



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Stapleton Long

Project: 9 Lansdowne Place
London , SE19 2UQ

Contact: Edwin Egbonu
Stansted Environmental Services
Edwin@sestesting.com

Report Issue Date: 14/03/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	109 Church Road		Issued on Date	14/03/2024	
Assessment Reference	EPC	Prop Type Ref	109 Church Road		
Property	9 Lansdowne Place, London , SE19 2UQ				
SAP Rating	81 B	DER	21.36	TER	26.64
Environmental	85 B	% DER<TER	19.81		
CO ₂ Emissions (t/year)	0.88	DFEE	53.61	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.77		
Assessor Details	Mr. Edwin Egbuonu, Stansted Environmental Services Limited, Tel: 01279873380, edwin@sestesting.com			Assessor ID	p721-0001
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	26.64	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.36	kgCO ₂ /m ²	Pass
	-5.28 (-19.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.29	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	53.61	kWh/m ² /yr	
	-2.7 (-4.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (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	4.66 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Electric Direct-acting boiler		
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This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

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 East

5.43 m², No overhang

Windows facing West

10.43 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.66 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.12

W/m²K

Photovoltaic array

4.73

kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	109 Church Road	Issued on Date	14/03/2024
Assessment Reference	EPC	Prop Type Ref	109 Church Road
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Environmental	85 B	% DER<TER	19.81		
CO ₂ Emissions (t/year)	0.88	DFEE	53.61	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.77		

Assessor Details	Mr. Edwin Egbunu, Stansted Environmental Services Limited, Tel: 01279873380, edwin@sestesting.com	Assessor ID	p721-0001
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Client	
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Table K1 - Approved	0.500	11.29	5.65	
External wall	E3 Sill	Table K1 - Approved	0.040	10.44	0.42	
External wall	E4 Jamb	Table K1 - Approved	0.050	19.60	0.98	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	28.20	4.51	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	28.20	1.97	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.98	0.60	
External wall	E12 Gable (insulation at ceiling level)	Table K1 - Approved	0.240	8.98	2.16	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	20.40	1.84	

Total: **18.12** W/mK:
 Y-Value: **0.080** W/m²K:

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 90 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) 26.64 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 21.36 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)53.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (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: 4.66 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Electric
Direct-acting boiler

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

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 East: 5.43 m², No overhang
Windows facing West: 10.43 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.12 W/m²K
Photovoltaic array 4.73 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.2175 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.4505 (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) =	0.3829 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4882	0.4786	0.4691	0.4212	0.4116	0.3638	0.3638	0.3542	0.3829	0.4116	0.4308	0.4499 (22b)
	0.6192	0.6145	0.6100	0.5887	0.5847	0.5662	0.5662	0.5627	0.5733	0.5847	0.5928	0.6012 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m2)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.3678	(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			18.0000	811.4400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 40158.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 445.4137 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1186 (36)
 Total fabric heat loss (33) + (36) = 73.4864 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.9764	46.6253	46.2812	44.6647	44.3623	42.9544	42.9544	42.6937	43.4967	44.3623	44.9741	45.6137 (38)
Average = Sum(39)m / 12 =	120.4628	120.1117	119.7675	118.1511	117.8487	116.4408	116.4408	116.1801	116.9831	117.8487	118.4605	119.1001 (39)
												118.1496 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3361	1.3322	1.3284	1.3105	1.3071	1.2915	1.2915	1.2886	1.2975	1.3071	1.3139	1.3210 (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 2.6279 (42)
 Average daily hot water use (litres/day) 96.6127 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy content (annual)	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1520.0944 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	(59)
Total heat required for water heating calculated for each month	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Output from w/h	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(64)	
Heat gains from water heating, kWh/month	33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	(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	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8784	19.4322	15.8033	11.9641	8.9433	7.5503	8.1584	10.6046	14.2335	18.0727	21.0935	22.4865
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	239.3718	241.8557	235.5963	222.2707	205.4496	189.6401	179.0784	176.5944	182.8539	196.1794	213.0006	228.8101
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395
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
Losses e.g. evaporation (negative values) (Table 5)	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162
Water heating gains (Table 5)	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935
Total internal gains	371.6825	370.2940	357.4438	336.2525	313.7963	292.9128	279.8305	283.8015	295.1141	316.4465	340.9944	360.3086

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	5.4300	19.6403	0.7200	0.7000	0.7700	37.2487 (76)						
West	10.4300	19.6403	0.7200	0.7000	0.7700	71.5477 (80)						
Solar gains	108.7963	212.8287	350.4986	511.1813	626.4718	641.3054	610.5489	524.4525	407.6443	252.5392	135.6562	89.4688 (83)
Total gains	480.4789	583.1227	707.9424	847.4337	940.2681	934.2182	890.3794	808.2539	702.7584	568.9857	476.6507	449.7774 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9999	0.9997	0.9979	0.9813	0.8858	0.6479	0.4299	0.5004	0.8590	0.9949	0.9998	1.0000 (94)
tau	92.6024	92.8731	93.1399	94.4142	94.6565	95.8009	95.8009	96.0159	95.3569	94.6565	94.1676	93.6619
alpha	7.1735	7.1915	7.2093	7.2943	7.3104	7.3867	7.3867	7.4011	7.3571	7.3104	7.2778	7.2441
util living area	1.0000	0.9999	0.9991	0.9909	0.9356	0.7619	0.5713	0.6504	0.9319	0.9980	0.9999	1.0000 (86)
MIT	20.0344	20.1478	20.3503	20.6269	20.8632	20.9788	20.9977	20.9945	20.9036	20.5839	20.2604	20.0202 (87)
Th 2	19.8127	19.8157	19.8187	19.8326	19.8353	19.8475	19.8475	19.8498	19.8428	19.8353	19.8300	19.8244 (88)
util rest of house	1.0000	0.9998	0.9984	0.9836	0.8880	0.6439	0.4243	0.4945	0.8596	0.9958	0.9998	1.0000 (89)
MIT 2	18.9372	19.0532	19.2580	19.5429	19.7570	19.8415	19.8473	19.8491	19.7999	19.5052	19.1779	18.9331 (90)
Living area fraction									fLA = Living area / (4) =			0.1683 (91)
MIT	19.1218	19.2374	19.4418	19.7253	19.9431	20.0329	20.0408	20.0418	19.9856	19.6867	19.3601	19.1160 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9718	19.0874	19.2918	19.5753	19.7931	19.8829	19.8908	19.8918	19.8356	19.5367	19.2101	18.9660 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	480.4482	582.9510	706.4823	831.5599	832.9296	605.2524	382.7545	404.4418	603.6667	566.0654	476.5459	449.7602 (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	1767.4085	1704.0737	1532.0408	1261.2988	953.7636	615.1422	383.1856	405.6753	670.9682	1053.1764	1434.5647	1758.6323 (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	957.4984	753.3944	614.2155	309.4120	89.9005	0.0000	0.0000	0.0000	0.0000	362.4105	689.7735	973.8008 (98)
Space heating												4750.4058 (98)
Space heating per m2										(98) / (4) =		52.6886 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4750.4058 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	957.4984	753.3944	614.2155	309.4120	89.9005	0.0000	0.0000	0.0000	0.0000	362.4105	689.7735	973.8008	(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)	957.4984	753.3944	614.2155	309.4120	89.9005	0.0000	0.0000	0.0000	0.0000	362.4105	689.7735	973.8008	(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	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(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	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(219)
Water heating fuel used													1292.0802 (219)
Annual totals kWh/year													
Space heating fuel - main system													4750.4058 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													386.3791 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.01 * 908 * 0.80) =										-1748.8904			-2748.2564
PV Unit 1 (0.80 * 1.72 * 908 * 0.80) =										-999.3659			-2748.2564 (233)
Total delivered energy for all uses													3710.6088 (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	4750.4058	0.5190	2465.4606 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.0802	0.5190	670.5896 (264)
Space and water heating			3136.0503 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	386.3791	0.5190	200.5307 (268)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2748.2564	0.5190	-1426.3450 (269)
Total CO2, kg/year			1925.8060 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.3600 (273)

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

DER			21.3600 ZC1
Total Floor Area		TFA	90.1600
Assumed number of occupants		N	2.6279
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.7328 ZC2
CO2 emissions from cooking, equation (L16)			2.0194 ZC3
Total CO2 emissions			39.1122 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
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			39.1122 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1305 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3805 (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) =		0.3234 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4124	0.4043	0.3962	0.3558	0.3477	0.3072	0.3072	0.2992	0.3234	0.3477	0.3638	0.3800 (22b)
Effective ac	0.5850	0.5817	0.5785	0.5633	0.5604	0.5472	0.5472	0.5447	0.5523	0.5604	0.5662	0.5722 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			1.7900	1.0000	1.7900		(26)					
TER Opening Type (Uw = 1.40)			15.8600	1.3258	21.0265		(27)					
Heat Loss Floor 1			45.0800	0.1300	5.8604		(28a)					
External Wall 1	135.3600	17.6500	117.7100	0.1800	21.1878		(29a)					
External Roof 1	45.0800		45.0800	0.1300	5.8604		(30)					
Total net area of external elements Aum(A, m ²)			225.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.7251		(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)							9.5521 (36)					
Total fabric heat loss							(33) + (36) = 65.2772 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.3851	Feb 44.1346	Mar 43.8891	Apr 42.7359	May 42.5202	Jun 41.5158	Jul 41.5158	Aug 41.3298	Sep 41.9027	Oct 42.5202	Nov 42.9566	Dec 43.4129 (38)
Heat transfer coeff	109.6623	109.4118	109.1663	108.0131	107.7974	106.7930	106.7930	106.6070	107.1799	107.7974	108.2338	108.6902 (39)
Average = Sum(39)m / 12 =												108.0121 (39)
HLP	Jan 1.2163	Feb 1.2135	Mar 1.2108	Apr 1.1980	May 1.1956	Jun 1.1845	Jul 1.1845	Aug 1.1824	Sep 1.1888	Oct 1.1956	Nov 1.2005	Dec 1.2055 (40)
HLP (average)												1.1980 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.6279 (42)
Average daily hot water use (litres/day)												96.6127 (43)
Daily hot water use	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy conte	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Energy content (annual)												Total = Sum(45)m = 1520.0944 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.6402	20.6759	21.3356	18.6009	17.8480	15.4015	14.2717	16.3770	16.5726	19.3138	21.0825	22.8943 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.7527 (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	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	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month														
204.1962	179.9248	188.8325	169.0980	165.5818	147.7685	141.7399	155.7752	155.5761	175.3536	185.6420	199.2233	199.2233	199.2233	(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	0.0000	(63)
Output from w/h														
204.1962	179.9248	188.8325	169.0980	165.5818	147.7685	141.7399	155.7752	155.5761	175.3536	185.6420	199.2233	199.2233	199.2233	(64)
Heat gains from water heating, kWh/month														
89.6783	79.5001	84.5699	77.3055	76.8391	70.2135	68.9116	73.5784	72.8095	80.0882	82.8064	88.0249	88.0249	88.0249	(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	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8784	19.4322	15.8033	11.9641	8.9433	7.5503	8.1584	10.6046	14.2335	18.0727	21.0935	22.4865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	239.3718	241.8557	235.5963	222.2707	205.4496	189.6401	179.0784	176.5944	182.8539	196.1794	213.0006	228.8101	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	(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)	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	(71)
Water heating gains (Table 5)	120.5354	118.3037	113.6692	107.3688	103.2783	97.5187	92.6232	98.8956	101.1243	107.6454	115.0089	118.3130	(72)
Total internal gains	447.2041	445.0101	430.4874	407.0222	383.0898	360.1277	345.2785	351.5132	363.6302	387.3161	414.5215	435.0281	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	5.4300	19.6403	0.6300	0.7000	0.7700		32.5926 (76)						
West	10.4300	19.6403	0.6300	0.7000	0.7700		62.6042 (80)						
Solar gains	95.1968	186.2251	306.6863	447.2836	548.1629	561.1422	534.2303	458.8959	356.6888	220.9718	118.6992	78.2852	(83)
Total gains	542.4009	631.2353	737.1737	854.3058	931.2526	921.2699	879.5088	810.4092	720.3190	608.2879	533.2207	513.3133	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)	tau	57.0945	57.2252	57.3539	57.9662	58.0822	58.6285	58.7308	58.4168	58.0822	57.8480	57.6051	21.0000 (85)	
alpha	4.8063	4.8150	4.8236	4.8644	4.8721	4.9086	4.9086	4.9154	4.8945	4.8721	4.8565	4.8403		
util living area	0.9980	0.9954	0.9864	0.9523	0.8588	0.6885	0.5225	0.5838	0.8411	0.9761	0.9958	0.9985	(86)	
MIT	19.6722	19.8331	20.1184	20.4905	20.7905	20.9491	20.9893	20.9821	20.8617	20.4552	19.9952	19.6455	(87)	
Th 2	19.9070	19.9092	19.9114	19.9216	19.9235	19.9324	19.9324	19.9341	19.9290	19.9235	19.9196	19.9156	(88)	
util rest of house	0.9973	0.9938	0.9815	0.9344	0.8086	0.5945	0.4018	0.4591	0.7664	0.9639	0.9941	0.9979	(89)	
MIT 2	18.1424	18.3786	18.7940	19.3284	19.7216	19.8994	19.9286	19.9269	19.8188	19.2900	18.6233	18.1093	(90)	
Living area fraction	MIT	18.3998	18.6233	19.0168	19.5239	19.9015	20.0760	20.1071	20.1045	19.9943	19.4860	18.8542	18.3678	(92)
Temperature adjustment	adjusted MIT	18.3998	18.6233	19.0168	19.5239	19.9015	20.0760	20.1071	20.1045	19.9943	19.4860	18.8542	18.3678	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	540.1044	625.5585	719.3856	791.1541	751.9389	560.1759	371.2561	388.9238	555.8567	582.1764	528.6540	511.6321	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1546.2149	1501.4921	1366.4135	1147.5248	884.0959	584.8022	374.5331	394.9223	631.7495	957.8900	1272.1987	1539.9010	(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	748.5462	588.6273	481.3887	256.5869	98.3247	0.0000	0.0000	0.0000	0.0000	279.5309	535.3522	765.0320	(98)
Space heating per m2												41.6303 (99)	

8c. Space cooling requirement
Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4014.3199 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	748.5462	588.6273	481.3887	256.5869	98.3247	0.0000	0.0000	0.0000	0.0000	279.5309	535.3522	765.0320	(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)	800.5842	629.5480	514.8542	274.4245	105.1602	0.0000	0.0000	0.0000	0.0000	298.9636	572.5692	818.2161	(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	204.1962	179.9248	188.8325	169.0980	165.5818	147.7685	141.7399	155.7752	155.5761	175.3536	185.6420	199.2233	(64)
Efficiency of water heater (217)m	87.9719	87.7456	87.2055	85.9234	83.4772	79.8000	79.8000	79.8000	79.8000	86.0521	87.4798	88.0604	(216)
Fuel for water heating, kWh/month	232.1153	205.0527	216.5372	196.8009	198.3557	185.1735	177.6189	195.2070	194.9575	203.7761	212.2113	226.2347	(219)
Water heating fuel used													2444.0408 (219)
Annual totals kWh/year													
Space heating fuel - main system													4014.3199 (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)													386.3791 (232)
Total delivered energy for all uses													6919.7398 (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	4014.3199	0.2160	867.0931 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2444.0408	0.2160	527.9128 (264)
Space and water heating			1395.0059 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.3791	0.5190	200.5307 (268)
Total CO2, kg/m2/year			1634.4617 (272)
Emissions per m2 for space and water heating			15.4726 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2242 (272b)
Emissions per m2 for pumps and fans			0.4317 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4726 * 1.55) + 2.2242 + 0.4317, rounded to 2 d.p.			26.6400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1305 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3635 (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) =	0.3090 (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	0.3939	0.3862	0.3785	0.3399	0.3321	0.2935	0.2935	0.2858	0.3090	0.3321	0.3476	0.3630 (22b)
Effective ac	0.5776	0.5746	0.5716	0.5578	0.5552	0.5431	0.5431	0.5408	0.5477	0.5552	0.5604	0.5659 (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
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m ²)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.3678		(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			9.0000	405.7200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 39752.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							440.9137 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.1186 (36)
Total fabric heat loss							(33) + (36) = 73.4864 (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	43.8215	43.5930	43.3689	42.3165	42.1196	41.2030	41.2030	41.0332	41.5560	42.1196	42.5179	42.9344 (38)
Heat transfer coeff	117.3079	117.0793	116.8553	115.8028	115.6059	114.6893	114.6893	114.5196	115.0424	115.6059	116.0043	116.4207 (39)
Average = Sum(39)m / 12 =												115.8019 (39)
HLP	1.3011	1.2986	1.2961	1.2844	1.2822	1.2721	1.2721	1.2702	1.2760	1.2822	1.2866	1.2913 (40)
HLP (average)												1.2844 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.6279 (42)
Average daily hot water use (litres/day)												96.6127 (43)
Daily hot water use	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy conte	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Energy content (annual)												Total = Sum(45)m = 1520.0944 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	(59)
Heat gains from water heating, kWh/month	33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	32.4335	(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	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	131.3952	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8784	19.4322	15.8033	11.9641	8.9433	7.5503	8.1584	10.6046	14.2335	18.0727	21.0935	22.4865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	239.3718	241.8557	235.5963	222.2707	205.4496	189.6401	179.0784	176.5944	182.8539	196.1794	213.0006	228.8101	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	36.1395	(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)	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	(71)
Water heating gains (Table 5)	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935	(72)
Total internal gains	368.6825	367.2940	354.4438	333.2525	310.7963	289.9128	276.8305	280.8015	292.1141	313.4465	337.9944	357.3086	(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							
East	5.4300	19.6403	0.7200	0.7000	0.7700	37.2487 (76)							
West	10.4300	19.6403	0.7200	0.7000	0.7700	71.5477 (80)							
Solar gains	108.7963	212.8287	350.4986	511.1813	626.4718	641.3054	610.5489	524.4525	407.6443	252.5392	135.6562	89.4688	(83)
Total gains	477.4789	580.1227	704.9424	844.4337	937.2681	931.2182	887.3794	805.2539	699.7584	565.9857	473.6507	446.7774	(84)

7. Mean internal temperature (heating season)

Utilisation during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	94.1321	94.3159	94.4967	95.3555	95.5179	96.2813	96.2813	96.4240	95.9858	95.5179	95.1899	94.8494	(85)
tau	7.2755	7.2877	7.2998	7.3570	7.3679	7.4188	7.4188	7.4283	7.3991	7.3679	7.3460	7.3233	
alpha	1.0000	0.9999	0.9990	0.9903	0.9317	0.7552	0.5649	0.6442	0.9287	0.9979	0.9999	1.0000	(86)
util living area	1.0000	0.9999	0.9990	0.9903	0.9317	0.7552	0.5649	0.6442	0.9287	0.9979	0.9999	1.0000	(86)
MIT	20.0539	20.1665	20.3674	20.6385	20.8708	20.9803	20.9979	20.9949	20.9078	20.5921	20.2716	20.0353	(87)
Th 2	19.8400	19.8420	19.8439	19.8531	19.8548	19.8628	19.8628	19.8643	19.8597	19.8548	19.8513	19.8477	(88)
util rest of house	1.0000	0.9998	0.9983	0.9827	0.8830	0.6388	0.4213	0.4914	0.8556	0.9957	0.9998	1.0000	(89)
MIT 2	18.9808	19.0950	19.2973	19.5725	19.7811	19.8572	19.8626	19.8636	19.8188	19.5307	19.2081	18.9687	(90)
Living area fraction	19.1613	19.2753	19.4773	19.7518	19.9645	20.0462	20.0536	20.0539	20.0020	19.7093	19.3870	19.1482	(92)
Temperature adjustment	19.1613	19.2753	19.4773	19.7518	19.9645	20.0462	20.0536	20.0539	20.0020	19.7093	19.3870	19.1482	(93)
adjusted MIT	19.1613	19.2753	19.4773	19.7518	19.9645	20.0462	20.0536	20.0539	20.0020	19.7093	19.3870	19.1482	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9999	0.9997	0.9980	0.9817	0.8888	0.6589	0.4457	0.5177	0.8672	0.9952	0.9998	1.0000	(94)
Useful gains	477.4508	579.9609	703.5335	829.0095	833.0130	613.6065	395.5354	416.8871	606.8608	563.2720	473.5540	446.7616	(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	1743.3506	1683.0474	1516.4677	1256.6733	955.4220	624.6158	396.0882	418.4472	678.9805	1053.0902	1425.3485	1740.2755	(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	941.8295	741.2741	604.8230	307.9179	91.0723	0.0000	0.0000	0.0000	0.0000	364.4247	685.2920	962.3743	(98)
Space heating												4699.0080	(98)
Space heating per m2												52.1185	(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	1078.0796	848.7010	870.3488	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9193	0.9680	0.9441	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	991.0788	821.5070	821.7282	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1187.7558	1134.4343	1040.2190	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	141.6074	232.8179	162.5571	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												536.9825 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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												
Space cooling per m2												134.2456 (107)
Energy for space heating												1.4890 (108)
Energy for space cooling												52.1185 (99)
Total												1.4890 (108)
Dwelling Fabric Energy Efficiency (DFEE)												53.6075 (109)
												53.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0800 (1b)	x 2.4000 (2b)	= 108.1920 (1b) - (3b)
First floor	45.0800 (1c)	x 2.7000 (2c)	= 121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1305 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3805 (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) =		0.3234 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4124	0.4043	0.3962	0.3558	0.3477	0.3072	0.3072	0.2992	0.3234	0.3477	0.3638	0.3800 (22b)
	0.5850	0.5817	0.5785	0.5633	0.5604	0.5472	0.5472	0.5447	0.5523	0.5604	0.5662	0.5722 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			1.7900	1.0000	1.7900		(26)					
TER Opening Type (Uw = 1.40)			15.8600	1.3258	21.0265		(27)					
Heat Loss Floor 1			45.0800	0.1300	5.8604		(28a)					
External Wall 1	135.3600	17.6500	117.7100	0.1800	21.1878		(29a)					
External Roof 1	45.0800		45.0800	0.1300	5.8604		(30)					
Total net area of external elements Aum(A, m ²)			225.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.7251	(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)							9.5521 (36)					
Total fabric heat loss							(33) + (36) = 65.2772 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.3851	Feb 44.1346	Mar 43.8891	Apr 42.7359	May 42.5202	Jun 41.5158	Jul 41.5158	Aug 41.3298	Sep 41.9027	Oct 42.5202	Nov 42.9566	Dec 43.4129 (38)
Heat transfer coeff	109.6623	109.4118	109.1663	108.0131	107.7974	106.7930	106.7930	106.6070	107.1799	107.7974	108.2338	108.6902 (39)
Average = Sum(39)m / 12 =												108.0121 (39)
HLP	Jan 1.2163	Feb 1.2135	Mar 1.2108	Apr 1.1980	May 1.1956	Jun 1.1845	Jul 1.1845	Aug 1.1824	Sep 1.1888	Oct 1.1956	Nov 1.2005	Dec 1.2055 (40)
HLP (average)												1.1980 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.6279 (42)
Average daily hot water use (litres/day)												96.6127 (43)
Daily hot water use	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy conte	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Energy content (annual)												Total = Sum(45)m = 1520.0944 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	40.7393	58.6654	44.4786	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												143.8833 (107)
Space cooling per m2												1.5959 (108)
Energy for space heating												47.3548 (99)
Energy for space cooling												1.5959 (108)
Total												48.9506 (109)
Target Fabric Energy Efficiency (TFEE)												56.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.2175 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.4505 (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) =	0.3829 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.0000	3.8000	3.7000	3.3000	3.3000	3.0000	3.1000	2.9000	2.8000	3.1000	3.1000	3.5000 (22)
Wind factor	1.0000	0.9500	0.9250	0.8250	0.8250	0.7500	0.7750	0.7250	0.7000	0.7750	0.7750	0.8750 (22a)
Adj infilt rate												
Effective ac	0.3829	0.3638	0.3542	0.3159	0.3159	0.2872	0.2968	0.2776	0.2680	0.2968	0.2968	0.3350 (22b)
	0.5733	0.5662	0.5627	0.5499	0.5499	0.5412	0.5440	0.5385	0.5359	0.5440	0.5440	0.5561 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m2)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.3678	(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			18.0000	811.4400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 40158.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 445.4137 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1186 (36)
 Total fabric heat loss (33) + (36) = 73.4864 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.4967	42.9544	42.6937	41.7204	41.7204	41.0634	41.2754	40.8583	40.6602	41.2754	41.2754	42.1932 (38)
Average = Sum(39)m / 12 =	116.9831	116.4408	116.1801	115.2068	115.2068	114.5498	114.7618	114.3447	114.1465	114.7618	114.7618	115.6795 (39)
												115.2519 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2975	1.2915	1.2886	1.2778	1.2778	1.2705	1.2729	1.2682	1.2660	1.2729	1.2729	1.2830 (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 2.6279 (42)
 Average daily hot water use (litres/day) 96.6127 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy content (annual)	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1520.0944 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	(59)
Total heat required for water heating calculated for each month	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	129.7342	(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	0.0000	(63)
Output from w/h	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	129.7342	(64)
RHI water heating demand	33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	32.4335	(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	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6960	48.5805	39.5083	29.9103	22.3583	18.8758	20.3960	26.5115	35.5837	45.1816	52.7336	56.2161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	357.2713	360.9787	351.6363	331.7473	306.6412	283.0449	267.2811	263.5738	272.9162	292.8051	317.9113	341.5076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	(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)	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	(71)
Water heating gains (Table 5)	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935	(72)
Total internal gains	565.9345	562.1001	540.7236	507.2101	471.9377	441.1780	423.8057	430.2226	450.0615	483.7160	521.0802	550.2706	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	5.4300	22.2970	0.7200	0.7200	0.7000	0.7700	42.2873	(76)					
West	10.4300	22.2970	0.7200	0.7200	0.7000	0.7700	81.2260	(80)					
Solar gains	123.5133	209.5968	349.4151	529.1991	627.4609	690.4834	656.8413	575.4318	448.0866	279.0224	157.7768	100.5837	(83)
Total gains	689.4478	771.6969	890.1387	1036.4092	1099.3987	1131.6614	1080.6470	1005.6543	898.1481	762.7385	678.8570	650.8543	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)	95.3569	95.8009	96.0159	96.8271	96.8271	97.3825	97.2025	97.5572	97.7265	97.2025	97.2025	96.4314	21.0000	(85)
tau	7.3571	7.3867	7.4011	7.4551	7.4551	7.4922	7.4802	7.5038	7.5151	7.4802	7.4802	7.4288		
alpha	0.9995	0.9987	0.9924	0.9406	0.7538	0.4648	0.2761	0.3070	0.6730	0.9689	0.9980	0.9996	(86)	
util living area	0.9995	0.9987	0.9924	0.9406	0.7538	0.4648	0.2761	0.3070	0.6730	0.9689	0.9980	0.9996	(86)	
MIT	20.2881	20.3815	20.5878	20.8437	20.9776	20.9994	21.0000	21.0000	20.9924	20.8207	20.5193	20.2827	(87)	
Th 2	19.8428	19.8475	19.8498	19.8583	19.8583	19.8640	19.8621	19.8658	19.8675	19.8621	19.8621	19.8541	(88)	
util rest of house	0.9992	0.9977	0.9869	0.9026	0.6552	0.3505	0.1553	0.1780	0.5399	0.9385	0.9964	0.9994	(89)	
MIT 2	19.2164	19.3136	19.5192	19.7604	19.8505	19.8639	19.8621	19.8658	19.8661	19.7510	19.4636	19.2208	(90)	
Living area fraction	19.3968	19.4933	19.6990	19.9427	20.0401	20.0550	20.0536	20.0566	20.0556	19.9310	19.6412	19.3995	(92)	
Temperature adjustment	19.2468	19.3433	19.5490	19.7927	19.8901	19.9050	19.9036	19.9066	19.9056	19.7810	19.4912	-0.1500	(93)	
adjusted MIT	19.2468	19.3433	19.5490	19.7927	19.8901	19.9050	19.9036	19.9066	19.9056	19.7810	19.4912	19.2495	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	688.6723	769.4811	876.6855	932.6082	723.5267	401.3856	172.5554	183.7090	489.0595	713.4876	675.7960	650.3250	(94)
Ext temp.	5.5000	6.0000	7.8000	10.4000	13.5000	16.4000	18.4000	18.3000	15.6000	12.1000	8.5000	5.6000	(96)
Heat loss rate W	1608.1379	1553.7038	1365.0032	1082.0982	736.1866	401.4956	172.5555	183.7094	491.4701	881.4856	1261.3749	1578.9636	(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	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(98)
Space heating												2928.9547	(98)
RHI space heating demand												2929	(98)

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				50.0000 / (5) =	0.2175 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.4505 (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) =	0.3829 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4882	0.4786	0.4691	0.4212	0.4116	0.3638	0.3638	0.3542	0.3829	0.4116	0.4308	0.4499 (22b)
	0.6192	0.6145	0.6100	0.5887	0.5847	0.5662	0.5662	0.5627	0.5733	0.5847	0.5928	0.6012 (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
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m ²)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.3678	(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			18.0000	811.4400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 40158.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 445.4137 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1186 (36)
 Total fabric heat loss (33) + (36) = 73.4864 (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	46.9764	46.6253	46.2812	44.6647	44.3623	42.9544	42.9544	42.6937	43.4967	44.3623	44.9741	45.6137 (38)
Heat transfer coeff	120.4628	120.1117	119.7675	118.1511	117.8487	116.4408	116.4408	116.1801	116.9831	117.8487	118.4605	119.1001 (39)
Average = Sum(39)m / 12 =												118.1496 (39)
HLP	1.3361	1.3322	1.3284	1.3105	1.3071	1.2915	1.2915	1.2886	1.2975	1.3071	1.3139	1.3210 (40)
HLP (average)												1.3104 (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	2.6279 (42)											
Average daily hot water use (litres/day)	96.6127 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy conte	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Energy content (annual)	Total = Sum(45)m = 1520.0944 (45)											
Distribution loss (46)m = 0.15 x (45)m												

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Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	(59)
Total heat required for water heating calculated for each month	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	129.7342	(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	0.0000	(63)
Output from w/h	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	129.7342	(64)
Heat gains from water heating, kWh/month	33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	32.4335	(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	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6960	48.5805	39.5083	29.9103	22.3583	18.8758	20.3960	26.5115	35.5837	45.1816	52.7336	56.2161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	357.2713	360.9787	351.6363	331.7473	306.6412	283.0449	267.2811	263.5738	272.9162	292.8051	317.9113	341.5076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	(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)	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	(71)
Water heating gains (Table 5)	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935	(72)
Total internal gains	565.9345	562.1001	540.7236	507.2101	471.9377	441.1780	423.8057	430.2226	450.0615	483.7160	521.0802	550.2706	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W							
East	5.4300	19.6403	0.7200	0.7000	0.7700	37.2487 (76)							
West	10.4300	19.6403	0.7200	0.7000	0.7700	71.5477 (80)							
Solar gains	108.7963	212.8287	350.4986	511.1813	626.4718	641.3054	610.5489	524.4525	407.6443	252.5392	135.6562	89.4688	(83)
Total gains	674.7308	774.9288	891.2222	1018.3914	1098.4096	1082.4834	1034.3546	954.6750	857.7058	736.2552	656.7364	639.7394	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9997	0.9992	0.9919	0.9532	0.8120	0.5650	0.3703	0.4246	0.7532	0.9782	0.9983	0.9996	(94)
tau	92.6024	92.8731	93.1399	94.4142	94.6565	95.8009	95.8009	96.0159	95.3569	94.6565	94.1676	93.6619	(85)
alpha	7.1735	7.1915	7.2093	7.2943	7.3104	7.3867	7.3867	7.4011	7.3571	7.3104	7.2778	7.2441	
util living area	0.9997	0.9992	0.9960	0.9742	0.8787	0.6742	0.4939	0.5564	0.8520	0.9902	0.9993	0.9998	(86)
MIT	20.1568	20.2685	20.4642	20.7233	20.9172	20.9902	20.9991	20.9979	20.9516	20.6859	20.3739	20.1401	(87)
Th 2	19.8127	19.8157	19.8187	19.8326	19.8353	19.8475	19.8475	19.8498	19.8428	19.8353	19.8300	19.8244	(88)
util rest of house	0.9996	0.9986	0.9933	0.9566	0.8122	0.5608	0.3654	0.4194	0.7509	0.9807	0.9987	0.9997	(89)
MIT 2	19.0596	19.1737	19.3706	19.6319	19.7931	19.8450	19.8474	19.8495	19.8252	19.6035	19.2913	19.0530	(90)
Living area fraction	19.2442	19.3579	19.5546	19.8155	19.9823	20.0377	20.0412	20.0428	20.0147	19.7856	19.4734	19.2359	(92)
MIT	19.2442	19.3579	19.5546	19.8155	19.9823	20.0377	20.0412	20.0428	20.0147	19.7856	19.4734	19.2359	(92)
Temperature adjustment	19.0942	19.2079	19.4046	19.6655	19.8323	19.8877	19.8912	19.8928	19.8647	19.6356	19.3234	19.0859	(93)
adjusted MIT	19.0942	19.2079	19.4046	19.6655	19.8323	19.8877	19.8912	19.8928	19.8647	19.6356	19.3234	19.0859	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	674.3357	773.5420	884.0158	970.7493	891.8862	611.5573	383.0714	405.3743	646.0013	720.2015	655.5974	639.4854	(95)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1782.1458	1718.5415	1545.5539	1271.9560	958.3762	615.7049	383.2289	405.7895	674.3772	1064.8362	1447.9950	1772.9113	(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	824.2108	635.0397	492.1844	216.8688	49.4686	0.0000	0.0000	0.0000	0.0000	256.4082	570.5263	843.2689	(98)
Space heating												3887.9756	(98)
Space heating per m2												43.1231	(99)

8c. Space cooling requirement

Not applicable

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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													3887.9756 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	824.2108	635.0397	492.1844	216.8688	49.4686	0.0000	0.0000	0.0000	0.0000	256.4082	570.5263	843.2689	(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)	824.2108	635.0397	492.1844	216.8688	49.4686	0.0000	0.0000	0.0000	0.0000	256.4082	570.5263	843.2689	(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	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(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	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(219)
Water heating fuel used													1292.0802 (219)
Annual totals kWh/year													
Space heating fuel - main system													3887.9756 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													386.3791 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.01 * 908 * 0.80) =										-1748.8904			-2748.2564
PV Unit 1 (0.80 * 1.72 * 908 * 0.80) =										-999.3659			-2748.2564 (233)
Total delivered energy for all uses													2848.1786 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (0.90*15.29 + 0.10*5.50)	3887.9756	14.3110	556.4082 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.0802	14.3110	184.9096 (247)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	30.0000	14.3110	4.2933 (249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	386.3791	14.3110	55.2947 (250)
Additional standing charges			24.0000 (251)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2748.2564	13.7505	-377.8990 (252)
Total energy cost			447.0068 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3890 (257)
SAP value		80.6229
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	3887.9756	0.5190	2017.8593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.0802	0.5190	670.5896 (264)
Space and water heating			2688.4490 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	386.3791	0.5190	200.5307 (268)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2748.2564	0.5190	-1426.3450 (269)
Total kg/year			1478.2047 (272)
CO2 emissions per m2			16.4000 (273)
EI value			85.3448
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$14.31 \times (1 + 0.29 \times 0.00) / 1.0000 = 14.311$, stars = 1
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 1.0000 = 0.5190$, stars = 2

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

14.31 / 1.0000 = 14.311, stars = 1
0.519 / 1.0000 = 0.5190, stars = 2

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.2175 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.4505 (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) =	0.3829 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.0000	3.8000	3.7000	3.3000	3.3000	3.0000	3.1000	2.9000	2.8000	3.1000	3.1000	3.5000 (22)
Wind factor	1.0000	0.9500	0.9250	0.8250	0.8250	0.7500	0.7750	0.7250	0.7000	0.7750	0.7750	0.8750 (22a)
Adj infilt rate												
Effective ac	0.3829	0.3638	0.3542	0.3159	0.3159	0.2872	0.2968	0.2776	0.2680	0.2968	0.2968	0.3350 (22b)
	0.5733	0.5662	0.5627	0.5499	0.5499	0.5412	0.5440	0.5385	0.5359	0.5440	0.5440	0.5561 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m2)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.3678	(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			18.0000	811.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 40158.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							445.4137 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.1186 (36)
Total fabric heat loss							(33) + (36) = 73.4864 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.4967	42.9544	42.6937	41.7204	41.7204	41.0634	41.2754	40.8583	40.6602	41.2754	41.2754	42.1932 (38)
Average = Sum(39)m / 12 =	116.9831	116.4408	116.1801	115.2068	115.2068	114.5498	114.7618	114.3447	114.1465	114.7618	114.7618	115.6795 (39)
												115.2519 (39)
HLP	1.2975	1.2915	1.2886	1.2778	1.2778	1.2705	1.2729	1.2682	1.2660	1.2729	1.2729	1.2830 (40)
HLP (average)												1.2783 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.6279 (42)
Average daily hot water use (litres/day)												96.6127 (43)
Daily hot water use	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy conte	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Energy content (annual)												Total = Sum(45)m = 1520.0944 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

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

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
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)
Total heat required for water heating calculated for each month	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(64)
Heat gains from water heating, kWh/month	33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	(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	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6960	48.5805	39.5083	29.9103	22.3583	18.8758	20.3960	26.5115	35.5837	45.1816	52.7336	56.2161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	357.2713	360.9787	351.6363	331.7473	306.6412	283.0449	267.2811	263.5738	272.9162	292.8051	317.9113	341.5076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	(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)	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	(71)
Water heating gains (Table 5)	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935	(72)
Total internal gains	565.9345	562.1001	540.7236	507.2101	471.9377	441.1780	423.8057	430.2226	450.0615	483.7160	521.0802	550.2706	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W							
East	5.4300	22.2970	0.7200	0.7000	0.7700	42.2873	(76)						
West	10.4300	22.2970	0.7200	0.7000	0.7700	81.2260	(80)						
Solar gains	123.5133	209.5968	349.4151	529.1991	627.4609	690.4834	656.8413	575.4318	448.0866	279.0224	157.7768	100.5837	(83)
Total gains	689.4478	771.6969	890.1387	1036.4092	1099.3987	1131.6614	1080.6470	1005.6543	898.1481	762.7385	678.8570	650.8543	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9995	0.9987	0.9924	0.9406	0.7538	0.4648	0.2761	0.3070	0.6730	0.9689	0.9980	0.9996	(86)
MIT	20.2881	20.3815	20.5878	20.8437	20.9776	20.9994	21.0000	21.0000	20.9924	20.8207	20.5193	20.2827	(87)
Th 2	19.8428	19.8475	19.8498	19.8583	19.8583	19.8640	19.8621	19.8658	19.8675	19.8621	19.8621	19.8541	(88)
util rest of house	0.9992	0.9977	0.9869	0.9026	0.6552	0.3505	0.1553	0.1780	0.5399	0.9385	0.9964	0.9994	(89)
MIT 2	19.2164	19.3136	19.5192	19.7604	19.8505	19.8639	19.8621	19.8658	19.8661	19.7510	19.4636	19.2208	(90)
Living area fraction	0.9992	0.9977	0.9869	0.9026	0.6552	0.3505	0.1553	0.1780	0.5399	0.9385	0.9964	0.9994	(91)
MIT	19.3968	19.4933	19.6990	19.9427	20.0401	20.0550	20.0536	20.0566	20.0556	19.9310	19.6412	19.3995	(92)
Temperature adjustment	19.2468	19.3433	19.5490	19.7927	19.8901	19.9050	19.9036	19.9066	19.9056	19.7810	19.4912	19.2495	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	688.6723	769.4811	876.6855	932.6082	723.5267	401.3856	172.5554	183.7090	489.0595	713.4876	675.7960	650.3250	(95)	
Ext temp.	5.5000	6.0000	7.8000	10.4000	13.5000	16.4000	18.4000	18.3000	15.6000	12.1000	8.5000	5.6000	(96)	
Heat loss rate W	1608.1379	1553.7038	1365.0032	1082.0982	736.1866	401.4956	172.5555	183.7094	491.4701	881.4856	1261.3749	1578.9636	(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	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(98)	
Space heating												2928.9547	(98)	
Space heating per m2												(98) / (4) =	32.4862	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													2928.9547 (211)
Space heating requirement	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(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)	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(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	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(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	133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(219)
Water heating fuel used													1292.0802 (219)
Annual totals kWh/year													
Space heating fuel - main system													2928.9547 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													386.3791 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.01 * 971 * 0.80) =										-1871.0431			-2940.2106
PV Unit 1 (0.80 * 1.72 * 971 * 0.80) =										-1069.1675			-2940.2106 (233)
Total delivered energy for all uses													1697.2033 (238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (0.90*39.13 + 0.10*14.19)	2928.9547	36.6360	1073.0518 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.0802	36.6360	473.3665 (247)
Pumps and fans for heating (0.90*39.13 + 0.10*14.19)	30.0000	36.6360	10.9908 (249)
Energy for lighting (0.90*39.13 + 0.10*14.19)	386.3791	36.6360	141.5538 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2940.2106	33.8580	-995.4965 (252)
Total energy cost			703.4665 (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	2928.9547	0.5190	1520.1275 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.0802	0.5190	670.5896 (264)
Space and water heating			2190.7171 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	386.3791	0.5190	200.5307 (268)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2940.2106	0.5190	-1525.9693 (269)
Total kg/year			880.8485 (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	2928.9547	3.0700	8991.8908 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.0802	3.0700	3966.6863 (264)
Space and water heating			12958.5771 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	386.3791	3.0700	1186.1838 (268)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2940.2106	3.0700	-9026.4466 (269)
Primary energy kWh/year			5210.4143 (272)
Primary energy kWh/m2/year			57.7908 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 81
 Current environmental impact rating: B 85

(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	+ 4.5	-£ 268	-380 kg (43.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£268 4.22 kg/m ²	B 85	B 89
Total Savings	£268 4.22 kg/m²		

Potential energy efficiency rating: B 85
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 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
Electricity	£1699	£1431	£268
Space heating	£1084	£1084	£0
Water heating	£473	£205	£268
Lighting	£142	£142	£0
Generated (PV)	-£995	-£995	£0
Total cost of fuels	£704	£436	£268
Total cost of uses	£704	£436	£268
Delivered energy	19 kWh/m ²	11 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.5 tonnes	0.4 tonnes
CO2 emissions per m ²	10 kg/m ²	6 kg/m ²	4 kg/m ²
Primary energy	58 kWh/m ²	33 kWh/m ²	25 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0800 (1b)	2.4000 (2b)	108.1920 (1b) - (3b)
First floor	45.0800 (1c)	2.7000 (2c)	121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.9080 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.2175 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.4505 (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) =	0.3829 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4882	0.4786	0.4691	0.4212	0.4116	0.3638	0.3638	0.3542	0.3829	0.4116	0.4308	0.4499 (22b)
	0.6192	0.6145	0.6100	0.5887	0.5847	0.5662	0.5662	0.5627	0.5733	0.5847	0.5928	0.6012 (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
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m ²)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.3678	(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			18.0000	811.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 40158.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							445.4137 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.1186 (36)
Total fabric heat loss							(33) + (36) = 73.4864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.9764	46.6253	46.2812	44.6647	44.3623	42.9544	42.9544	42.6937	43.4967	44.3623	44.9741	45.6137 (38)
Average = Sum(39)m / 12 =	120.4628	120.1117	119.7675	118.1511	117.8487	116.4408	116.4408	116.1801	116.9831	117.8487	118.4605	119.1001 (39)
												118.1496 (39)
HLP	1.3361	1.3322	1.3284	1.3105	1.3071	1.2915	1.2915	1.2886	1.2975	1.3071	1.3139	1.3210 (40)
HLP (average)												1.3104 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.6279 (42)
Daily hot water use												96.6127 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)	
157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)	
Energy content (annual)											Total = Sum(45)m =	1520.0944 (45)
Distribution loss (46)m = 0.15 x (45)m												

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0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000 (57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Primary loss												
Total heat required for water heating calculated for each month												
133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(62)
Aperture area of solar collector												
Zero-loss collector efficiency												
Collector heat loss coefficient												
Collector 2nd order heat loss coefficient												
Collector effective heat loss coefficient												
Collector performance ratio												
Annual solar radiation per m2												
Overshading factor												
Solar energy available												
Adjustment factor for showers												
Solar-to-load ratio												
Utilisation factor												
Collector performance factor												
Dedicated solar storage volume												
Effective solar volume												
Daily hot water demand												
Volume ratio Veff/V												
Solar storage volume factor												
Solar input												
-24.9135	-41.5735	-70.8045	-94.8920	-117.2310	-115.2568	-113.7336	-99.3696	-77.8263	-53.1462	-29.5510	-859.1466	(H17)
Solar input (sum of months) = Sum (63)m =												
Output from w/h												
109.0475	75.5897	50.0975	10.5133	0.0000	0.0000	0.0000	0.0000	16.0852	56.2987	89.9166	108.8858	(64)
Total per year (kWh/year) = Sum (64)m =												
Heat gains from water heating, kWh/month												
33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	(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	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	54.6960	48.5805	39.5083	29.9103	22.3583	18.8758	20.3960	26.5115	35.5837	45.1816	52.7336	56.2161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	357.2713	360.9787	351.6363	331.7473	306.6412	283.0449	267.2811	263.5738	272.9162	292.8051	317.9113	341.5076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953 (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)												
	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162 (71)
Water heating gains (Table 5)												
	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935 (72)
Total internal gains												
	565.9345	562.1001	540.7236	507.2101	471.9377	441.1780	423.8057	430.2226	450.0615	483.7160	521.0802	550.2706 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
East		5.4300	19.6403	0.7200	0.7000	0.7700	37.2487 (76)					
West		10.4300	19.6403	0.7200	0.7000	0.7700	71.5477 (80)					
Solar gains	108.7963	212.8287	350.4986	511.1813	626.4718	641.3054	610.5489	524.4525	407.6443	252.5392	135.6562	89.4688 (83)
Total gains	674.7308	774.9288	891.2222	1018.3914	1098.4096	1082.4834	1034.3546	954.6750	857.7058	736.2552	656.7364	639.7394 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	92.6024	92.8731	93.1399	94.4142	94.6565	95.8009	95.8009	96.0159	95.3569	94.6565	94.1676	93.6619
alpha	7.1735	7.1915	7.2093	7.2943	7.3104	7.3867	7.3867	7.4011	7.3571	7.3104	7.2778	7.2441
util living area												
	0.9997	0.9992	0.9960	0.9742	0.8787	0.6742	0.4939	0.5564	0.8520	0.9902	0.9993	0.9998 (86)
MIT	20.1568	20.2685	20.4642	20.7233	20.9172	20.9902	20.9991	20.9979	20.9516	20.6859	20.3739	20.1401 (87)
Th 2	19.8127	19.8157	19.8187	19.8326	19.8353	19.8475	19.8475	19.8498	19.8428	19.8353	19.8300	19.8244 (88)
util rest of house												
	0.9996	0.9986	0.9933	0.9566	0.8122	0.5608	0.3654	0.4194	0.7509	0.9807	0.9987	0.9997 (89)
MIT 2	19.0596	19.1737	19.3706	19.6319	19.7931	19.8450	19.8474	19.8495	19.8252	19.6035	19.2913	19.0530 (90)
Living area fraction									fLA = Living area / (4) =			0.1683 (91)
MIT	19.2442	19.3579	19.5546	19.8155	19.9823	20.0377	20.0412	20.0428	20.0147	19.7856	19.4734	19.2359 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0942	19.2079	19.4046	19.6655	19.8323	19.8877	19.8912	19.8928	19.8647	19.6356	19.3234	19.0859 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9994	0.9982	0.9919	0.9532	0.8120	0.5650	0.3703	0.4246	0.7532	0.9782	0.9983	0.9996	(94)
Useful gains	674.3357	773.5420	884.0158	970.7493	891.8862	611.5573	383.0714	405.3743	646.0013	720.2015	655.5974	639.4854	(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													
Month fracti	1782.1458	1718.5415	1545.5539	1271.9560	958.3762	615.7049	383.2289	405.7895	674.3772	1064.8362	1447.9950	1772.9113	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	824.2108	635.0397	492.1844	216.8688	49.4686	0.0000	0.0000	0.0000	0.0000	256.4082	570.5263	843.2689	(98)
Space heating per m2												3887.9756	(98)
												(98) / (4) =	43.1231 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3887.9756 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	824.2108	635.0397	492.1844	216.8688	49.4686	0.0000	0.0000	0.0000	0.0000	256.4082	570.5263	843.2689	(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)	824.2108	635.0397	492.1844	216.8688	49.4686	0.0000	0.0000	0.0000	0.0000	256.4082	570.5263	843.2689	(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	109.0475	75.5897	50.0975	10.5133	0.0000	0.0000	0.0000	0.0000	16.0852	56.2987	89.9166	108.8858	(64)
Efficiency of water heater	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)
(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	(217)
Fuel for water heating, kWh/month	109.0475	75.5897	50.0975	10.5133	0.0000	0.0000	0.0000	0.0000	16.0852	56.2987	89.9166	108.8858	(219)
Water heating fuel used													516.4343 (219)
Annual totals kWh/year													
Space heating fuel - main system													3887.9756 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													386.3791 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.01 * 908 * 0.80) =										-1748.8904			-2748.2564
PV Unit 1 (0.80 * 1.72 * 908 * 0.80) =										-999.3659			-2748.2564 (233)
Total delivered energy for all uses													2122.5326 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.90*15.29 + 0.10*5.50)	3887.9756	14.3110	556.4082	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	516.4343	14.3110	73.9069	(247)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	30.0000	14.3110	4.2933	(249)
Pump for solar water heating	50.0000	14.3110	7.1555	(249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	386.3791	14.3110	55.2947	(250)
Additional standing charges			24.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*39.13 + 0.10*14.19)		-2748.2564	13.7505	-377.8990 (252)
Total energy cost			343.1596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	1.0663 (257)
SAP value			85.1245
SAP rating (Section 12)			85 (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	3887.9756	0.5190	2017.8593	(261)

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Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	516.4343	0.5190	268.0294 (264)
Space and water heating			2285.8887 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	386.3791	0.5190	200.5307 (268)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2748.2564	0.5190	-1426.3450 (269)
Total kg/year			1101.5944 (272)
CO2 emissions per m2			12.2200 (273)
EI value			89.0786
EI rating			89 (274)
EI band			B

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Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0800 (1b)	x 2.4000 (2b)	= 108.1920 (1b) - (3b)
First floor	45.0800 (1c)	x 2.7000 (2c)	= 121.7160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 229.9080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.2175 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.4505 (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) = 0.3829 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.0000	3.8000	3.7000	3.3000	3.3000	3.0000	3.1000	2.9000	2.8000	3.1000	3.1000	3.5000 (22)
Wind factor	1.0000	0.9500	0.9250	0.8250	0.8250	0.7500	0.7750	0.7250	0.7000	0.7750	0.7750	0.8750 (22a)
Adj inflt rate												
Effective ac	0.3829	0.3638	0.3542	0.3159	0.3159	0.2872	0.2968	0.2776	0.2680	0.2968	0.2968	0.3350 (22b)
	0.5733	0.5662	0.5627	0.5499	0.5499	0.5412	0.5440	0.5385	0.5359	0.5440	0.5440	0.5561 (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
windows (Uw = 1.30)			15.8600	1.2357	19.5989		(27)
Door			1.7900	1.5000	2.6850		(26)
Heat Loss Floor 1			45.0800	0.1700	7.6636	110.0000	4958.8000 (28a)
External Wall 1	135.3600	17.6500	117.7100	0.1700	20.0107	110.0000	12948.1000 (29a)
External Roof 1	45.0800		45.0800	0.1200	5.4096	9.0000	405.7200 (30)
Total net area of external elements Aum(A, m ²)			225.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.3678		(33)
GF			94.9900			100.0000	9499.0000 (32c)
FF			107.2400			100.0000	10724.0000 (32c)
Internal Floor 1			45.0800			18.0000	811.4400 (32d)
Internal Ceiling 1			45.0800			18.0000	811.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 40158.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							445.4137 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.1186 (36)
Total fabric heat loss							(33) + (36) = 73.4864 (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	43.4967	42.9544	42.6937	41.7204	41.7204	41.0634	41.2754	40.8583	40.6602	41.2754	41.2754	42.1932 (38)
Heat transfer coeff	116.9831	116.4408	116.1801	115.2068	115.2068	114.5498	114.7618	114.3447	114.1465	114.7618	114.7618	115.6795 (39)
Average = Sum(39)m / 12 =												115.2519 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2975	1.2915	1.2886	1.2778	1.2778	1.2705	1.2729	1.2682	1.2660	1.2729	1.2729	1.2830 (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	2.6279 (42)											
Average daily hot water use (litres/day)	96.6127 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.2740	102.4095	98.5450	94.6805	90.8160	86.9515	86.9515	90.8160	94.6805	98.5450	102.4095	106.2740 (44)
Energy content (annual)	157.6013	137.8391	142.2376	124.0062	118.9869	102.6766	95.1450	109.1803	110.4842	128.7587	140.5502	152.6284 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1520.0944 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000 (57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Primary loss												
Total heat required for water heating calculated for each month												
133.9611	117.1632	120.9019	105.4052	101.1388	87.2751	80.8732	92.8032	93.9116	109.4449	119.4677	129.7342	(62)
Aperture area of solar collector												
Zero-loss collector efficiency												
Collector heat loss coefficient												
Collector 2nd order heat loss coefficient												
Collector effective heat loss coefficient												
Collector performance ratio												
Annual solar radiation per m2												
Overshading factor												
Solar energy available												
Adjustment factor for showers												
Solar-to-load ratio												
Utilisation factor												
Collector performance factor												
Dedicated solar storage volume												
Effective solar volume												
Daily hot water demand												
Volume ratio Veff/V												
Solar storage volume factor												
Solar input												
-26.8991	-38.9947	-67.4426	-94.2469	-112.9774	-119.5418	-117.8102	-104.7404	-81.8716	-55.9853	-32.6984	-22.2850	(63)
Solar input (sum of months) = Sum (63)m =												
Output from w/h												
107.0620	78.1685	53.4593	11.1583	0.0000	0.0000	0.0000	0.0000	12.0400	53.4596	86.7692	107.4492	(64)
Total per year (kWh/year) = Sum (64)m =												
Heat gains from water heating, kWh/month												
33.4903	29.2908	30.2255	26.3513	25.2847	21.8188	20.2183	23.2008	23.4779	27.3612	29.8669	32.4335	(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	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743	157.6743 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	54.6960	48.5805	39.5083	29.9103	22.3583	18.8758	20.3960	26.5115	35.5837	45.1816	52.7336	56.2161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	357.2713	360.9787	351.6363	331.7473	306.6412	283.0449	267.2811	263.5738	272.9162	292.8051	317.9113	341.5076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953	53.3953 (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)												
	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162	-105.1162 (71)
Water heating gains (Table 5)												
	45.0138	43.5875	40.6257	36.5990	33.9848	30.3039	27.1751	31.1839	32.6082	36.7758	41.4818	43.5935 (72)
Total internal gains												
	565.9345	562.1001	540.7236	507.2101	471.9377	441.1780	423.8057	430.2226	450.0615	483.7160	521.0802	550.2706 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
East		5.4300	22.2970	0.7200	0.7000	0.7700	42.2873 (76)					
West		10.4300	22.2970	0.7200	0.7000	0.7700	81.2260 (80)					
Solar gains	123.5133	209.5968	349.4151	529.1991	627.4609	690.4834	656.8413	575.4318	448.0866	279.0224	157.7768	100.5837 (83)
Total gains	689.4478	771.6969	890.1387	1036.4092	1099.3987	1131.6614	1080.6470	1005.6543	898.1481	762.7385	678.8570	650.8543 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	95.3569	95.8009	96.0159	96.8271	96.8271	97.3825	97.2025	97.5572	97.7265	97.2025	97.2025	96.4314
alpha	7.3571	7.3867	7.4011	7.4551	7.4551	7.4922	7.4802	7.5038	7.5151	7.4802	7.4802	7.4288
util living area												
	0.9995	0.9987	0.9924	0.9406	0.7538	0.4648	0.2761	0.3070	0.6730	0.9689	0.9980	0.9996 (86)
MIT	20.2881	20.3815	20.5878	20.8437	20.9776	20.9994	21.0000	21.0000	20.9924	20.8207	20.5193	20.2827 (87)
Th 2	19.8428	19.8475	19.8498	19.8583	19.8583	19.8640	19.8621	19.8658	19.8675	19.8621	19.8621	19.8541 (88)
util rest of house												
	0.9992	0.9977	0.9869	0.9026	0.6552	0.3505	0.1553	0.1780	0.5399	0.9385	0.9964	0.9994 (89)
MIT 2	19.2164	19.3136	19.5192	19.7604	19.8505	19.8639	19.8621	19.8658	19.8661	19.7510	19.4636	19.2208 (90)
Living area fraction									fLA = Living area / (4) =			0.1683 (91)
MIT	19.3968	19.4933	19.6990	19.9427	20.0401	20.0550	20.0536	20.0566	20.0556	19.9310	19.6412	19.3995 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2468	19.3433	19.5490	19.7927	19.8901	19.9050	19.9036	19.9066	19.9056	19.7810	19.4912	19.2495 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9971	0.9849	0.8998	0.6581	0.3547	0.1597	0.1827	0.5445	0.9354	0.9955	0.9992	(94)
Useful gains	688.6723	769.4811	876.6855	932.6082	723.5267	401.3856	172.5554	183.7090	489.0595	713.4876	675.7960	650.3250	(95)
Ext temp.	5.5000	6.0000	7.8000	10.4000	13.5000	16.4000	18.4000	18.3000	15.6000	12.1000	8.5000	5.6000	(96)
Heat loss rate W													
Month fracti	1608.1379	1553.7038	1365.0032	1082.0982	736.1866	401.4956	172.5555	183.7094	491.4701	881.4856	1261.3749	1578.9636	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(98)
Space heating per m2												2928.9547	(98)
												(98) / (4) =	32.4862 (99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													2928.9547 (211)
Space heating requirement	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(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)	684.0824	526.9977	363.3083	107.6328	9.4190	0.0000	0.0000	0.0000	0.0000	124.9905	421.6168	690.9071	(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	107.0620	78.1685	53.4593	11.1583	0.0000	0.0000	0.0000	0.0000	12.0400	53.4596	86.7692	107.4492	(64)
Efficiency of water heater	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)
(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	(217)
Fuel for water heating, kWh/month	107.0620	78.1685	53.4593	11.1583	0.0000	0.0000	0.0000	0.0000	12.0400	53.4596	86.7692	107.4492	(219)
Water heating fuel used													509.5662 (219)
Annual totals kWh/year													2928.9547 (211)
Space heating fuel - main system													0.0000 (215)
Space heating fuel - secondary													
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													386.3791 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.01 * 971 * 0.80) =										-1871.0431			-2940.2106
PV Unit 1 (0.80 * 1.72 * 971 * 0.80) =										-1069.1675			-2940.2106 (233)
Total delivered energy for all uses													964.6893 (238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.90*39.13 + 0.10*14.19)	2928.9547	36.6360	1073.0518	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	509.5662	36.6360	186.6847	(247)
Pumps and fans for heating (0.90*39.13 + 0.10*14.19)	30.0000	36.6360	10.9908	(249)
Pump for solar water heating	50.0000	36.6360	18.3180	(249)
Energy for lighting (0.90*39.13 + 0.10*14.19)	386.3791	36.6360	141.5538	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*39.13 + 0.10*14.19)		-2940.2106	33.8580	-995.4965 (252)
Total energy cost			435.1026	(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	2928.9547	0.5190	1520.1275	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	509.5662	0.5190	264.4649	(264)
Space and water heating			1784.5923	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	386.3791	0.5190	200.5307	(268)
Energy saving/generation technologies				
PV Unit (0.90*39.13 + 0.10*14.19)		-2940.2106	0.5190	-1525.9693 (269)
Total kg/year			500.6738	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2928.9547	3.0700	8991.8908 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	509.5662	3.0700	1564.3683 (264)
Space and water heating			10556.2591 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	386.3791	3.0700	1186.1838 (268)
Energy saving/generation technologies			
PV Unit (0.90*39.13 + 0.10*14.19)	-2940.2106	3.0700	-9026.4466 (269)
Primary energy kWh/year			2961.5963 (272)
Primary energy kWh/m2/year			32.8482 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	445.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	303.48 (P1)
Transmission heat loss coefficient	73.49 (37)
Summer heat loss coefficient	376.96 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (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
East	5.4300	117.5071	0.7200	0.7000	0.9000	260.4830
West	10.4300	117.5071	0.7200	0.7000	0.9000	500.3384

total: 760.8214

Solar gains	Jun 808	Jul 761	Aug 669	(P3)
Internal gains	438	421	427	
Total summer gains	1246	1182	1097	(P5)
Summer gain/loss ratio	3.30	3.13	2.91	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 445.4)	0.00	0.00	0.00	
Threshold temperature	19.30	21.03	20.71	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

U-VALUE CALCULATOR REPORT

Property Reference	109 Church Road		Issued on Date	14/03/2024
Assessment Reference	EPC	Prop Type Ref	109 Church Road	
Project	9 Lansdowne Place, London , SE19 2UQ			
Calculation Type	New Build (As Built)			

SAP Rating	81 B	DER	21.36	TER	26.64
Environmental	85 B	% DER<TER	19.81		
CO ₂ Emissions (t/year)	0.88	DFEE	53.61	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.77		

Assessor Details	Mr. Edwin Egbunu, Stansted Environmental Services Limited, Tel: 01279873380, edwin@sestesting.com	Assessor ID	p721-0001
Client			

Building Elements

Roof 000002

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	New Layer				
	Main construction	0	0.2000	0.2000	100.00
Layer 2	ROCKWOOL ROLL				
	Main construction	230	0.0440	5.2273	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	ROCKWOOL ROLL				
	Main construction	170	0.0440	3.8636	87.50
	Main construction	170	0.1300	1.3077	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 5	Plasterboard, standard				
	Main construction	12	0.2100	0.0571	100.00
Layer 6	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: Upper limit = 9.078 m² K/W Lower limit = 8.737 m² K/W Average = 8.907 m² K/W
 Total correction = 0.0047 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 416 mm

U-value: 0.12 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	109 Church Road		Issued on Date	14/03/2024
Assessment Reference	EPC	Prop Type Ref	109 Church Road	
Project	9 Lansdowne Place, London , SE19 2UQ			
Calculation Type	New Build (As Built)			

SAP Rating	81 B	DER	21.36	TER	26.64
Environmental	85 B	% DER<TER	19.81		
CO ₂ Emissions (t/year)	0.88	DFEE	53.61	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.77		

Assessor Details	Mr. Edwin Egbuonu, Stansted Environmental Services Limited, Tel: 01279873380, edwin@sestesting.com	Assessor ID	p721-0001
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Client	
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Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	103	0.7700	0.1338	82.81
	Main construction	103	0.9407	0.1095	17.19
Layer 2	Celotex CW4000				
	Main construction	100	0.0220	4.5455	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Standard cavity				
	Main construction	50	0.2778	0.1800	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Celcon Solar - Normal - Trad joint 10mm				
	Main construction	100	0.1100	0.9091	93.18
	Main construction	100	0.8803	0.1136	6.82
Layer 5	airspace/plaster dabs				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance: Upper limit = 6.102 m² K/W Lower limit = 5.869 m² K/W Average = 5.986 m² K/W
 Total correction = 0.0058 m² K/W U-value (unrounded) = 0.17 W/m² K

Unheated space: None
Total thickness: 381 mm U-value: 0.17 W/m ² K Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	109 Church Road	Issued on Date	14/03/2024
Assessment Reference	EPC	Prop Type Ref	109 Church Road
Project	9 Lansdowne Place, London , SE19 2UQ		
Calculation Type	New Build (As Built)		

SAP Rating	81 B	DER	21.36	TER	26.64
Environmental	85 B	% DER<TER	19.81		
CO ₂ Emissions (t/year)	0.88	DFEE	53.61	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.77		

Assessor Details	Mr. Edwin Egbuonu, Stansted Environmental Services Limited, Tel: 01279873380, edwin@sestesting.com	Assessor ID	p721-0001
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Client	
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Building Elements

Floor 000003

Floor Type: Slab On Ground Floor

Area = 45.08 m², Perimeter = 28.20 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Screed						
	Main construction	65	1.1500	0.0565	100.00		
Layer 2	Celotex GA4000						
	Main construction	100	0.0220	4.5455	100.00	30	1400
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Concrete, dense						
	Main construction	150	2.0000	0.0750	100.00		
Layer 4	Polythene, 500 gauge						
	Main construction	1	0.0000	0.0000	100.00		
Int surface				0.1700			

Total resistance: Upper limit = 4.677 m² K/W Lower limit = 4.677 m² K/W Average = 4.677 m² K/W

Total correction = 0.0094 m² K/W

U-value (unrounded) = 0.17 W/m² K

Unheated space: None

Total thickness: 316 mm

U-value: 0.17 W/m² K

Kappa: 0.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	109 Church Road		Issued on Date	14/03/2024	
Assessment Reference	EPC	Prop Type Ref	109 Church Road		
Property	9 Lansdowne Place, London , SE19 2UQ				
SAP Rating	81 B	DER	21.36	TER	26.64
Environmental	85 B	% DER<TER	19.81		
CO ₂ Emissions (t/year)	0.88	DFEE	53.61	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.77		
Assessor Details	Mr. Edwin Egbuonu, Stansted Environmental Services Limited, Tel: 01279873380, edwin@sestesting.com			Assessor ID	p721-0001
Client					

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.20 m	45.08 m ²	2.40 m
1st Storey:	28.20 m	45.08 m ²	2.70 m

7.0 Living Area m²

8.0 Thermal Mass Parameter
 Thermal Mass
 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.17	110.00	135.36	117.71

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
GF	Dense block, dense plaster	100.00	94.99
FF	Dense block, dense plaster	100.00	107.24

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.12	9.00	45.08	45.08

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	45.08

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Heat Loss Floor 1	Ground Floor - Solid	Slab on ground, screed over insulation	0.17	110.00	45.08

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	45.08

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
windows	Manufacture r	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacture r	Solid Door							1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Door	Solid Door	[1] External Wall 1	East							1.79	
Kitchen	Window	[1] External Wall 1	East	None	0.00					2.17	
Living Room	Window	[1] External Wall 1	West	None	0.00					8.40	
East small	Window	[1] External Wall 1	East	None	0.00					1.09	
East Large	Window	[1] External Wall 1	East	None	0.00					2.17	
West big	Window	[1] External Wall 1	West	None	0.00					1.22	
West small	Window	[1] External Wall 1	West	None	0.00					0.81	

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	11.29	0.500	Yes
Table K1 - Approved	E3 Sill	10.44	0.040	Yes
Table K1 - Approved	E4 Jamb	19.60	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	28.20	0.160	Yes
Table K1 - Approved	E6 Intermediate floor within a dwelling	28.20	0.070	Yes
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.98	0.060	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	8.98	0.240	No
Table K1 - Approved	E16 Corner (normal)	20.40	0.090	Yes

Y-value	<input type="text" value="0.080"/>	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	<input type="text" value="5.00"/>	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	<input type="text" value="Yes"/>	
As Built AP ₅₀	<input type="text" value="4.66"/>	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	<input type="text" value="Windows half open"/>
Cross ventilation possible	<input type="text" value="Yes"/>
Night Ventilation	<input type="text" value="No"/>
Air change rate	<input type="text" value="4.00"/>

Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings	<input type="text" value="28"/>	
Total number of L.E.L. fittings	<input type="text" value="28"/>	
Percentage of L.E.L. fittings	<input type="text" value="100.00"/>	%

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

	<input type="text" value="SAP table"/>	
Percentage of Heat	<input type="text" value="100"/>	%
Main Heating	<input type="text" value="BEE"/>	
SAP Code	<input type="text" value="191"/>	
Efficiency (SAP Table)	<input type="text" value="100.0"/>	%
Controls	<input type="text" value="CBE Programmer, room thermostat and TRVs"/>	
PCDF Controls	<input type="text" value="0"/>	
Delayed Start Stat	<input type="text" value="Yes"/>	
Sap Code	<input type="text" value="2106"/>	
Is MHS Pumped	<input type="text" value="Pump in heated space"/>	
Heat Emitter	<input type="text" value="Radiators"/>	

25.0 Main Heating 2

Community Heating

28.0 Water Heating

	<input type="text" value="HES Instantaneous at point of use"/>
Water Heating	<input type="text" value="Independent"/>
Flue Gas Heat Recovery System	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 1	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 2	<input type="text" value="No"/>
Waste Water Heat Recovery Storage System	<input type="text" value="No"/>
Solar Panel	<input type="text" value="No"/>
Water use <= 125 litres/person/day	<input type="text" value="Yes"/>
SAP Code	<input type="text" value="909"/>

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.01	West	30°	Modest	Yes
1.72	East	30°	Modest	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£268	B 85	