195	13.7166	17.4164	20.3275	21.6699 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.4971	238.9512	232.7670	219.6014	202.9823	187.3627	176.9278	174.4737	180.6579	193.8235	210.4426	226.0622 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311	36.0311 (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)	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485 (71)
Water heating gains (Table 5)	44.7738	43.3551	40.4090	36.4039	33.8036	30.1423	27.0302	31.0176	32.4343	36.5797	41.2606	43.3610 (72)
Total internal gains	364.4480	363.1260	350.4986	329.6282	307.4976	286.8743	273.9133	277.8040	288.9020	309.9128	334.1239	353.1863 (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	9.6700	10.6334	0.6300		0.7000	0.7700	31.4246 (74)
South	2.7400	46.7521	0.6300		0.7000	0.7700	39.1492 (78)
South	6.0600	26.0000	0.6300		0.7000	1.0000	62.5356 (82)
West	1.7800	26.6635	0.6300		0.7000	1.0000	18.8373 (82)

Solar gains	151.9467	292.4430	481.6016	720.4796	910.6864	947.2360	895.4680	748.6073	564.4046	345.9347	188.3099	125.8471 (83)
Total gains	516.3947	655.5690	832.1002	1050.1077	1218.1841	1234.1103	1169.3814	1026.4112	853.3067	655.8475	522.4338	479.0334 (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	41.7997	41.8715	41.9422	42.2774	42.3407	42.6379	42.6379	42.6934	42.5229	42.3407	42.2128	42.0800
alpha	3.7866	3.7914	3.7961	3.8185	3.8227	3.8425	3.8425	3.8462	3.8349	3.8227	3.8142	3.8053
util living area	0.9979	0.9944	0.9825	0.9389	0.8317	0.6664	0.5180	0.5975	0.8504	0.9763	0.9958	0.9984 (86)
MIT	19.1159	19.3372	19.7289	20.2460	20.6707	20.9014	20.9714	20.9515	20.7342	20.1524	19.5358	19.0782 (87)
Th 2	19.5686	19.5707	19.5727	19.5823	19.5840	19.5924	19.5924	19.5939	19.5891	19.5840	19.5804	19.5767 (88)
util rest of house	0.9971	0.9923	0.9758	0.9146	0.7677	0.5506	0.3642	0.4369	0.7639	0.9629	0.9939	0.9978 (89)
MIT 2	17.8885	18.1104	18.4994	19.0041	19.3791	19.5524	19.5865	19.5823	19.4503	18.9280	18.3165	17.8568 (90)
Living area fraction									fLA = Living area / (4) =			0.3169 (91)
MIT	18.2775	18.4991	18.8890	19.3977	19.7884	19.9799	20.0254	20.0162	19.8572	19.3160	18.7029	18.2438 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2775	18.4991	18.8890	19.3977	19.7884	19.9799	20.0254	20.0162	19.8572	19.3160	18.7029	18.2438 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	514.3313	649.1028	808.3013	956.2776	948.0923	722.1422	483.7497	501.5443	668.6234	629.1916	518.3311	477.5886 (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	2057.6699	1998.5389	1817.6291	1527.9366	1175.5081	776.4252	494.3513	521.2130	833.1182	1266.7207	1691.3842	2053.6703 (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	1148.2439	906.8211	750.9399	411.5945	169.1973	0.0000	0.0000	0.0000	0.0000	474.3217	844.5982	1172.6048 (98)
Space heating												5878.3213 (98)
Space heating per m2										(98) / (4) =		66.3393 (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	1356.6027	1067.9638	1095.4020	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8155	0.8779	0.8327	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1106.2594	937.5827	912.1672	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1436.1191	1364.1223	1215.3399	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	237.4989	317.3454	225.5605	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												780.4049 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	59.3747	79.3364	56.3901	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												195.1012 (107)
Space cooling per m2												2.2018 (108)
Energy for space heating												66.3393 (99)
Energy for space cooling												2.2018 (108)
Total												68.5411 (109)
Target Fabric Energy Efficiency (TFEE)												78.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1270 (8)
Pressure test					Yes
Measured/design AP50					4.9300
Infiltration rate					0.3735 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3175 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.2000	3.3000	3.5000	3.3000	3.5000	3.5000	3.9000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8000	0.8250	0.8750	0.8250	0.8750	0.8750	0.9750 (22a)
Adj infilt rate	0.3334	0.3175	0.3175	0.2937	0.2937	0.2540	0.2620	0.2778	0.2620	0.2778	0.2778	0.3096 (22b)
Effective ac	0.5556	0.5504	0.5504	0.5431	0.5431	0.5323	0.5343	0.5386	0.5343	0.5386	0.5386	0.5479 (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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	43.2923	42.8897	42.8897	42.3226	42.3226	41.4756	41.6352	41.9691	41.6352	41.9691	41.9691	42.6958 (38)
Heat transfer coeff	141.5260	141.1233	141.1233	140.5562	140.5562	139.7093	139.8689	140.2027	139.8689	140.2027	140.2027	140.9294 (39)
Average = Sum(39)m / 12 =												140.4891 (39)
HLP	1.5972	1.5926	1.5926	1.5862	1.5862	1.5767	1.5785	1.5822	1.5785	1.5822	1.5822	1.5904 (40)
HLP (average)												1.5855 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)										Total = Sum(45)m =		1511.9886 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

3646 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1270 (8)
Pressure test										Yes							
Measured/design AP50																	4.9300
Infiltration rate																	0.3735 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3175 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)				
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (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	45.3472	45.0992	44.8562	43.7146	43.5010	42.5067	42.5067	42.3226	42.8897	43.5010	43.9331	44.3848 (38)
Heat transfer coeff	143.5808	143.3328	143.0898	141.9482	141.7346	140.7404	140.7404	140.5562	141.1233	141.7346	142.1667	142.6184 (39)
Average = Sum(39)m / 12 =												141.9472 (39)
HLP	1.6204	1.6176	1.6148	1.6019	1.5995	1.5883	1.5883	1.5862	1.5926	1.5995	1.6044	1.6095 (40)
HLP (average)												1.6019 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)												Total = Sum(45)m = 1511.9886 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2

(98) / (4) = 4683.5614 (98)
52.8559 (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	1322.9595	1041.4788	1068.2275	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8375	0.8955	0.8560	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1108.0010	932.6025	914.3626	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1475.4078	1402.1964	1257.2040	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	264.5329	349.3779	255.0741	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												868.9848	(104)
Cooled fraction									fC = cooled area / (4) =				1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	66.1332	87.3445	63.7685	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												217.2462	(107)
Space cooling per m2												2.4517	(108)

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

Fraction of space heat from secondary/supplementary system (Table 11)

Fraction of space heat from main system(s)	0.0000 (201)
Efficiency of main space heating system 1 (in %)	1.0000 (202)
Efficiency of secondary/supplementary heating system, %	100.0000 (206)
Space heating requirement	0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)	4683.5614 (211)
	5.3375 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	950.1367	737.5328	589.5900	301.6157	111.7689	0.0000	0.0000	0.0000	0.0000	342.3100	674.5758	976.0315	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	950.1367	737.5328	589.5900	301.6157	111.7689	0.0000	0.0000	0.0000	0.0000	342.3100	674.5758	976.0315	(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	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710	(219)
Water heating fuel used												1371.9144	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	12.3903	16.3643	11.9473	0.0000	0.0000	0.0000	0.0000	(221)
Cooling												40.7019	(221)
Annual totals kWh/year													
Space heating fuel - main system												4683.5614	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.3481	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 4.00 * 908 * 1.00) =												-2905.1336	(233)
Total delivered energy for all uses												3563.3922	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.00*15.29 + 1.00*5.50)	4683.5614	5.5000	257.5959	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.1184	(243)
Low-rate fraction			0.8816	(244)
High-rate cost	162.4330	15.2900	24.8360	(245)
Low-rate cost	1209.4814	5.5000	66.5215	(246)
Space cooling (0.90*15.29 + 0.10*5.50)	40.7019	14.3110	5.8248	(248)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	0.0000	0.0000	0.0000	(249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	372.3481	14.3110	53.2867	(250)
Additional standing charges			24.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*35.09 + 0.10*14.87)	0.0000	0.0000	0.0000	(252)
Total energy cost			432.0649	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] = 1.3582$ (257)
 SAP value 81.0533
 SAP rating (Section 12) 81 (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	4683.5614	0.5190	2430.7684 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	1371.9144	0.5190	712.0236 (264)
Space and water heating			3142.7920 (265)
Space cooling	40.7019	0.5190	21.1243 (266)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	372.3481	0.5190	193.2487 (268)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	-2905.1336	0.5190	-1507.7643 (269)
Total kg/year			1849.4006 (272)
CO2 emissions per m2			20.8700 (273)
EI value			81.4520
EI rating			81 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency $5.50 \times (1 + 0.29 \times 0.20) / 1.0000 = 5.819$, stars = 3
 Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.20) / 1.0000 = 0.5491$, stars = 2
 Water heating energy efficiency $6.66 / 1.0000 = 6.659$, stars = 4
 Water heating environmental impact $0.519 / 1.0000 = 0.5190$, stars = 3

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (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							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1270 (8)				
Pressure test							Yes					
Measured/design AP50								4.9300				
Infiltration rate								0.3735 (18)				
Number of sides sheltered								2 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3175 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.2000	3.3000	3.5000	3.3000	3.5000	3.5000	3.9000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8000	0.8250	0.8750	0.8250	0.8750	0.8750	0.9750 (22a)
Adj infilt rate	0.3334	0.3175	0.3175	0.2937	0.2937	0.2540	0.2620	0.2778	0.2620	0.2778	0.2778	0.3096 (22b)
Effective ac	0.5556	0.5504	0.5504	0.5431	0.5431	0.5323	0.5343	0.5386	0.5343	0.5386	0.5386	0.5479 (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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.2923	42.8897	42.8897	42.3226	42.3226	41.4756	41.6352	41.9691	41.6352	41.9691	41.9691	42.6958 (38)
Heat transfer coeff	141.5260	141.1233	141.1233	140.5562	140.5562	139.7093	139.8689	140.2027	139.8689	140.2027	140.2027	140.9294 (39)
Average = Sum(39)m / 12 =												140.4891 (39)
HLP	1.5972	1.5926	1.5926	1.5862	1.5862	1.5767	1.5785	1.5822	1.5785	1.5822	1.5822	1.5904 (40)
HLP (average)												1.5855 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)												Total = Sum(45)m = 1511.9886 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)

Water storage loss:												
Store volume											150.0000 (47)	
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)											0.0115 (51)	
Volume factor from Table 2a											0.9283 (52)	
Temperature factor from Table 2b											0.6000 (53)	
Enter (49) or (54) in (55)											0.9648 (55)	
Total storage loss												
29.9084	27.0140	29.9084	28.9436	29.9084	28.9436	29.9084	29.9084	28.9436	29.9084	28.9436	29.9084 (56)	
If cylinder contains dedicated solar storage												
29.9084	27.0140	29.9084	28.9436	29.9084	28.9436	29.9084	29.9084	28.9436	29.9084	28.9436	29.9084 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Total heat required for water heating calculated for each month												
186.6693	164.1181	171.3875	152.2885	148.2608	131.0727	124.5460	138.5065	138.8387	157.9805	168.7443	181.7229 (62)	
WWHRS	-54.7856	-48.2038	-49.1985	-40.4830	-37.5913	-31.0124	-26.2494	-31.7810	-32.7070	-40.4295	-46.8283	-52.9519 eq. (G10)
Total of WWHRS savings												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Solar input (sum of months) = Sum (63)m =											0.0000 (63)	
Output from w/h												
131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710 (64)	
Total per year (kWh/year) = Sum (64)m =											1371.9144 (64)	
Heat gains from water heating, kWh/month												
76.0497	67.1983	70.9685	64.1671	63.2789	57.1128	55.3937	60.0356	59.6950	66.5107	69.6386	74.4051 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728	156.3728 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.7097	46.8163	38.0736	28.8242	21.5464	18.1904	19.6553	25.5488	34.2915	43.5409	50.8187	54.1747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.9808	356.6436	347.4134	327.7633	302.9587	279.6458	264.0713	260.4085	269.6387	289.2888	314.0934	337.4063 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435	53.2435 (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)	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485	-104.2485 (71)
Water heating gains (Table 5)	102.2174	99.9975	95.3878	89.1209	85.0523	79.3234	74.4540	80.6930	82.9097	89.3961	96.7203	100.0068 (72)
Total internal gains	613.2756	608.8252	586.2425	551.0762	514.9251	482.5272	463.5483	472.0180	492.2077	527.5935	567.0002	596.9556 (73)

[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	10.5800	11.9672	0.5700	0.7000	0.7700	35.0094 (74)
South	3.0000	50.8329	0.5700	0.7000	0.7700	42.1669 (78)
South	6.6300	30.0000	0.5700	0.7000	1.0000	71.4250 (82)
West	1.9500	30.6054	0.5700	0.7000	1.0000	21.4313 (82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.4795	43.6035	43.6035	43.7794	43.7794	44.0448	43.9946	43.8898	43.9946	43.8898	43.8898	43.6635
alpha	3.8986	3.9069	3.9069	3.9186	3.9186	3.9363	3.9330	3.9260	3.9330	3.9260	3.9260	3.9109
util living area	0.9878	0.9789	0.9471	0.8433	0.6537	0.4048	0.2260	0.2596	0.6065	0.8973	0.9755	0.9901 (86)
MIT	19.8534	19.9922	20.2916	20.6510	20.8657	20.9362	20.9444	20.9439	20.9022	20.6217	20.1788	19.8244 (87)
Th 2	19.6154	19.6187	19.6187	19.6234	19.6234	19.6305	19.6292	19.6264	19.6292	19.6264	19.6264	19.6203 (88)
util rest of house	0.9833	0.9712	0.9274	0.7899	0.5554	0.2826	0.0915	0.1114	0.4680	0.8456	0.9646	0.9864 (89)
MIT 2	18.1571	18.3588	18.7813	19.2557	19.4894	19.5475	19.5486	19.5456	19.5299	19.2404	18.6355	18.1189 (90)
Living area fraction									fLA = Living area / (4) =			0.3169 (91)
MIT	18.6946	18.8764	19.2599	19.6978	19.9256	19.9876	19.9909	19.9887	19.9648	19.6781	19.1246	18.6594 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6946	18.8764	19.2599	19.6978	19.9256	19.9876	19.9909	19.9887	19.9648	19.6781	19.1246	18.6594 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9791	0.9656	0.9210	0.7932	0.5785	0.3151	0.1271	0.1507	0.5043	0.8480	0.9592	0.9827 (94)
Useful gains	766.9214	862.9197	974.7147	1023.1871	819.0724	469.7363	180.5117	194.6079	559.6228	764.1415	751.1235	723.5555 (95)
Ext temp.	5.7000	6.2000	8.0000	10.6000	13.7000	16.6000	18.7000	18.6000	15.8000	12.3000	8.6000	5.7000 (96)
Heat loss rate W	1839.0779	1788.9367	1589.0354	1278.7591	875.0416	473.2787	180.5590	194.7062	582.5230	1034.4314	1475.5777	1826.3559 (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	797.6844	622.2835	457.0546	184.0118	41.6411	0.0000	0.0000	0.0000	0.0000	201.0957	521.6070	820.4835 (98)

FULL SAP CALCULATION PRINTOUT

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Space heating
Space heating per m2 (98) / (4) = 3645.8617 (98)
41.1450 (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.	5.7000	6.2000	8.0000	10.6000	13.7000	16.6000	18.7000	18.6000	15.8000	12.3000	8.6000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1033.8487	741.3049	757.0947	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9218	0.9657	0.9508	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	952.9587	715.8813	719.8290	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1549.9017	1476.2774	1339.7548	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	429.7989	565.7347	461.2248	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	429.7989	565.7347	461.2248	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =				1456.7584 (104)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	107.4497	141.4337	115.3062	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	107.4497	141.4337	115.3062	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2												364.1896 (107)	
												4.1100 (108)	

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 %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3645.8617 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)													5.3375 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	797.6844	622.2835	457.0546	184.0118	41.6411	0.0000	0.0000	0.0000	0.0000	201.0957	521.6070	820.4835	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	797.6844	622.2835	457.0546	184.0118	41.6411	0.0000	0.0000	0.0000	0.0000	201.0957	521.6070	820.4835	(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	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	131.8837	115.9144	122.1890	111.8056	110.6695	100.0604	98.2967	106.7254	106.1317	117.5510	121.9160	128.7710	(219)
Water heating fuel used												1371.9144	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	20.1311	26.4981	21.6030	0.0000	0.0000	0.0000	0.0000	(221)
Cooling												68.2322	(221)
Annual totals kWh/year													
Space heating fuel - main system												3645.8617	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.3481	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 4.00 * 966 * 1.00) =												-3090.5973	(233)
Total delivered energy for all uses												2367.7592	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.00*35.09 + 1.00*14.87)	3645.8617	14.8700	542.1396	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.1184	(243)
Low-rate fraction			0.8816	(244)
High-rate cost	162.4330	35.0900	56.9977	(245)
Low-rate cost	1209.4814	14.8700	179.8499	(246)
Space cooling (0.90*35.09 + 0.10*14.87)	68.2322	33.0680	22.5630	(248)
Pumps and fans for heating (0.90*35.09 + 0.10*14.87)	0.0000	0.0000	0.0000	(249)
Energy for lighting (0.90*35.09 + 0.10*14.87)	372.3481	33.0680	123.1281	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*35.09 + 0.10*14.87)	0.0000	0.0000	0.0000	(252)
Total energy cost			924.6784	(255)

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3645.8617	0.5190	1892.2022 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	1371.9144	0.5190	712.0236 (264)
Space and water heating			2604.2258 (265)
Space cooling	68.2322	0.5190	35.4125 (266)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	372.3481	0.5190	193.2487 (268)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	-3090.5973	0.5190	-1604.0200 (269)
Total kg/year			1228.8670 (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	3645.8617	3.0700	11192.7955 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	1371.9144	3.0700	4211.7772 (264)
Space and water heating			15404.5727 (265)
Space cooling	68.2322	3.0700	209.4730 (266)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	372.3481	3.0700	1143.1087 (268)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	-3090.5973	3.0700	-9488.1337 (269)
Primary energy kWh/year			7269.0206 (272)
Primary energy kWh/m2/year			82.0339 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 81
Current environmental impact rating: B 81

(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	+ 1.8	-£ 110	-368 kg (30.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£110	4.16 kg/m²	B 83 B 85
Total Savings	£110	4.16 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 85

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):
Current Potential Saving

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Electricity	£925	£815	£110
Space heating	£542	£547	-£5
Space cooling	£23	£22	£0
Water heating	£237	£122	£114
Lighting	£123	£123	£0
Total cost of fuels	£925	£815	£110
Total cost of uses	£925	£814	£109
Delivered energy	27 kWh/m ²	19 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.4 tonnes
CO2 emissions per m ²	14 kg/m ²	10 kg/m ²	4 kg/m ²
Primary energy	82 kWh/m ²	57 kWh/m ²	25 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1270 (8)
Pressure test					Yes
Measured/design AP50					4.9300
Infiltration rate					0.3735 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3175 (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	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731 (22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696 (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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.3472	45.0992	44.8562	43.7146	43.5010	42.5067	42.5067	42.3226	42.8897	43.5010	43.9331	44.3848 (38)
Heat transfer coeff	143.5808	143.3328	143.0898	141.9482	141.7346	140.7404	140.7404	140.5562	141.1233	141.7346	142.1667	142.6184 (39)
Average = Sum(39)m / 12 =												141.9472 (39)
HLP	1.6204	1.6176	1.6148	1.6019	1.5995	1.5883	1.5883	1.5862	1.5926	1.5995	1.6044	1.6095 (40)
HLP (average)												1.6019 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)												Total = Sum(45)m = 1511.9886 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)

Water storage loss:													190.0000 (47)
Store volume													
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0115 (51)
Volume factor from Table 2a													0.8580 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.1295 (55)
Total storage loss													
	35.0134	31.6250	35.0134	33.8840	35.0134	33.8840	35.0134	35.0134	33.8840	35.0134	33.8840	35.0134	(56)
If cylinder contains dedicated solar storage													
	21.1923	19.1415	21.1923	20.5087	21.1923	20.5087	21.1923	21.1923	20.5087	21.1923	20.5087	21.1923	(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)
Total heat required for water heating calculated for each month													
	177.9532	156.2455	162.6715	143.8536	139.5447	122.6378	115.8300	129.7904	130.4038	149.2645	160.3095	173.0069	(62)
WWHRS	-54.7856	-48.2038	-49.1985	-40.4830	-37.5913	-31.0124	-26.2494	-31.7810	-32.7070	-40.4295	-46.8283	-52.9519	eq. (G10)
Total of WWHRS savings													-492.2216
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													1.7784 (H8)
Utilisation factor													0.4301 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													109.5000 (H13)
Daily hot water demand													96.0975 (H14)
Volume ratio Veff/V													1.1395 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-685.8698 (H17)
Solar input	-19.8889	-33.1888	-56.5243	-75.7537	-93.5873	-92.0112	-90.7953	-79.3283	-62.1300	-42.4274	-23.5910	-16.6436	(63)
													-685.8698 (63)
Output from w/h													
	103.2788	74.8530	56.9487	27.6170	8.3661	0.0000	0.0000	18.6811	35.5668	66.4075	89.8901	103.4114	(64)
													585.0205 (64)
Heat gains from water heating, kWh/month													
	69.0769	60.9003	63.9957	57.4192	56.3060	50.3649	48.4209	53.0627	52.9471	59.5379	62.8907	67.4322	(65)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.8572	42.9314	43.0043	43.3501	43.4154	43.7222	43.7222	43.7794	43.6035	43.4154	43.2835	43.1464
alpha	3.8571	3.8621	3.8670	3.8900	3.8944	3.9148	3.9148	3.9186	3.9069	3.8944	3.8856	3.8764
util living area	0.9921	0.9844	0.9628	0.8987	0.7689	0.5936	0.4495	0.5142	0.7685	0.9448	0.9859	0.9936 (86)
MIT	19.6557	19.8247	20.1152	20.4825	20.7594	20.8952	20.9317	20.9232	20.8087	20.4266	19.9713	19.6232 (87)
Th 2	19.5984	19.6005	19.6025	19.6119	19.6137	19.6219	19.6219	19.6234	19.6187	19.6137	19.6101	19.6064 (88)
util rest of house	0.9893	0.9790	0.9498	0.8640	0.6973	0.4836	0.3148	0.3712	0.6680	0.9180	0.9800	0.9914 (89)
MIT 2	17.8574	18.1032	18.5199	19.0301	19.3712	19.5130	19.5372	19.5355	19.4422	18.9729	18.3251	17.8158 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.3169 (91)

MIT	18.4273	18.6487	19.0254	19.4903	19.8111	19.9510	19.9792	19.9752	19.8753	19.4336	18.8468	18.3886 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4273	18.6487	19.0254	19.4903	19.8111	19.9510	19.9792	19.9752	19.8753	19.4336	18.8468	18.3886 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9860	0.9741	0.9428	0.8604	0.7086	0.5114	0.3507	0.4094	0.6892	0.9136	0.9756	0.9886 (94)
Useful gains	743.8395	865.9946	993.5203	1079.8895	997.2154	721.5998	470.2441	492.8475	717.8961	786.3562	725.9100	704.0941 (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	2028.4043	1970.6462	1792.2613	1503.2765	1149.6290	753.0975	475.5829	502.5219	815.0260	1252.0248	1670.0000	2023.5525 (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	955.7162	742.3258	594.2633	304.8387	113.3957	0.0000	0.0000	0.0000	0.0000	346.4574	679.7448	981.6771 (98)
Space heating												4718.4190 (98)
Space heating per m2										(98) / (4) =		53.2493 (99)

[illegible][illegible]

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (0.00*15.29 + 1.00*5.50)	4718.4190	5.5000	259.5130 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (electric off-peak tariff)			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

High-rate fraction			0.1648 (243)
Low-rate fraction			0.8352 (244)
High-rate cost			14.7405 (245)
Low-rate cost	96.4061	15.2900	26.8738 (246)
Space cooling (0.90*15.29 + 0.10*5.50)	488.6144	5.5000	5.7228 (248)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	39.9890	14.3110	0.0000 (249)
Pump for solar water heating	0.0000	0.0000	7.1555 (249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	50.0000	14.3110	53.2867 (250)
Additional standing charges	372.3481	14.3110	24.0000 (251)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	0.0000	0.0000	0.0000 (252)
Total energy cost			391.2924 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2300 (257)
SAP value		82.8412
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	4718.4190	0.5190	2448.8595 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	585.0205	0.5190	303.6256 (264)
Space and water heating			2752.4851 (265)
Space cooling	39.9890	0.5190	20.7543 (266)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	372.3481	0.5190	193.2487 (268)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	-2905.1336	0.5190	-1507.7643 (269)
Total kg/year			1484.6737 (272)
CO ₂ emissions per m ²			16.7600 (273)
EI value			85.1099
EI rating			85 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.5000 (1b)	x 2.5700 (2b)	= 158.0550 (1b) - (3b)
First floor	27.1100 (1c)	x 2.8800 (2c)	= 78.0768 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.1318 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1270 (8)
Pressure test					Yes
Measured/design AP50					4.9300
Infiltration rate					0.3735 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3175 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.2000	3.3000	3.5000	3.3000	3.5000	3.5000	3.9000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8000	0.8250	0.8750	0.8250	0.8750	0.8750	0.9750 (22a)
Adj infilt rate	0.3334	0.3175	0.3175	0.2937	0.2937	0.2540	0.2620	0.2778	0.2620	0.2778	0.2778	0.3096 (22b)
Effective ac	0.5556	0.5504	0.5504	0.5431	0.5431	0.5323	0.5343	0.5386	0.5343	0.5386	0.5386	0.5479 (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
External door			1.9000	1.4000	2.6600		(26a)
Triple glazed window (Uw = 1.10)			13.5800	1.0536	14.3084		(27)
Walk-able Roof light (Uw = 1.20)			6.6300	1.1450	7.5916		(27a)
Roof Light (Uw = 1.10)			1.9500	1.0536	2.0546		(27a)
Heat Loss Floor 1			61.5000	0.0900	5.5350		(28a)
External Wall 1	99.9200	15.4800	84.4400	0.1800	15.1992		(29a)
Zinc Roof Warm	42.8400	1.9500	40.8900	0.1100	4.4979		(30)
Flat roof Warm	47.2200	6.6300	40.5900	0.1100	4.4649		(30)
Total net area of external elements Aum(A, m ²)			251.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3116		(33)
Party Wall 1			43.0500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							41.9220 (36)
Total fabric heat loss						(33) + (36) =	98.2336 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	43.2923	42.8897	42.8897	42.3226	42.3226	41.4756	41.6352	41.9691	41.6352	41.9691	41.9691	42.6958 (38)
Heat transfer coeff	141.5260	141.1233	141.1233	140.5562	140.5562	139.7093	139.8689	140.2027	139.8689	140.2027	140.2027	140.9294 (39)
Average = Sum(39)m / 12 =												140.4891 (39)
HLP	1.5972	1.5926	1.5926	1.5862	1.5862	1.5767	1.5785	1.5822	1.5785	1.5822	1.5822	1.5904 (40)
HLP (average)												1.5855 (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												2.6062 (42)
Average daily hot water use (litres/day)												96.0975 (43)
Daily hot water use	105.7073	101.8634	98.0195	94.1756	90.3317	86.4878	86.4878	90.3317	94.1756	98.0195	101.8634	105.7073 (44)
Energy conte	156.7609	137.1041	141.4791	123.3449	118.3524	102.1291	94.6376	108.5981	109.8951	128.0721	139.8007	151.8145 (45)
Energy content (annual)										Total = Sum(45)m =		1511.9886 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5141	20.5656	21.2219	18.5017	17.7529	15.3194	14.1956	16.2897	16.4843	19.2108	20.9701	22.7722 (46)

Water storage loss:												
Store volume												190.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8580 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.1295 (55)
Total storage loss												
	35.0134	31.6250	35.0134	33.8840	35.0134	33.8840	35.0134	35.0134	33.8840	35.0134	33.8840	35.0134 (56)
If cylinder contains dedicated solar storage												
	21.1923	19.1415	21.1923	20.5087	21.1923	20.5087	21.1923	21.1923	20.5087	21.1923	20.5087	21.1923 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month												
	177.9532	156.2455	162.6715	143.8536	139.5447	122.6378	115.8300	129.7904	130.4038	149.2645	160.3095	173.0069 (62)
WWHRS	-54.7856	-48.2038	-49.1985	-40.4830	-37.5913	-31.0124	-26.2494	-31.7810	-32.7070	-40.4295	-46.8283	-52.9519 eq.(G10)
Total of WWHRS savings												-492.2216
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												1133.3053 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1903.9528 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.8670 (H8)
Utilisation factor												0.4147 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												96.0975 (H14)
Volume ratio Veff/V												1.1395 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-694.2380 (H17)
Solar input	-21.4640	-31.1119	-53.2412	-74.6739	-89.1380	-94.4115	-93.4555	-83.5111	-65.2969	-44.0605	-26.0908	-17.7826 (63)
												-694.2380 (63)
								Solar input (sum of months) = Sum(63)m =				
Output from w/h												
	101.7036	76.9299	60.2318	28.6968	12.8155	0.0000	0.0000	14.4983	32.3999	64.7744	87.3903	102.2724 (64)
								Total per year (kW/year) = Sum(64)m =				581.7128 (64)
Heat gains from water heating, kWh/month												
	69.0769	60.9003	63.9957	57.4192	56.3060	50.3649	48.4209	53.0627	52.9471	59.5379	62.8907	67.4322 (65)

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	43.4795	43.6035	43.6035	43.7794	43.7794	44.0448	43.9946	43.8898	43.9946	43.8898	43.8898	43.6635
alpha	3.8986	3.9069	3.9069	3.9186	3.9186	3.9363	3.9330	3.9260	3.9330	3.9260	3.9260	3.9109
util living area												
	0.9883	0.9796	0.9485	0.8458	0.6568	0.4072	0.2275	0.2615	0.6105	0.9000	0.9764	0.9905 (86)
MIT	19.8465	19.9855	20.2858	20.6473	20.8644	20.9361	20.9444	20.9439	20.9012	20.6170	20.1722	19.8174 (87)
Th 2	19.6154	19.6187	19.6187	19.6234	19.6234	19.6305	19.6292	19.6264	19.6292	19.6264	19.6264	19.6203 (88)
util rest of house												
	0.9839	0.9721	0.9292	0.7928	0.5585	0.2843	0.0921	0.1122	0.4716	0.8491	0.9659	0.9869 (89)
MIT 2	18.1471	18.3493	18.7734	19.2515	19.4884	19.5475	19.5486	19.5456	19.5294	19.2349	18.6263	18.1088 (90)
Living area fraction												
									fLA = Living area / (4) =			0.3169 (91)

MIT	18.6856	18.8678	19.2527	19.6938	19.9244	19.9875	19.9909	19.9887	19.9641	19.6729	19.1162	18.6502 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6856	18.8678	19.2527	19.6938	19.9244	19.9875	19.9909	19.9887	19.9641	19.6729	19.1162	18.6502 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9798	0.9666	0.9227	0.7960	0.5816	0.3170	0.1279	0.1518	0.5080	0.8512	0.9606	0.9834 (94)
Unsup. gains	758.3291	854.7804	967.9037	1019.2647	817.9007	469.6445	180.5099	194.6039	558.9478	759.1182	743.1910	714.8374 (95)
Ext temp.	5.7000	6.2000	8.0000	10.6000	13.7000	16.6000	18.7000	18.6000	15.8000	12.3000	8.6000	5.7000 (96)
Heat loss rate W	1837.7984	1787.7204	1588.0137	1278.1930	874.8830	473.2651	180.5583	194.7050	582.4305	1033.6968	1474.3969	1825.0645 (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	803.1252	626.9357	461.3619	186.4284	42.3948	0.0000	0.0000	0.0000	0.0000	204.2865	526.4682	826.0089 (98)
Space heating												3677.0096 (98)
Space heating per m2											(98) / (4) =	41.4966 (99)

[illegible]

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 %)	100.0000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3677.0096 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)	5.3375 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	803.1252	626.9357	461.3619	186.4284	42.3948	0.0000	0.0000	0.0000	0.0000	204.2865	526.4682	826.0089	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	803.1252	626.9357	461.3619	186.4284	42.3948	0.0000	0.0000	0.0000	0.0000	204.2865	526.4682	826.0089	(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	101.7036	76.9299	60.2318	28.6968	12.8155	0.0000	0.0000	14.4983	32.3999	64.7744	87.3903	102.2724	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	101.7036	76.9299	60.2318	28.6968	12.8155	0.0000	0.0000	14.4983	32.3999	64.7744	87.3903	102.2724	(219)
Water heating fuel used (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	19.8601	26.1891	21.3035	0.0000	0.0000	0.0000	0.0000	(221)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	19.8601	26.1891	21.3035	0.0000	0.0000	0.0000	0.0000	(221)
Cooling													(221)
Annual totals kWh/year													(221)
Space heating fuel - main system												3677.0096	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												50.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.3481	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 4.00 * 966 * 1.00) =												-3090.5973	(233)
Total delivered energy for all uses												1657.8259	(238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (0.00*35.09 + 1.00*14.87)	3677.0096	14.8700	546.7713 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (electric off-peak tariff)			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

High-rate fraction			0.1648 (243)
Low-rate fraction			0.8352 (244)
High-rate cost	95.8610	35.0900	33.6376 (245)
Low-rate cost	485.8518	14.8700	72.2462 (246)
Space cooling (0.90*35.09 + 0.10*14.87)	67.3527	33.0680	22.2722 (248)
Pumps and fans for heating (0.90*35.09 + 0.10*14.87)	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	33.0680	16.5340 (249)
Energy for lighting (0.90*35.09 + 0.10*14.87)	372.3481	33.0680	123.1281 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	0.0000	0.0000	0.0000 (252)
Total energy cost			814.5894 (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	3677.0096	0.5190	1908.3680 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	581.7128	0.5190	301.9089 (264)
Space and water heating			2210.2769 (265)
Space cooling	67.3527	0.5190	34.9561 (266)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	372.3481	0.5190	193.2487 (268)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	-3090.5973	0.5190	-1604.0200 (269)
Total kg/year			860.4116 (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	3677.0096	3.0700	11288.4194 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	581.7128	3.0700	1785.8582 (264)
Space and water heating			13074.2777 (265)
Space cooling	67.3527	3.0700	206.7729 (266)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	372.3481	3.0700	1143.1087 (268)
Energy saving/generation technologies			
PV Unit (0.90*35.09 + 0.10*14.87)	-3090.5973	3.0700	-9488.1337 (269)
Primary energy kWh/year			5089.5255 (272)
Primary energy kWh/m2/year			57.4374 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	311.69 (P1)
Transmission heat loss coefficient	98.23 (37)
Summer heat loss coefficient	409.93 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
South	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs
North	0.999	0.90	1.000
South	0.999	0.90	1.000
South	1.000	1.00	1.000
West	0.999	1.00	1.000
			Z summer
			0.899 (P8)
			0.899 (P8)
			1.000 (P8)
			0.999 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

North	10.5800	81.1852	0.5700	0.7000	0.8989	277.2674
South	3.0000	112.2060	0.5700	0.7000	0.8989	108.6610
South	6.6300	203.0000	0.5700	0.7000	1.0000	483.3091
West	1.9500	197.1775	0.5700	0.7000	0.9988	137.9069
total:						1007.1444
Solar gains		Jun	Jul	Aug		
Internal gains		1077	1007	862		(P3)
Total summer gains		483	464	472		
		1559	1471	1334		(P5)
Summer gain/loss ratio		3.80	3.59	3.26		(P6)
Summer external temperature		16.00	17.90	17.80		
Thermal mass temperature increment (TMP = 250.0)		0.25	0.25	0.25		
Threshold temperature		20.05	21.74	21.31		(P7)
Likelihood of high internal temperature		Not significant	Slight	Slight		
Assessment of likelihood of high internal temperature:		Slight				

U-VALUE CALCULATOR REPORT

Property Reference	000009-1	Issued on Date	26/08/2024
Assessment Reference	002	Prop Type Ref	Forest Gate Part L1a
Project	3, Belford House, 53 Hampton Road, Forest Gate, E7 0PD		
Calculation Type	New Build (As Designed)		

SAP Rating	81 B	DER	24.96	TER	33.19
Environmental	81 B	% DER<TER	24.79		
CO ₂ Emissions (t/year)	1.23	DFEE	66.55	TFEE	78.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		

Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk	Assessor ID	D226-0001
Client	Cheryl Simmonds, Forest Gate		

Building Elements

Roof 000002 - Flat roof Warm

Roof Type: Flat Roof standard (no precipitation)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Felt				
	Main construction	7	0.0300	0.2333	100.00
Layer 2	Plywood				
	Main construction	22	0.1300	0.1692	100.00
Layer 3	airspace/timber battens				
	Main construction	22	0.1222	0.1800	89.63
	Main construction	22	0.1375	0.1600	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Sarking felt				
	Main construction	0.5	0.2300	0.0022	100.00
Layer 5	Thermarroof TR27 (*80mm-119mm)				
	Main construction	110	0.0250	4.4000	91.67
	Main construction	110	0.1300	0.8462	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Thermarroof TR27 (120mm +)				
	Main construction	130	0.0240	5.4167	97.50
	Main construction	130	0.1300	1.0000	2.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	97.50
	Main construction	12.5	0.1300	0.0962	2.50
Layer 8	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 9.973 m ² K/W	Lower limit = 8.927 m ² K/W	Average = 9.450 m ² K/W
	Total correction = 0.0039 m ² K/W	U-value (unrounded) = 0.11 W/m ² K	

Unheated space: None

Total thickness: 307 mm

U-value: 0.11 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	000009-1	Issued on Date	26/08/2024
Assessment Reference	002	Prop Type Ref	Forest Gate Part L1a
Project	3, Belford House, 53 Hampton Road, Forest Gate, E7 OPD		
Calculation Type	New Build (As Designed)		

SAP Rating	81 B	DER	24.96	TER	33.19
Environmental	81 B	% DER<TER	24.79		
CO ₂ Emissions (t/year)	1.23	DFEE	66.55	TFEE	78.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		

Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk	Assessor ID	D226-0001
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Client	Cheryl Simmonds, Forest Gate
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Building Elements

Roof 000004 - Flat roof Warm

Roof Type: Flat Roof standard (no precipitation)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Felt				
	Main construction	7	0.0300	0.2333	100.00
Layer 2	Plywood				
	Main construction	22	0.1300	0.1692	100.00
Layer 3	airspace/timber battens				
	Main construction	22	0.1222	0.1800	89.63
	Main construction	22	0.1375	0.1600	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Sarking felt				
	Main construction	0.5	0.2300	0.0022	100.00
Layer 5	Thermarroof TR27 (*80mm-119mm)				
	Main construction	110	0.0250	4.4000	91.67
	Main construction	110	0.1300	0.8462	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Thermarroof TR27 (120mm +)				
	Main construction	130	0.0240	5.4167	97.50
	Main construction	130	0.1300	1.0000	2.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	97.50
	Main construction	12.5	0.1300	0.0962	2.50
Layer 8	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 9.973 m ² K/W	Lower limit = 8.927 m ² K/W	Average = 9.450 m ² K/W
	Total correction = 0.0039 m ² K/W	U-value (unrounded) = 0.11 W/m ² K	

Unheated space: None

Total thickness: 307 mm

U-value: 0.11 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	000009-1	Issued on Date	26/08/2024
Assessment Reference	002	Prop Type Ref	Forest Gate Part L1a
Project	3, Belford House, 53 Hampton Road, Forest Gate, E7 0PD		
Calculation Type	New Build (As Designed)		

SAP Rating	81 B	DER	24.96	TER	33.19
Environmental	81 B	% DER<TER	24.79		
CO ₂ Emissions (t/year)	1.23	DFEE	66.55	TFEE	78.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		

Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk	Assessor ID	D226-0001
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Client	Cheryl Simmonds, Forest Gate
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Building Elements

Wall 000003 - Masonry wall cavity Insulation Boards

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf (smeed Deen mile End Mixture)				
	Main construction	102	0.7700	0.1325	100.00
Layer 2	Standard cavity				
	Main construction	50	0.2778	0.1800	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Kooltherm K8 Cavity Board (100)				
	Main construction	100	0.0200	5.0000	100.00
	Corrections - Air Gap: Level 1, Fasteners: Wall ties, Cross sectional area: 0.00 mm ² , Lambda: 0.000 W/m.K, per m ² : 2.500				
Layer 4	Blockwork, medium				
	Main construction	100	0.5700	0.1754	93.43
	Main construction	100	0.8803	0.1136	6.57
Layer 5	airspace, dot and dab				
	Main construction	22	0.1220	0.1803	88.20
	Main construction	22	0.1302	0.1690	11.80
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard (standard wallboard)				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 7	Plaster skim finish				
	Main construction	3	0.1800	0.0167	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 5.909 m ² K/W	Lower limit = 5.907 m ² K/W	Average = 5.908 m ² K/W
	Total correction = 0.0072 m ² K/W	U-value (unrounded) = 0.18 W/m ² K	

Unheated space: None

Total thickness: 390 mm

U-value: 0.18 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	000009-1	Issued on Date	26/08/2024
Assessment Reference	002	Prop Type Ref	Forest Gate Part L1a
Project	3, Belford House, 53 Hampton Road, Forest Gate, E7 0PD		
Calculation Type	New Build (As Designed)		

SAP Rating	81 B	DER	24.96	TER	33.19
Environmental	81 B	% DER<TER	24.79		
CO ₂ Emissions (t/year)	1.23	DFEE	66.55	TFEE	78.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		

Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk	Assessor ID	D226-0001
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Client	Cheryl Simmonds, Forest Gate
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Building Elements

Floor 000001 - floor - slab-on-ground floor

Floor Type: Slab On Ground Floor

Area = 61.50 m², Perimeter = 30.14 m, Wall thickness = 300.00 mm, Soil: Clay

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Concrete, reinforced (2% steel)				
	Main construction	200	2.5000	0.0800	100.00
Layer 2	1200g Visqueen DPM				
	Main construction	1	0.0000	0.0000	100.00
Layer 3	Thermafloor TF70 zero ODP				
	Main construction	100	0.0220	4.5455	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Thermafloor TF70 zero ODP				
	Main construction	100	0.0220	4.5455	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	1000g VCL				
	Main construction	1	0.0000	0.0000	100.00
Layer 6	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 9.236 m² K/W Lower limit = 9.236 m² K/W Average = 9.236 m² K/W

Total correction = 0.0048 m² K/W

U-value (unrounded) = 0.09 W/m² K

Unheated space: None

Total thickness: 477 mm

U-value: 0.09 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	000009-1	Issued on Date	26/08/2024
Assessment Reference	002	Prop Type Ref	Forest Gate Part L1a
Property	3, Belford House, 53 Hampton Road, Forest Gate, E7 OPD		
SAP Rating	81 B	DER	24.96
Environmental	81 B	TER	33.19
CO ₂ Emissions (t/year)	1.23	% DER<TER	24.79
General Requirements Compliance	Pass	DfEE	66.55
		TFEE	78.82
		% DfEE<TFEE	15.57
Assessor Details	Mr. Iftikhar Ahmed, Iftikhar Ahmed, Tel: 01706 662 700, ifty@energynational.co.uk		Assessor ID
			D226-0001
Client	Cheryl Simmonds, Forest Gate		

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

Orientation	South			
Property Tenure	Unknown			
Transaction Type	New dwelling			
Terrain Type	Suburban			
1.0 Property Type	House, Semi-Detached			
2.0 Number of Storeys	2			
3.0 Date Built	2022			
4.0 Sheltered Sides	2			
5.0 Sunlight/Shade	Average or unknown			
6.0 Measurements				
	Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	30.14 m	61.50 m²	2.57 m
		14.99 m	27.11 m²	2.88 m
7.0 Living Area	28.08		m²	
8.0 Thermal Mass Parameter	Simple calculation - Medium			
Thermal Mass	250.00		kJ/m²K	
9.0 External Walls				
Description	Type		U-Value (W/m²K)	Gross Area (m²)
				Nett Area (m²)
External Wall 1	Cavity Wall		0.18	99.92
				84.44
9.1 Party Walls				
Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	43.05
10.0 External Roofs				
Description	Type		U-Value (W/m²K)	Gross Area (m²)
				Nett Area (m²)
Zinc Roof Warm	External Slope Roof		0.11	42.84
Flat roof Warm	External Flat Roof		0.11	47.22
				40.59
11.0 Heat Loss Floors				
Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid		0.09	61.50

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External door	Manufacture r	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Triple glazed window	Manufacture r	Window	Triple Low-E Soft 0.05			0.57		0.70	1.10
Walk-able Roof light	Manufacture r	Roof Window	Triple Low-E Soft 0.05			0.57		0.70	1.20
Roof Light	Manufacture r	Roof Window	Triple Low-E Soft 0.05			0.57		0.70	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Window	[1] External Wall 1	North	Dark-coloured venetian blind	0.00					2.73	1
Opening 2	Window	[1] External Wall 1	North	Dark-coloured venetian blind	0.00					7.85	1
Opening 3	Window	[1] External Wall 1	South	Dark-coloured venetian blind	0.00					1.40	1
Opening 4	Window	[1] External Wall 1	South	Dark-coloured venetian blind	0.00					1.60	1
Opening 5	Half Glazed Door	[1] External Wall 1	South							1.90	
Opening 6	Roof Window	[1] Zinc Roof Warm	West	Dark-coloured venetian blind						1.95	1
Opening 7	Roof Window	[2] Flat roof Warm	South	None						3.18	
Opening 8	Roof Window	[2] Flat roof Warm	South	None						1.25	
Opening 9	Roof Window	[2] Flat roof Warm	South	None						1.25	
Opening 10	Roof Window	[2] Flat roof Warm	South	None						0.95	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E1 Steel lintel with perforated steel base plate	8.52	0.500	No
Table K1 - Approved	E3 Sill	3.03	0.040	No
Table K1 - Approved	E4 Jamb	26.10	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	30.14	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	14.94	0.070	No
Table K1 - Default	E15 Flat roof with parapet	45.13	0.560	No
Table K1 - Approved	E16 Corner (normal)	18.92	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	8.02	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	10.90	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	7.90	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.90	0.000	No
Table K1 - Default	R1 Head of roof window	4.29	0.080	No
Table K1 - Default	R2 Sill of roof window	4.29	0.060	No
Table K1 - Default	R3 Jamb of roof window	19.94	0.080	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Y-value	0.167	W/m ² K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	4.93	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation	
Summer Overheating	
Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	4.00
Mechanical Ventilation	
Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues				
	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	Yes	
Cooled Area	88.61	m ²
Data Source	Manufacturer	
Cooling Type	Split or Multi-Split	
Energy Efficiency Ratio	4.27	
System Control	On/Off	

22.0 Lighting	
Internal	
Total number of light fittings	11
Total number of L.E.L. fittings	11
Percentage of L.E.L. fittings	100.00
External	
External lights fitted	No

23.0 Electricity Tariff	7 Hour Off Peak
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24.0 Main Heating 1	SAP table	
Description	Storage Heaters	
Percentage of Heat	100	%
Main Heating	SEK	
SAP Code	409	
Efficiency (SAP Table)	100.0	%
Controls	CSD Controls for high heat retention storage heaters	
Sap Code	2404	

25.0 Main Heating 2	None
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SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Community Heating	None
28.0 Water Heating	HEI Immersion
Water Heating	Independent
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	Yes
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	903
Immersion Heater	Dual

28.2 Waste Water Heat Recovery System

Total rooms with shower and/or bath 2

Instantaneous System 1

Database ID	80182
Brand Model	Showersave, Blue QB1-21D
Details	Year: 2020 + current Efficiency: 69.7 Utilisation factor: 0.952
Number of mixer showers in rooms with a bath	1
Number of mixer showers in rooms without a bath	1

29.0 Hot Water Cylinder	Hot Water Cylinder
Cylinder In Heated Space	Yes
Insulation Type	Foam
Insulation Thickness	80 mm
Cylinder Volume	150.00 L

32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
4.00	West	30°	None Or Little	No

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	£110	B 83	