



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 9, Fairfield Phase 2, Parklands
St Merryn, Padstow, Cornwall, PL28 8FQ

Contact: Stuart Thomas
Energy Access (Southwest) Ltd
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Report Issue Date: 28/02/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

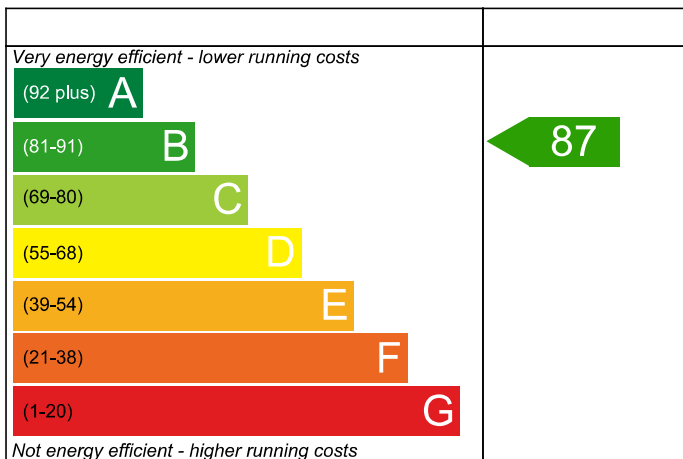
Plot 9, Fairfield Phase 2, Parklands,
St Merryn,
Padstow,
Cornwall,
PL28 8FQ

Dwelling type: House, Detached
Date of assessment: 28/02/2022
Produced by: Energy Access (Southwest) Ltd
Total floor area: 244.12 m²
DRRN: 0158-2202-2124

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

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

Energy Efficiency Rating

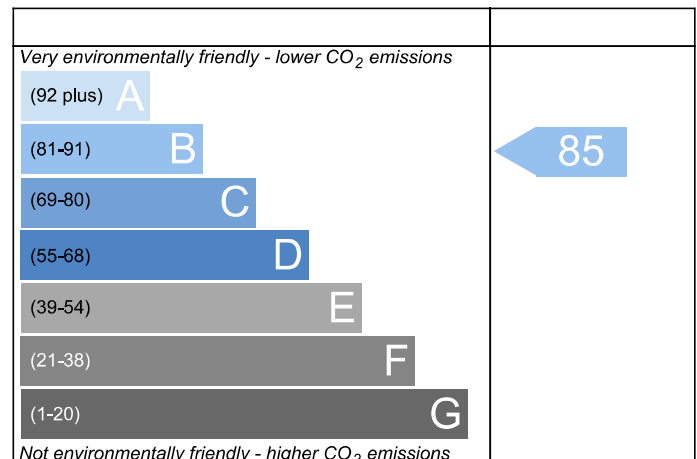


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

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



BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	AMAZON-1879-22 P9	Issued on Date	28/02/2022
Assessment Reference	DS	Prop Type Ref	
Property	Plot 9, Fairfield Phase 2, Parklands, St Merryn, Padstow, Cornwall, PL28 8FQ		
SAP Rating	87 B	DER	13.69
Environmental	85 B	TER	14.11
CO ₂ Emissions (t/year)	2.64	% DER<TER	2.95
General Requirements Compliance	Pass	DFEE	50.53
		TFEE	55.88
		% DFEE<TFEE	9.57
Assessor Details	Mr. Stuart Thomas, Energy Access (Southwest) Ltd, Tel: 01736 367474, s.thomas@energyaccess.org.uk	Assessor ID	V220-0003
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	14.11	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.69	kgCO ₂ /m ²	Pass
	-0.42 (-3.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.88	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.53	kWh/m ² /yr	
	-5.4 (-9.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.28 (max. 0.70)	Pass
Floor	0.21 (max. 0.25)	0.22 (max. 0.70)	Pass
Roof	0.18 (max. 0.20)	0.21 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	2.00 (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	4.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoTEC plus 637 VU 386/5-5 (H-GB) R6

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.28 kWh/day
Permitted by DBSCG 2.86

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South West England)

Medium

Pass

Based on:

Overshading

Average

Windows facing North East

2.99 m², No overhang

Windows facing South East

9.36 m², No overhang

Windows facing South West

1.98 m², No overhang

Windows facing North West

20.40 m², No overhang

Air change rate

1.00 ach

Blinds/curtains

Light-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

None

N/A

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating			B 87	B 87	SAP increase too small
Photovoltaic	£3,500 - £5,500	£382	B 91	B 90	Recommended
Wind turbine			0	0	Not applicable
Totals	£3,500 - £5,500	£382	B 91	B 90	

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	AMAZON-1879-22 P9		Issued on Date	28/02/2022	
Assessment Reference	DS	Prop Type Ref			
Property	Plot 9, Fairfield Phase 2, Parklands, St Merryn, Padstow, Cornwall, PL28 8FQ				
SAP Rating	87 B	DER	13.69	TER	14.11
Environmental	85 B	% DER<TER	2.95		
CO₂ Emissions (t/year)	2.64	DFEE	50.53	TFEE	55.88
General Requirements Compliance	Pass	% DFEE<TFEE	9.57		
Assessor Details	Mr. Stuart Thomas, Energy Access (Southwest) Ltd, Tel: 01736 367474, s.thomas@energyaccess.org.uk			Assessor ID	V220-0003
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 244 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.69 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.28 (max. 0.70)	OK
Floor	0.21 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.21 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	2.00 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoTEC plus 637 VU 386/5-5 (H-GB) R6

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.28 kWh/day
Permitted by DBSCG 2.86 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South West England): Medium OK

Based on:

Overshading: Average
Windows facing North East: 2.99 m², No overhang
Windows facing South East: 9.36 m², No overhang
Windows facing South West: 1.98 m², No overhang
Windows facing North West: 20.40 m², No overhang
Air change rate: 1.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

None

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.0980 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2980 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2086 (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	0.2660	0.2607	0.2555	0.2294	0.2242	0.1982	0.1982	0.1929	0.2086	0.2242	0.2347	0.2451 (22b)
Effective ac	0.5354	0.5340	0.5326	0.5263	0.5251	0.5196	0.5196	0.5186	0.5218	0.5251	0.5275	0.5300 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss							(33) + (36) = 192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	108.1836	107.9061	107.6341	106.3565	106.1174	105.0047	105.0047	104.7986	105.4333	106.1174	106.6010	107.1066 (38)
Heat transfer coeff	300.2946	300.0171	299.7451	298.4675	298.2284	297.1157	297.1157	296.9096	297.5443	298.2284	298.7120	299.2175 (39)
Average = Sum(39)m / 12 =												298.4663 (39)
HLP	1.2301	1.2290	1.2279	1.2226	1.2216	1.2171	1.2171	1.2162	1.2188	1.2216	1.2236	1.2257 (40)
HLP (average)												1.2226 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Total = Sum(45)m =												
Water storage loss:	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2312 (55)
Total storage loss												
	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (56)
If cylinder contains dedicated solar storage												
	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (62)
Solar input (sum of months) = Sum(63)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 (63)
Output from w/h												
	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Total per year (kWh/year) = Sum(64)m =												2404.5771 (64)
Heat gains from water heating, kWh/month												
	107.1031	95.0795	101.4530	93.1629	92.9023	85.3188	84.1342	89.2958	88.1901	96.4960	99.2471	105.2743 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4428	33.2564	27.0459	20.4755	15.3057	12.9217	13.9623	18.1488	24.3593	30.9297	36.0995	38.4835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.2567	415.5243	404.7702	381.8759	352.9761	325.8143	307.6686	303.4010	314.1551	337.0494	365.9492	393.1110 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	143.9558	141.4874	136.3615	129.3929	124.8687	118.4983	113.0836	120.0213	122.4862	129.6989	137.8433	141.4977 (72)
Total internal gains	664.5447	662.1574	640.0669	603.6337	565.0397	529.1236	506.6038	513.4604	532.8899	569.5672	611.7813	644.9815 (73)

6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m ²	Table 6a	Specific data	Specific data	factor	W				
				W/m ²	or Table 6b	or Table 6c	Table 6d					
Northeast			2.9900	11.2829	0.7600	0.7000	0.7700	12.4377 (75)				
Southeast			9.3600	36.7938	0.7600	0.7000	0.7700	126.9684 (77)				
Southwest			1.9800	36.7938	0.7600	0.7000	0.7700	26.8587 (79)				
Northwest			20.4000	11.2829	0.7600	0.7000	0.7700	84.8589 (81)				
Northeast			0.7600	17.4137	0.7600	0.7000	1.0000	6.3366 (82)				
Southeast			2.1500	38.2331	0.7600	0.7000	1.0000	39.3579 (82)				
Southwest			1.0800	38.2331	0.7600	0.7000	1.0000	19.7705 (82)				
Northwest			3.6800	17.4137	0.7600	0.7000	1.0000	30.6827 (82)				
Solar gains	347.2713	648.3543	1033.6289	1519.1061	1913.9029	1992.0880	1882.3912	1574.7070	1200.1608	756.5018	426.4059	290.3690 (83)
Total gains	1011.8160	1310.5117	1673.6958	2122.7398	2478.9426	2521.2115	2388.9950	2088.1674	1733.0508	1326.0690	1038.1871	935.3504 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	22.5815	22.6024	22.6229	22.7198	22.7380	22.8231	22.8231	22.8390	22.7903	22.7380	22.7012	22.6628
alpha	2.5054	2.5068	2.5082	2.5147	2.5159	2.5215	2.5215	2.5226	2.5194	2.5159	2.5134	2.5109
util living area	0.9855	0.9720	0.9418	0.8719	0.7545	0.6097	0.4857	0.5541	0.7736	0.9289	0.9768	0.9880 (86)
MIT	18.1390	18.4666	19.0260	19.7431	20.3551	20.7393	20.8948	20.8507	20.4908	19.6648	18.7606	18.0742 (87)
Th 2	19.8960	19.8969	19.8978	19.9019	19.9027	19.9064	19.9064	19.9070	19.9050	19.9027	19.9011	19.8995 (88)
util rest of house	0.9831	0.9674	0.9319	0.8495	0.7108	0.5366	0.3843	0.4514	0.7147	0.9119	0.9722	0.9860 (89)
MIT 2	16.0489	16.5253	17.3342	18.3540	19.1871	19.6721	19.8390	19.8036	19.3933	18.2658	16.9593	15.9562 (90)
Living area fraction									fIA = Living area / (4) =			0.1201 (91)
MIT	16.2998	16.7584	17.5373	18.5207	19.3273	19.8002	19.9657	19.9293	19.5251	18.4338	17.1756	16.2105 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.1498	16.6084	17.3873	18.3707	19.1773	19.6502	19.8157	19.7793	19.3751	18.2838	17.0256	16.0605 (93)

8. Space heating requirement

Utilisation	0.9690	0.9453	0.8990	0.8090	0.6768	0.5176	0.3752	0.4380	0.6796	0.8754	0.9523	0.9739 (94)
Useful gains	980.4280	1238.8759	1504.7183	1717.3036	1677.7020	1304.8933	896.2351	914.5825	1177.7447	1160.8249	988.6817	910.9119 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Heat loss rate W	3558.4369	3512.7094	3263.4167	2826.7104	2229.9474	1500.5016	955.4430	1003.3417	1569.5715	2291.5171	2964.9001	3548.8777 (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	1918.0386	1528.0162	1308.4716	798.7729	410.8706	0.0000	0.0000	0.0000	0.0000	841.2351	1422.8772	1962.6465 (98)
Space heating												10190.9287 (98)
Space heating per m2												(98) / (4) = 41.7456 (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 %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												10899.3890 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1918.0386	1528.0162	1308.4716	798.7729	410.8706	0.0000	0.0000	0.0000	0.0000	841.2351	1422.8772	1962.6465 (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)	2051.3782	1634.2419	1399.4349	854.3026	439.4338	0.0000	0.0000	0.0000	0.0000	899.7166	1521.7938	2099.0872 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Efficiency of water heater	89.1910	89.0694	88.7946	88.1650	86.7806	79.8000	79.8000	79.8000	79.8000	88.1934	88.9353	79.8000 (216)
Fuel for water heating, kWh/month	264.3134	233.4595	246.3558	222.9960	222.4396	216.8083	208.8524	228.3056	227.6298	231.1312	241.6397	257.9944 (219)
Water heating fuel used												2801.9256 (219)
Annual totals kWh/year												
Space heating fuel - main system												10899.3890 (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)												661.2522 (232)
Total delivered energy for all uses												14437.5668 (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	10899.3890	0.2160	2354.2680 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2801.9256	0.2160	605.2159 (264)
Space and water heating			2959.4840 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	661.2522	0.5190	343.1899 (268)
Total CO2, kg/year			3341.5988 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6900 (273)

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

DER			13.6900	ZC1
Total Floor Area		TFA	244.1200	
Assumed number of occupants		N	3.0593	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			9.9829	ZC2
CO2 emissions from cooking, equation (L16)			0.7882	ZC3
Total CO2 emissions			24.4611	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			24.4611	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0653 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3153 (18)
Number of sides sheltered					4 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2207 (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	0.2814	0.2759	0.2704	0.2428	0.2373	0.2097	0.2097	0.2042	0.2207	0.2373	0.2483	0.2594 (22b)
Effective ac	0.5396	0.5381	0.5366	0.5295	0.5282	0.5220	0.5220	0.5208	0.5244	0.5282	0.5308	0.5336 (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			1.7000	1.0000	1.7000		(26)
TER Semi-glazed door			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
TER Room Window (Uw = 1.70)			7.6700	1.5918	12.2088		(27a)
Floor 1 GF P/a 0.45			90.5300	0.1300	11.7689		(28a)
Floor 2 floor garage			18.9700	0.1300	2.4661		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.1800	20.0070		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.1800	12.4956		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.1800	2.1780		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1800	7.0866		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.1300	9.0922		(30)
Roof 2 horz	11.6300		11.6300	0.1300	1.5119		(30)
Roof 3 "attic"	36.2900		36.2900	0.1300	4.7177		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 133.7964		(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)							24.9659 (36)
Total fabric heat loss							(33) + (36) = 158.7623 (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	109.0394	108.7287	108.4241	106.9935	106.7258	105.4798	105.4798	105.2491	105.9598	106.7258	107.2673	107.8334 (38)
Average = Sum(39)m / 12 =	267.8017	267.4910	267.1864	265.7558	265.4881	264.2421	264.2421	264.0113	264.7220	265.4881	266.0296	265.7545 (39)
HLP	1.0970	1.0957	1.0945	1.0886	1.0875	1.0824	1.0824	1.0815	1.0844	1.0875	1.0897	1.0921 (40)
HLP (average)												1.0886 (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 3.0593 (42)
 Average daily hot water use (litres/day) 106.8580 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Total	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss												
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)
If cylinder contains dedicated solar storage												
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	232.9429	205.4113	215.9500	193.8940	190.2337	170.3025	163.8635	179.3871	178.9381	201.0418	212.1924	227.4427 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	232.9429	205.4113	215.9500	193.8940	190.2337	170.3025	163.8635	179.3871	178.9381	201.0418	212.1924	227.4427 (64)
Total per year (kWh/year) = Sum(64)m =												2371.6001 (64)
Heat gains from water heating, kWh/month												
	104.8625	93.0557	99.2123	90.9946	90.6617	83.1504	81.8936	87.0552	86.0217	94.2554	97.0788	103.0337 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4428	33.2564	27.0459	20.4755	15.3057	12.9217	13.9623	18.1488	24.3593	30.9297	36.0995	38.4835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.2567	415.5243	404.7702	381.8759	352.9761	325.8143	307.6686	303.4010	314.1551	337.0494	365.9492	393.1110 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	140.9442	138.4758	133.3499	126.3813	121.8571	115.4867	110.0720	117.0097	119.4746	126.6873	134.8317	138.4861 (72)
Total internal gains	661.5331	659.1458	637.0553	600.6221	562.0281	526.1120	503.5922	510.4488	529.8783	566.5556	608.7697	641.9699 (73)

6. Solar gains

[Jan]												
		Area	Solar flux					FF	Access		Gains	
		m ²	Table 6a	g	Specific data	or Table 6b	Specific data	or Table 6c	Table 6d		W	
Northeast		2.9900	11.2829	0.6300			0.7000		0.7700		10.3102 (75)	
Southeast		9.3600	36.7938	0.6300			0.7000		0.7700		105.2501 (77)	
Southwest		1.9800	36.7938	0.6300			0.7000		0.7700		22.2645 (79)	
Northwest		20.4000	11.2829	0.6300			0.7000		0.7700		70.3436 (81)	
Northeast		0.7600	17.4137	0.6300			0.7000		1.0000		5.2527 (82)	
Southeast		2.1500	38.2331	0.6300			0.7000		1.0000		32.6256 (82)	
Southwest		1.0800	38.2331	0.6300			0.7000		1.0000		16.3887 (82)	
Northwest		3.6800	17.4137	0.6300			0.7000		1.0000		25.4343 (82)	
Solar gains	287.8697	537.4516	856.8239	1259.2590	1586.5247	1651.3361	1560.4032	1305.3493	994.8702	627.1002	353.4680	240.7006 (83)
Total gains	949.4027	1196.5974	1493.8792	1859.8811	2148.5529	2177.4481	2063.9955	1815.7980	1524.7485	1193.6558	962.2377	882.6705 (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)												21.0000 (85)
tau	63.3035	63.3770	63.4493	63.7908	63.8551	64.1562	64.1562	64.2123	64.0399	63.8551	63.7252	63.5898
alpha	5.2202	5.2251	5.2300	5.2527	5.2570	5.2771	5.2771	5.2808	5.2693	5.2570	5.2483	5.2393
util living area	0.9998	0.9991	0.9958	0.9754	0.8924	0.7192	0.5511	0.6400	0.9059	0.9931	0.9994	0.9998 (86)
MIT	19.6314	19.7912	20.0725	20.4547	20.7854	20.9513	20.9902	20.9796	20.8266	20.3868	19.9357	19.6017 (87)
Th 2	20.0033	20.0043	20.0053	20.0101	20.0110	20.0152	20.0152	20.0160	20.0136	20.0110	20.0092	20.0073 (88)
util rest of house												
	0.9997	0.9988	0.9942	0.9654	0.8511	0.6307	0.4341	0.5172	0.8514	0.9891	0.9991	0.9998 (89)
MIT 2	18.1506	18.3852	18.7967	19.3508	19.7957	19.9823	20.0115	20.0072	19.8611	19.2599	18.6004	18.1100 (90)
Living area fraction												0.1201 (91)
MIT	18.3284	18.5540	18.9499	19.4834	19.9145	20.0987	20.1290	20.1239	19.9770	19.3952	18.7607	18.2891 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3284	18.5540	18.9499	19.4834	19.9145	20.0987	20.1290	20.1239	19.9770	19.3952	18.7607	18.2891 (93)

8. Space heating requirement

Utilisation	0.9994	0.9980	0.9916	0.9583	0.8464	0.6388	0.4480	0.5315	0.8488	0.9854	0.9985	0.9996 (94)
Useful gains	948.8625	1194.2327	1481.2870	1782.2841	1818.4979	1390.9021	924.7381	965.1168	1294.2651	1176.2528	960.8115	882.3282 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Heat loss rate W	3756.8247	3652.3175	3326.4388	2812.5896	2180.8636	1452.9757	932.5129	983.1586	1555.7840	2335.0298	3102.0894	3756.0930 (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	2089.1239	1651.8330	1372.7930	741.8199	269.6001	0.0000	0.0000	0.0000	0.0000	862.1301	1541.7201	2138.0810 (98)
Space heating per m2												10667.1011 (98)
											(98) / (4) =	43.6961 (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 %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												11408.6643 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2089.1239	1651.8330	1372.7930	741.8199	269.6001	0.0000	0.0000	0.0000	0.0000	862.1301	1541.7201	2138.0810 (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)	2234.3571	1766.6663	1468.2278	793.3903	288.3424	0.0000	0.0000	0.0000	0.0000	922.0642	1648.8986	2286.7177 (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	232.9429	205.4113	215.9500	193.8940	190.2337	170.3025	163.8635	179.3871	178.9381	201.0418	212.1924	227.4427 (64)
Efficiency of water heater (217)m	89.2988	89.1775	88.8801	88.0535	85.7437	79.8000	79.8000	79.8000	79.8000	88.2621	89.0553	79.8000 (216)
Fuel for water heating, kWh/month	260.8578	230.3398	242.9677	220.2003	221.8632	213.4117	205.3427	224.7959	224.2332	227.7781	238.2703	254.5580 (219)
Water heating fuel used												2764.6186 (219)
Annual totals kWh/year												
Space heating fuel - main system												11408.6643 (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)												661.2522 (232)
Total delivered energy for all uses												14909.5350 (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	11408.6643	0.2160	2464.2715 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2764.6186	0.2160	597.1576 (264)
Space and water heating			3061.4291 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	661.2522	0.5190	343.1899 (268)
Total CO2, kg/m2/year			3443.5440 (272)
Emissions per m2 for space and water heating			12.5407 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.4058 (272b)
Emissions per m2 for pumps and fans			0.1595 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5407 * 1.00) + 1.4058 + 0.1595, rounded to 2 d.p.			14.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0653 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2653 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1857 (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	0.2368	0.2322	0.2275	0.2043	0.1997	0.1764	0.1764	0.1718	0.1857	0.1997	0.2089	0.2182 (22b)
Effective ac	0.5280	0.5269	0.5259	0.5209	0.5199	0.5156	0.5156	0.5148	0.5172	0.5199	0.5218	0.5238 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss						(33) + (36) =	192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	106.7029	106.4829	106.2672	105.2543	105.0648	104.1826	104.1826	104.0193	104.5224	105.0648	105.4482	105.8490 (38)
Heat transfer coeff	298.8139	298.5939	298.3782	297.3653	297.1758	296.2936	296.2936	296.1303	296.6334	297.1758	297.5592	297.9600 (39)
Average = Sum(39)m / 12 =												297.3644 (39)
HLP	1.2240	1.2231	1.2223	1.2181	1.2173	1.2137	1.2137	1.2131	1.2151	1.2173	1.2189	1.2205 (40)
HLP (average)												1.2181 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438	(44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1681.2931	(45)
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)
Heat gains from water heating, kWh/month	37.0418	32.3970	33.4308	29.1457	27.9660	24.1326	22.3624	25.6611	25.9676	30.2628	33.0342	35.8730	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4428	33.2564	27.0459	20.4755	15.3057	12.9217	13.9623	18.1488	24.3593	30.9297	36.0995	38.4835	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.2567	415.5243	404.7702	381.8759	352.9761	325.8143	307.6686	303.4010	314.1551	337.0494	365.9492	393.1110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	(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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	(71)
Water heating gains (Table 5)	49.7873	48.2098	44.9338	40.4802	37.5888	33.5174	30.0569	34.4908	36.0661	40.6757	45.8808	48.2163	(72)
Total internal gains	567.3761	565.8797	545.6392	511.7209	474.7598	441.1427	420.5772	424.9299	443.4698	477.5441	516.8188	548.7001	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m ²	Table 6a	Specific data	Specific data	factor	W
		W/m ²	or Table 6b	or Table 6c	Table 6d	
Northeast	2.9900	11.2829	0.7600	0.7000		12.4377 (75)
Southeast	9.3600	36.7938	0.7600	0.7000	0.7700	126.9684 (77)
Southwest	1.9800	36.7938	0.7600	0.7000	0.7700	26.8587 (79)
Northwest	20.4000	11.2829	0.7600	0.7000	0.7700	84.8589 (81)
Northeast	0.7600	17.4137	0.7600	0.7000	1.0000	6.3366 (82)
Southeast	2.1500	38.2331	0.7600	0.7000	1.0000	39.3579 (82)
Southwest	1.0800	38.2331	0.7600	0.7000	1.0000	19.7705 (82)
Northwest	3.6800	17.4137	0.7600	0.7000	1.0000	30.6827 (82)

Solar gains	347.2713	648.3543	1033.6289	1519.1061	1913.9029	1992.0880	1882.3912	1574.7070	1200.1608	756.5018	426.4059	290.3690	(83)
Total gains	914.6475	1214.2340	1579.2680	2030.8271	2388.6627	2433.2307	2302.9684	1999.6369	1643.6307	1234.0459	943.2247	839.0690	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.6934	22.7101	22.7266	22.8040	22.8185	22.8865	22.8865	22.8991	22.8602	22.8185	22.7891	22.7585	
alpha	2.5129	2.5140	2.5151	2.5203	2.5212	2.5258	2.5258	2.5266	2.5240	2.5212	2.5193	2.5172	
util living area	0.9885	0.9763	0.9482	0.8811	0.7661	0.6227	0.4987	0.5702	0.7897	0.9382	0.9813	0.9907	(86)
MIT	18.0844	18.4149	18.9801	19.7069	20.3322	20.7271	20.8888	20.8410	20.4641	19.6177	18.7052	18.0178	(87)
Th 2	19.9008	19.9015	19.9022	19.9055	19.9062	19.9090	19.9090	19.9096	19.9079	19.9062	19.9049	19.9036	(88)
util rest of house	0.9865	0.9723	0.9392	0.8599	0.7234	0.5498	0.3960	0.4667	0.7329	0.9231	0.9775	0.9891	(89)
MIT 2	17.2183	17.5471	18.1061	18.8142	19.3979	19.7405	19.8600	19.8336	19.5370	18.7430	17.8405	17.1539	(90)
Living area fraction									fLA = Living area / (4) =			0.1201	(91)
MIT	17.3223	17.6512	18.2111	18.9214	19.5100	19.8590	19.9835	19.9546	19.6483	18.8480	17.9443	17.2576	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3223	17.6512	18.2111	18.9214	19.5100	19.8590	19.9835	19.9546	19.6483	18.8480	17.9443	17.2576	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Useful gains	896.1386	1166.6321	1454.1616	1698.6295	1685.5382	1328.7357	929.3353	942.6437	1178.0053	1114.7932	912.7085	825.1620	(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	3891.2513	3807.4444	3494.3235	2980.0096	2320.9544	1558.2016	1002.5115	1052.6121	1645.8194	2451.1185	3226.8203	3890.6446	(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	2228.3638	1774.6259	1517.8805	922.5937	472.7496	0.0000	0.0000	0.0000	0.0000	994.2260	1666.1605	2280.7191	(98)
Space heating												11857.3191	(98)
Space heating per m ²												(98) / (4) =	48.5717 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2785.1601	2192.5729	2250.5900	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7291	0.7906	0.7397	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2030.6970	1733.4873	1664.7771	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	2886.9771	2737.1972	2404.4282	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	616.5217	746.7602	550.3004	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												
Cooled fraction												1913.5822 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	154.1304	186.6900	137.5751	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												478.3955 (107)
Space cooling per m2												1.9597 (108)
Energy for space heating												48.5717 (99)
Energy for space cooling												1.9597 (108)
Total												50.5314 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0653 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3153 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2207 (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	0.2814	0.2759	0.2704	0.2428	0.2373	0.2097	0.2097	0.2042	0.2207	0.2373	0.2483	0.2594 (22b)
	0.5396	0.5381	0.5366	0.5295	0.5282	0.5220	0.5220	0.5208	0.5244	0.5282	0.5308	0.5336 (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			1.7000	1.0000	1.7000		(26)
TER Semi-glazed door			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
TER Room Window (Uw = 1.70)			7.6700	1.5918	12.2088		(27a)
Floor 1 GF P/a 0.45			90.5300	0.1300	11.7689		(28a)
Floor 2 floor garage			18.9700	0.1300	2.4661		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.1800	20.0070		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.1800	12.4956		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.1800	2.1780		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1800	7.0866		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.1300	9.0922		(30)
Roof 2 horz	11.6300		11.6300	0.1300	1.5119		(30)
Roof 3 "attic"	36.2900		36.2900	0.1300	4.7177		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	133.7964	(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)							24.9659 (36)
Total fabric heat loss						(33) + (36) =	158.7623 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	109.0394	108.7287	108.4241	106.9935	106.7258	105.4798	105.4798	105.2491	105.9598	106.7258	107.2673	107.8334 (38)
Heat transfer coeff	267.8017	267.4910	267.1864	265.7558	265.4881	264.2421	264.2421	264.0113	264.7220	265.4881	266.0296	266.5957 (39)
Average = Sum(39)m / 12 =												265.7545 (39)
HLP	1.0970	1.0957	1.0945	1.0886	1.0875	1.0824	1.0824	1.0815	1.0844	1.0875	1.0897	1.0921 (40)
HLP (average)												1.0886 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438	(44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1681.2931	(45)
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)
Heat gains from water heating, kWh/month	37.0418	32.3970	33.4308	29.1457	27.9660	24.1326	22.3624	25.6611	25.9676	30.2628	33.0342	35.8730	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	152.9643	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4428	33.2564	27.0459	20.4755	15.3057	12.9217	13.9623	18.1488	24.3593	30.9297	36.0995	38.4835	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.2567	415.5243	404.7702	381.8759	352.9761	325.8143	307.6686	303.4010	314.1551	337.0494	365.9492	393.1110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	38.2964	(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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	(71)
Water heating gains (Table 5)	49.7873	48.2098	44.9338	40.4802	37.5888	33.5174	30.0569	34.4908	36.0661	40.6757	45.8808	48.2163	(72)
Total internal gains	567.3761	565.8797	545.6392	511.7209	474.7598	441.1427	420.5772	424.9299	443.4698	477.5441	516.8188	548.7001	(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	(75)
Northeast	2.9900	11.2829	0.6300	0.7000	0.7700	10.3102	(75)
Southeast	9.3600	36.7938	0.6300	0.7000	0.7700	105.2501	(77)
Southwest	1.9800	36.7938	0.6300	0.7000	0.7700	22.2645	(79)
Northwest	20.4000	11.2829	0.6300	0.7000	0.7700	70.3436	(81)
Northeast	0.7600	17.4137	0.6300	0.7000	1.0000	5.2527	(82)
Southeast	2.1500	38.2331	0.6300	0.7000	1.0000	32.6256	(82)
Southwest	1.0800	38.2331	0.6300	0.7000	1.0000	16.3887	(82)
Northwest	3.6800	17.4137	0.6300	0.7000	1.0000	25.4343	(82)

Solar gains	287.8697	537.4516	856.8239	1259.2590	1586.5247	1651.3361	1560.4032	1305.3493	994.8702	627.1002	353.4680	240.7006	(83)
Total gains	855.2458	1103.3313	1402.4631	1770.9800	2061.2846	2092.4788	1980.9804	1730.2791	1438.3400	1104.6442	870.2868	789.4007	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	63.3035	63.3770	63.4493	63.7908	63.8551	64.1562	64.1562	64.2123	64.0399	63.8551	63.7252	63.5898		
alpha	5.2202	5.2251	5.2300	5.2527	5.2570	5.2771	5.2771	5.2808	5.2693	5.2570	5.2483	5.2393		
util living area	0.9999	0.9994	0.9969	0.9799	0.9055	0.7399	0.5718	0.6657	0.9223	0.9951	0.9996	0.9999	(86)	
MIT	19.5949	19.7551	20.0377	20.4241	20.7655	20.9443	20.9883	20.9756	20.8053	20.3533	19.9000	19.5655	(87)	
Th 2	20.0033	20.0043	20.0053	20.0101	20.0110	20.0152	20.0152	20.0160	20.0136	20.0110	20.0092	20.0073	(88)	
util rest of house	0.9998	0.9992	0.9956	0.9715	0.8673	0.6518	0.4516	0.5408	0.8738	0.9923	0.9994	0.9999	(89)	
MIT 2	18.7018	18.8628	19.1456	19.5308	19.8481	19.9891	20.0122	20.0086	19.8934	19.4653	19.0117	18.6757	(90)	
Living area fraction									fLA = Living area / (4) =			0.1201	(91)	
MIT	18.8090	18.9699	19.2527	19.6381	19.9583	20.1038	20.1294	20.1247	20.0029	19.5719	19.1184	18.7825	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.8090	18.9699	19.2527	19.6381	19.9583	20.1038	20.1294	20.1247	20.0029	19.5719	19.1184	18.7825	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)	
Useful gains	0.9997	0.9988	0.9943	0.9674	0.8649	0.6604	0.4661	0.5555	0.8732	0.9905	0.9992	0.9998	(94)	
Ext temp.	854.9989	1102.0496	1394.4830	1713.2298	1782.8566	1381.9125	923.2627	961.2515	1255.9287	1094.1286	869.6015	789.2524	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Month fracti	3885.5460	3763.5819	3407.3528	2853.7000	2192.4719	1454.3286	932.6088	983.3628	1562.6359	2381.9409	3197.2376	3887.6343	(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 per m2	2254.7270	1788.5497	1497.5752	821.1386	304.7538	0.0000	0.0000	0.0000	0.0000	958.1323	1675.8980	2305.1961	(98)	
												11605.9706	(98)	
												(98) / (4) =	47.5421	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	2483.8756	1955.3915	2006.4862	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8447	0.9106	0.8601	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2098.0721	1780.5957	1725.8024	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2507.7082	2378.7689	2104.3801	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	294.9380	445.0409	281.6618	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												1021.6406 (104)
Intermittency factor (Table 10b)												1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	73.7345	111.2602	70.4155	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												255.4102 (107)
Energy for space heating												1.0462 (108)
Energy for space cooling												47.5421 (99)
Total												1.0462 (108)
Target Fabric Energy Efficiency (TFEE)												48.5883 (109)
												55.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) = 0.0980 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2980 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2086 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	7.0000	6.6000	6.3000	5.5000	5.5000	5.0000	4.9000	4.9000	5.4000	6.3000	6.6000	7.0000 (22)
Wind factor	1.7500	1.6500	1.5750	1.3750	1.3750	1.2500	1.2250	1.2250	1.3500	1.5750	1.6500	1.7500 (22a)
Adj infilt rate	0.3650	0.3442	0.3285	0.2868	0.2868	0.2607	0.2555	0.2555	0.2816	0.3285	0.3442	0.3650 (22b)
Effective ac	0.5666	0.5592	0.5540	0.5411	0.5411	0.5340	0.5326	0.5326	0.5396	0.5540	0.5592	0.5666 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss							(33) + (36) = 192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	114.5002	113.0055	111.9422	109.3485	109.3485	107.9061	107.6341	107.6341	109.0491	111.9422	113.0055	114.5002 (38)
Heat transfer coeff	306.6112	305.1165	304.0532	301.4595	301.4595	300.0171	299.7451	299.7451	301.1601	304.0532	305.1165	306.6112 (39)
Average = Sum(39)m / 12 =												302.9290 (39)
HLP	1.2560	1.2499	1.2455	1.2349	1.2349	1.2290	1.2279	1.2279	1.2337	1.2455	1.2499	1.2560 (40)
HLP (average)												1.2409 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Water storage loss:	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2312 (55)
Total storage loss												
If cylinder contains dedicated solar storage	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
RHI water heating demand												2404.5771 (64)
Heat gains from water heating, kWh/month	107.1031	95.0795	101.4530	93.1629	92.9023	85.3188	84.1342	89.2958	88.1901	96.4960	99.2471	105.2743 (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	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.6071	83.1410	67.6148	51.1887	38.2642	32.3042	34.9059	45.3720	60.8982	77.3242	90.2488	96.2087 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	613.8160	620.1855	604.1346	569.9641	526.8300	486.2900	459.2068	452.8373	468.8883	503.0587	546.1928	586.7328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	143.9558	141.4874	136.3615	129.3929	124.8687	118.4983	113.0836	120.0213	122.4862	129.6989	137.8433	141.4977 (72)
Total internal gains	971.9796	965.4146	928.7116	871.1465	810.5636	757.6933	727.7970	738.8313	772.8734	830.6826	894.8856	945.0400 (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
Northeast	2.9900	15.4538	0.7600	0.7000	0.7700	17.0354 (75)
Southeast	9.3600	47.2368	0.7600	0.7000	0.7700	163.0051 (77)
Southwest	1.9800	47.2368	0.7600	0.7000	0.7700	34.4819 (79)
Northwest	20.4000	15.4538	0.7600	0.7000	0.7700	116.2279 (81)
Northeast	0.7600	24.0812	0.7600	0.7000	1.0000	8.7628 (82)
Southeast	2.1500	50.8937	0.7600	0.7000	1.0000	52.3910 (82)
Southwest	1.0800	50.8937	0.7600	0.7000	1.0000	26.3173 (82)
Northwest	3.6800	24.0812	0.7600	0.7000	1.0000	42.4306 (82)

Solar gains	460.6521	742.2828	1180.8762	1778.5286	2121.3329	2353.4750	1982.7200	1807.4229	1408.1154	879.0529	545.8693	396.6125 (83)
Total gains	1432.6317	1707.6974	2109.5878	2649.6751	2931.8965	3111.1682	2710.5170	2546.2542	2180.9888	1709.7355	1440.7549	1341.6524 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.1163	22.2247	22.3024	22.4943	22.4943	22.6024	22.6229	22.6229	22.5166	22.3024	22.2247	22.1163
alpha	2.4744	2.4816	2.4868	2.4996	2.4996	2.5068	2.5082	2.5082	2.5011	2.4868	2.4816	2.4744
util living area	0.9556	0.9357	0.8883	0.7946	0.6819	0.5308	0.4581	0.4647	0.6381	0.8413	0.9299	0.9588 (86)
MIT	18.9145	19.1087	19.5490	20.0965	20.5140	20.8086	20.9023	20.9034	20.7261	20.1881	19.5088	18.9428 (87)
Th 2	19.8755	19.8803	19.8838	19.8922	19.8922	19.8969	19.8978	19.8978	19.8932	19.8838	19.8803	19.8755 (88)
util rest of house	0.9474	0.9244	0.8692	0.7617	0.6316	0.4596	0.3641	0.3653	0.5575	0.8025	0.9144	0.9509 (89)
MIT 2	17.1654	17.4441	18.0689	18.8259	19.3744	19.7306	19.8335	19.8368	19.6562	18.9779	18.0271	17.2080 (90)
Living area fraction									fLA = Living area / (4) =			0.1201 (91)
MIT	17.3754	17.6440	18.2466	18.9784	19.5112	19.8600	19.9618	19.9648	19.7846	19.1232	18.2050	17.4163 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2254	17.4940	18.0966	18.8204	19.3612	19.7100	19.8118	19.8148	19.6346	18.9732	18.0550	17.2663 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9178	0.8896	0.8287	0.7238	0.6043	0.4465	0.3562	0.3572	0.5361	0.7615	0.8777	0.9224 (94)
	1314.8834	1519.0893	1748.1670	1917.7485	1771.7205	1389.1427	965.5719	909.4819	1169.1915	1301.9050	1264.5719	1237.5122 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Ext temp.	6.9000	7.0000	8.1000	9.8000	12.1000	14.6000	16.4000	16.6000	15.1000	12.5000	9.7000	7.3000 (96)
Heat loss rate W												
	3165.8779	3201.8867	3039.4921	2721.7038	2188.9575	1533.0861	1022.6835	963.6264	1365.6483	1968.2111	2549.2551	3055.7637 (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												
	1377.1399	1130.8398	960.7459	578.8478	310.4243	0.0000	0.0000	0.0000	0.0000	495.7317	924.9719	1352.7791 (98)
Space heating												7131.4805 (98)
RHI space heating demand												7131 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) = 0.0980 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2980 (18)
Number of sides sheltered					4 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2086 (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	0.2660	0.2607	0.2555	0.2294	0.2242	0.1982	0.1982	0.1929	0.2086	0.2242	0.2347	0.2451 (22b)
Effective ac	0.5354	0.5340	0.5326	0.5263	0.5251	0.5196	0.5196	0.5186	0.5218	0.5251	0.5275	0.5300 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss							(33) + (36) = 192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	108.1836	107.9061	107.6341	106.3565	106.1174	105.0047	105.0047	104.7986	105.4333	106.1174	106.6010	107.1066 (38)
Heat transfer coeff	300.2946	300.0171	299.7451	298.4675	298.2284	297.1157	297.1157	296.9096	297.5443	298.2284	298.7120	299.2175 (39)
Average = Sum(39)m / 12 =												298.4663 (39)
HLP	1.2301	1.2290	1.2279	1.2226	1.2216	1.2171	1.2171	1.2162	1.2188	1.2216	1.2236	1.2257 (40)
HLP (average)												1.2226 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Water storage loss:	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2312 (55)
Total storage loss												
If cylinder contains dedicated solar storage	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Heat gains from water heating, kWh/month	107.1031	95.0795	101.4530	93.1629	92.9023	85.3188	84.1342	89.2958	88.1901	96.4960	99.2471	105.2743 (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	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.6071	83.1410	67.6148	51.1887	38.2642	32.3042	34.9059	45.3720	60.8982	77.3242	90.2488	96.2087 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	613.8160	620.1855	604.1346	569.9641	526.8300	486.2900	459.2068	452.8373	468.8883	503.0587	546.1928	586.7328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	143.9558	141.4874	136.3615	129.3929	124.8687	118.4983	113.0836	120.0213	122.4862	129.6989	137.8433	141.4977 (72)
Total internal gains	971.9796	965.4146	928.7116	871.1465	810.5636	757.6933	727.7970	738.8313	772.8734	830.6826	894.8856	945.0400 (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						
Northeast	2.9900	11.2829	0.7600	0.7000	0.7700	12.4377 (75)						
Southeast	9.3600	36.7938	0.7600	0.7000	0.7700	126.9684 (77)						
Southwest	1.9800	36.7938	0.7600	0.7000	0.7700	26.8587 (79)						
Northwest	20.4000	11.2829	0.7600	0.7000	0.7700	84.8589 (81)						
Northeast	0.7600	17.4137	0.7600	0.7000	1.0000	6.3366 (82)						
Southeast	2.1500	38.2331	0.7600	0.7000	1.0000	39.3579 (82)						
Southwest	1.0800	38.2331	0.7600	0.7000	1.0000	19.7705 (82)						
Northwest	3.6800	17.4137	0.7600	0.7000	1.0000	30.6827 (82)						
Solar gains	347.2713	648.3543	1033.6289	1519.1061	1913.9029	1992.0880	1882.3912	1574.7070	1200.1608	756.5018	426.4059	290.3690 (83)
Total gains	1319.2510	1613.7689	1962.3405	2390.2526	2724.4664	2749.7812	2610.1882	2313.5383	1973.0342	1587.1844	1321.2915	1235.4089 (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)	22.5815	22.6024	22.6229	22.7198	22.7380	22.8231	22.8231	22.8390	22.7903	22.7380	22.7012	22.6628
alpha	2.5054	2.5068	2.5082	2.5147	2.5159	2.5215	2.5215	2.5226	2.5194	2.5159	2.5134	2.5109
util living area	0.9738	0.9564	0.9205	0.8435	0.7219	0.5758	0.4529	0.5145	0.7299	0.9000	0.9609	0.9776 (86)
MIT	18.3438	18.6586	19.1899	19.8612	20.4240	20.7724	20.9105	20.8745	20.5619	19.8052	18.9430	18.2764 (87)
Th 2	19.8960	19.8969	19.8978	19.9019	19.9027	19.9064	19.9064	19.9070	19.9050	19.9027	19.9011	19.8995 (88)
util rest of house	0.9696	0.9496	0.9077	0.8179	0.6761	0.5033	0.3557	0.4149	0.6668	0.8779	0.9536	0.9740 (89)
MIT 2	16.3456	16.8013	17.5653	18.5127	19.2707	19.7046	19.8499	19.8218	19.4741	18.4583	17.2213	16.2497 (90)
Living area fraction									fLA = Living area / (4) =			0.1201 (91)
MIT	16.5855	17.0243	17.7603	18.6747	19.4091	19.8328	19.9773	19.9482	19.6047	18.6200	17.4280	16.4931 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4355	16.8743	17.6103	18.5247	19.2591	19.6828	19.8273	19.7982	19.4547	18.4700	17.2780	16.3431 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9485	0.9212	0.8708	0.7778	0.6451	0.4870	0.3482	0.4041	0.6360	0.8381	0.9264	0.9550 (94)
Ext temp.	1251.3218	1486.5254	1708.7919	1859.0475	1757.5688	1339.2430	908.8443	934.8448	1254.8050	1330.1839	1224.1074	1179.8248 (95)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Heat loss rate W	3644.2167	3592.5020	3330.2677	2872.6452	2254.3492	1510.1794	958.8753	1008.9614	1593.2527	2347.0592	3040.3033	3633.4201 (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	1780.3138	1415.2163	1206.3781	729.7903	369.6047	0.0000	0.0000	0.0000	0.0000	756.5552	1307.6610	1825.4749 (98)
Space heating												9390.9943 (98)
Space heating per m2												(98) / (4) = 38.4688 (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 %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												10043.8442 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1780.3138	1415.2163	1206.3781	729.7903	369.6047	0.0000	0.0000	0.0000	0.0000	756.5552	1307.6610	1825.4749 (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)	1904.0789	1513.6003	1290.2439	780.5244	395.2991	0.0000	0.0000	0.0000	0.0000	809.1500	1398.5679	1952.3796 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Efficiency of water heater (217)m	89.1030	88.9717	88.6749	87.9960	86.5198	79.8000	79.8000	79.8000	79.8000	87.9957	88.8191	79.8000 (216)
Fuel for water heating, kWh/month	264.5745	233.7160	246.6884	223.4244	223.1101	216.8083	208.8524	228.3056	227.6298	231.6506	241.9558	258.2334 (219)
Water heating fuel used												2804.9493 (219)
Annual totals kWh/year												
Space heating fuel - main system												10043.8442 (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)												661.2522 (232)
Total delivered energy for all uses												13585.0457 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	10043.8442	3.4800	349.5258 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2804.9493	3.4800	97.6122 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	661.2522	13.1900	87.2192 (250)
Additional standing charges			120.0000 (251)
Total energy cost			664.2497 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9649 (257)
SAP value		86.5390
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	10043.8442	0.2160	2169.4703 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2804.9493	0.2160	605.8690 (264)
Space and water heating			2775.3394 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	661.2522	0.5190	343.1899 (268)
Total kg/year			3157.4543 (272)
CO2 emissions per m2			12.9300 (273)
EI value			85.3660
EI rating			85 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency $3.48 / 0.8554 = 4.068$, stars = 4
Water heating environmental impact $0.216 / 0.8554 = 0.2525$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) = 0.0980 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2980 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2086 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	7.0000	6.6000	6.3000	5.5000	5.5000	5.0000	4.9000	4.9000	5.4000	6.3000	6.6000	7.0000 (22)
Wind factor	1.7500	1.6500	1.5750	1.3750	1.3750	1.2500	1.2250	1.2250	1.3500	1.5750	1.6500	1.7500 (22a)
Adj infilt rate	0.3650	0.3442	0.3285	0.2868	0.2868	0.2607	0.2555	0.2555	0.2816	0.3285	0.3442	0.3650 (22b)
Effective ac	0.5666	0.5592	0.5540	0.5411	0.5411	0.5340	0.5326	0.5326	0.5396	0.5540	0.5592	0.5666 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss							(33) + (36) = 192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	114.5002	113.0055	111.9422	109.3485	109.3485	107.9061	107.6341	107.6341	109.0491	111.9422	113.0055	114.5002 (38)
Heat transfer coeff	306.6112	305.1165	304.0532	301.4595	301.4595	300.0171	299.7451	299.7451	301.1601	304.0532	305.1165	306.6112 (39)
Average = Sum(39)m / 12 =												302.9290 (39)
HLP	1.2560	1.2499	1.2455	1.2349	1.2349	1.2290	1.2279	1.2279	1.2337	1.2455	1.2499	1.2560 (40)
HLP (average)												1.2409 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Water storage loss:	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2312 (55)
Total storage loss												
If cylinder contains dedicated solar storage	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Heat gains from water heating, kWh/month	107.1031	95.0795	101.4530	93.1629	92.9023	85.3188	84.1342	89.2958	88.1901	96.4960	99.2471	105.2743 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.6071	83.1410	67.6148	51.1887	38.2642	32.3042	34.9059	45.3720	60.8982	77.3242	90.2488	96.2087 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	613.8160	620.1855	604.1346	569.9641	526.8300	486.2900	459.2068	452.8373	468.8883	503.0587	546.1928	586.7328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	143.9558	141.4874	136.3615	129.3929	124.8687	118.4983	113.0836	120.0213	122.4862	129.6989	137.8433	141.4977 (72)
Total internal gains	971.9796	965.4146	928.7116	871.1465	810.5636	757.6933	727.7970	738.8313	772.8734	830.6826	894.8856	945.0400 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m ²	Table 6a	Specific data	Specific data	factor	W					
			W/m ²	or Table 6b	or Table 6c	Table 6d						
Northeast		2.9900	15.4538	0.7600	0.7000	0.7700	17.0354 (75)					
Southeast		9.3600	47.2368	0.7600	0.7000	0.7700	163.0051 (77)					
Southwest		1.9800	47.2368	0.7600	0.7000	0.7700	34.4819 (79)					
Northwest		20.4000	15.4538	0.7600	0.7000	0.7700	116.2279 (81)					
Northeast		0.7600	24.0812	0.7600	0.7000	1.0000	8.7628 (82)					
Southeast		2.1500	50.8937	0.7600	0.7000	1.0000	52.3910 (82)					
Southwest		1.0800	50.8937	0.7600	0.7000	1.0000	26.3173 (82)					
Northwest		3.6800	24.0812	0.7600	0.7000	1.0000	42.4306 (82)					
Solar gains	460.6521	742.2828	1180.8762	1778.5286	2121.3329	2353.4750	1982.7200	1807.4229	1408.1154	879.0529	545.8693	396.6125 (83)
Total gains	1432.6317	1707.6974	2109.5878	2649.6751	2931.8965	3111.1682	2710.5170	2546.2542	2180.9888	1709.7355	1440.7549	1341.6524 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	22.1163	22.2247	22.3024	22.4943	22.4943	22.6024	22.6229	22.6229	22.5166	22.3024	22.2247	22.1163
alpha	2.4744	2.4816	2.4868	2.4996	2.4996	2.5068	2.5082	2.5082	2.5011	2.4868	2.4816	2.4744
util living area	0.9556	0.9357	0.8883	0.7946	0.6819	0.5308	0.4581	0.4647	0.6381	0.8413	0.9299	0.9588 (86)
MIT	18.9145	19.1087	19.5490	20.0965	20.5140	20.8086	20.9023	20.9034	20.7261	20.1881	19.5088	18.9428 (87)
Th 2	19.8755	19.8803	19.8838	19.8922	19.8922	19.8969	19.8978	19.8978	19.8932	19.8838	19.8803	19.8755 (88)
util rest of house	0.9474	0.9244	0.8692	0.7617	0.6316	0.4596	0.3641	0.3653	0.5575	0.8025	0.9144	0.9509 (89)
MIT 2	17.1654	17.4441	18.0689	18.8259	19.3744	19.7306	19.8335	19.8368	19.6562	18.9779	18.0271	17.2080 (90)
Living area fraction									fLA = Living area / (4) =			0.1201 (91)
MIT	17.3754	17.6440	18.2466	18.9784	19.5112	19.8600	19.9618	19.9648	19.7846	19.1232	18.2050	17.4163 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2254	17.4940	18.0966	18.8284	19.3612	19.7100	19.8118	19.8148	19.6346	18.9732	18.0550	17.2663 (93)

8. Space heating requirement

Utilisation	0.9178	0.8896	0.8287	0.7238	0.6043	0.4465	0.3562	0.3572	0.5361	0.7615	0.8777	0.9224 (94)
Useful gains	1314.8834	1519.0893	1748.1670	1917.7485	1771.7205	1389.1427	965.5719	909.4819	1169.1915	1301.9050	1264.5719	1237.5122 (95)
Ext temp.	6.9000	7.0000	8.1000	9.8000	12.1000	14.6000	16.4000	16.6000	15.1000	12.5000	9.7000	7.3000 (96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Heat loss rate W	3165.8779	3201.8867	3039.4921	2721.7038	2188.9575	1533.0861	1022.6835	963.6264	1365.6483	1968.2111	2549.2551	3055.7637	(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	1377.1399	1130.8398	960.7459	578.8478	310.4243	0.0000	0.0000	0.0000	0.0000	495.7317	924.9719	1352.7791	(98)
Space heating												7131.4805	(98)
Space heating per m2												(98) / (4) =	29.2130 (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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7627.2519 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1377.1399	1130.8398	960.7459	578.8478	310.4243	0.0000	0.0000	0.0000	0.0000	495.7317	924.9719	1352.7791	(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)	1472.8769	1209.4544	1027.5357	619.0886	332.0046	0.0000	0.0000	0.0000	0.0000	530.1944	989.2747	1446.8226	(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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435	(64)
Efficiency of water heater (217)m	88.7604	88.6537	88.3041	87.5246	86.0748	79.8000	79.8000	79.8000	79.8000	87.0971	88.2686	88.7688	(217)
Fuel for water heating, kWh/month	265.5955	234.5544	247.7244	224.6277	224.2635	216.8083	208.8524	228.3056	227.6298	234.0405	243.4646	259.3743	(219)
Water heating fuel used													2815.2409 (219)
Annual totals kWh/year													
Space heating fuel - main system													7627.2519 (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)													661.2522 (232)
Total delivered energy for all uses													11178.7450 (238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7627.2519	3.6300	276.8692 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2815.2409	3.6300	102.1932 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	661.2522	19.4400	128.5474 (250)
Additional standing charges			95.0000 (251)
Total energy cost			617.1899 (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	7627.2519	0.2160	1647.4864 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2815.2409	0.2160	608.0920 (264)
Space and water heating			2255.5785 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	661.2522	0.5190	343.1899 (268)
Total kg/year			2637.6933 (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	7627.2519	1.2200	9305.2473 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2815.2409	1.2200	3434.5940 (264)
Space and water heating			12739.8413 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	661.2522	3.0700	2030.0442 (268)
Primary energy kWh/year			15000.1355 (272)
Primary energy kWh/m2/year			61.4457 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
 Current environmental impact rating: B 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	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
U Solar photovoltaic panels	+ 4.6	-£ 382	-1020 kg (38.7%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 41	-276 kg (10.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£382	4.18 kg/m ²	B 91 B 90
Total Savings	£382	4.18 kg/m ²	
Potential energy efficiency rating:			B 91
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£143	£143	£0
Mains gas	£474	£474	£0
Space heating	£386	£386	£0
Water heating	£102	£102	£0
Lighting	£129	£129	£0
Generated (PV)	-£0	-£382	£382
Total cost of fuels	£617	£235	£382
Total cost of uses	£617	£235	£382
Delivered energy	46 kWh/m ²	38 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	2.6 tonnes	1.6 tonnes	1.0 tonnes
CO2 emissions per m ²	11 kg/m ²	7 kg/m ²	4 kg/m ²
Primary energy	61 kWh/m ²	37 kWh/m ²	25 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.0980 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2980 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2086 (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	0.2660	0.2607	0.2555	0.2294	0.2242	0.1982	0.1982	0.1929	0.2086	0.2242	0.2347	0.2451 (22b)
Effective ac	0.5354	0.5340	0.5326	0.5263	0.5251	0.5196	0.5196	0.5186	0.5218	0.5251	0.5275	0.5300 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss							(33) + (36) = 192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	108.1836	107.9061	107.6341	106.3565	106.1174	105.0047	105.0047	104.7986	105.4333	106.1174	106.6010	107.1066 (38)
Heat transfer coeff	300.2946	300.0171	299.7451	298.4675	298.2284	297.1157	297.1157	296.9096	297.5443	298.2284	298.7120	299.2175 (39)
Average = Sum(39)m / 12 =												298.4663 (39)
HLP	1.2301	1.2290	1.2279	1.2226	1.2216	1.2171	1.2171	1.2162	1.2188	1.2216	1.2236	1.2257 (40)
HLP (average)												1.2226 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Water storage loss:	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2312 (55)
Total storage loss												
If cylinder contains dedicated solar storage	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Heat gains from water heating, kWh/month	107.1031	95.0795	101.4530	93.1629	92.9023	85.3188	84.1342	89.2958	88.1901	96.4960	99.2471	105.2743 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.6071	83.1410	67.6148	51.1887	38.2642	32.3042	34.9059	45.3720	60.8982	77.3242	90.2488	96.2087 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	613.8160	620.1855	604.1346	569.9641	526.8300	486.2900	459.2068	452.8373	468.8883	503.0587	546.1928	586.7328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	143.9558	141.4874	136.3615	129.3929	124.8687	118.4983	113.0836	120.0213	122.4862	129.6989	137.8433	141.4977 (72)
Total internal gains	971.9796	965.4146	928.7116	871.1465	810.5636	757.6933	727.7970	738.8313	772.8734	830.6826	894.8856	945.0400 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
Northeast	2.9900	11.2829	0.7600	0.7000	0.7700	12.4377 (75)						
Southeast	9.3600	36.7938	0.7600	0.7000	0.7700	126.9684 (77)						
Southwest	1.9800	36.7938	0.7600	0.7000	0.7700	26.8587 (79)						
Northwest	20.4000	11.2829	0.7600	0.7000	0.7700	84.8589 (81)						
Northeast	0.7600	17.4137	0.7600	0.7000	1.0000	6.3366 (82)						
Southeast	2.1500	38.2331	0.7600	0.7000	1.0000	39.3579 (82)						
Southwest	1.0800	38.2331	0.7600	0.7000	1.0000	19.7705 (82)						
Northwest	3.6800	17.4137	0.7600	0.7000	1.0000	30.6827 (82)						
Solar gains	347.2713	648.3543	1033.6289	1519.1061	1913.9029	1992.0880	1882.3912	1574.7070	1200.1608	756.5018	426.4059	290.3690 (83)
Total gains	1319.2510	1613.7689	1962.3405	2390.2526	2724.4664	2749.7812	2610.1882	2313.5383	1973.0342	1587.1844	1321.2915	1235.4089 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	22.5815	22.6024	22.6229	22.7198	22.7380	22.8231	22.8231	22.8390	22.7903	22.7380	22.7012	22.6628
alpha	2.5054	2.5068	2.5082	2.5147	2.5159	2.5215	2.5215	2.5226	2.5194	2.5159	2.5134	2.5109
util living area	0.9738	0.9564	0.9205	0.8435	0.7219	0.5758	0.4529	0.5145	0.7299	0.9000	0.9609	0.9776 (86)
MIT	18.3438	18.6586	19.1899	19.8612	20.4240	20.7724	20.9105	20.8745	20.5619	19.8052	18.9430	18.2764 (87)
Th 2	19.8960	19.8969	19.8978	19.9019	19.9027	19.9064	19.9064	19.9070	19.9050	19.9027	19.9011	19.8995 (88)
util rest of house	0.9696	0.9496	0.9077	0.8179	0.6761	0.5033	0.3557	0.4149	0.6668	0.8779	0.9536	0.9740 (89)
MIT 2	16.3456	16.8013	17.5653	18.5127	19.2707	19.7046	19.8499	19.8218	19.4741	18.4583	17.2213	16.2497 (90)
Living area fraction									fLA = Living area / (4) =			0.1201 (91)
MIT	16.5855	17.0243	17.7603	18.6747	19.4091	19.8328	19.9773	19.9482	19.6047	18.6200	17.4280	16.4931 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4355	16.8743	17.6103	18.5247	19.2591	19.6828	19.8273	19.7982	19.4547	18.4700	17.2780	16.3431 (93)

8. Space heating requirement

Utilisation	0.9485	0.9212	0.8708	0.7778	0.6451	0.4870	0.3482	0.4041	0.6360	0.8381	0.9264	0.9550 (94)
Useful gains	1251.3218	1486.5254	1708.7919	1859.0475	1757.5688	1339.2430	908.8443	934.8448	1254.8050	1330.1839	1224.1074	1179.8248 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W	3644.2167	3592.5020	3330.2677	2872.6452	2254.3492	1510.1794	958.8753	1008.9614	1593.2527	2347.0592	3040.3033	3633.4201 (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	1780.3138	1415.2163	1206.3781	729.7903	369.6047	0.0000	0.0000	0.0000	0.0000	756.5552	1307.6610	1825.4749 (98)
Space heating												9390.9943 (98)
Space heating per m2												(98) / (4) = 38.4688 (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 %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												10043.8442 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1780.3138	1415.2163	1206.3781	729.7903	369.6047	0.0000	0.0000	0.0000	0.0000	756.5552	1307.6610	1825.4749 (98)
Space heating efficiency (main heating system 1) (217)m	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)	1904.0789	1513.6003	1290.2439	780.5244	395.2991	0.0000	0.0000	0.0000	0.0000	809.1500	1398.5679	1952.3796 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Efficiency of water heater	89.1030	88.9717	88.6749	87.9960	86.5198	79.8000	79.8000	79.8000	79.8000	87.9957	88.8191	79.8000 (216)
Fuel for water heating, kWh/month	264.5745	233.7160	246.6884	223.4244	223.1101	216.8083	208.8524	228.3056	227.6298	231.6506	241.9558	258.2334 (219)
Water heating fuel used												2804.9493 (219)
Annual totals kWh/year												
Space heating fuel - main system												10043.8442 (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)												661.2522 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394 (233)
Total delivered energy for all uses												11857.8063 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	10043.8442	3.4800	349.5258 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2804.9493	3.4800	97.6122 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	661.2522	13.1900	87.2192 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			436.4268 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.6340 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	91.1558
SAP rating (Section 12)		91 (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	10043.8442	0.2160	2169.4703 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2804.9493	0.2160	605.8690 (264)
Space and water heating			2775.3394 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	661.2522	0.5190	343.1899 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			2261.0170 (272)
CO2 emissions per m2			9.2600 (273)
EI value			89.5207
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.5300 (1b)	x 2.4700 (2b)	= 223.6091 (1b) - (3b)
First floor	109.5000 (1c)	x 2.6200 (2c)	= 286.8900 (1c) - (3c)
Second floor	44.0900 (1d)	x 2.3100 (2d)	= 101.8479 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	244.1200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 612.3470 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) = 0.0980 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2980 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2086 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	7.0000	6.6000	6.3000	5.5000	5.5000	5.0000	4.9000	4.9000	5.4000	6.3000	6.6000	7.0000 (22)
Wind factor	1.7500	1.6500	1.5750	1.3750	1.3750	1.2500	1.2250	1.2250	1.3500	1.5750	1.6500	1.7500 (22a)
Adj infilt rate	0.3650	0.3442	0.3285	0.2868	0.2868	0.2607	0.2555	0.2555	0.2816	0.3285	0.3442	0.3650 (22b)
Effective ac	0.5666	0.5592	0.5540	0.5411	0.5411	0.5340	0.5326	0.5326	0.5396	0.5540	0.5592	0.5666 (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
Door			2.1000	1.4000	2.9400		(26a)
Window (Uw = 1.40)			34.7300	1.3258	46.0436		(27)
Fire Door			1.7000	2.0000	3.4000		(26)
Velux (Uw = 1.30)			7.6700	1.2357	9.4781		(27a)
Floor 1 GF P/a 0.45			90.5300	0.2200	19.9166		(28a)
Floor 2 floor garage			18.9700	0.1900	3.6043		(28b)
Wall 1 Clad	129.4500	18.3000	111.1500	0.2200	24.4530		(29a)
Wall 2 Render	87.9500	18.5300	69.4200	0.2400	16.6608		(29a)
Wall 3 Garage	13.8000	1.7000	12.1000	0.2800	3.3880		(29a)
Wall 4 "attic"	39.3700		39.3700	0.1500	5.9055		(29a)
Roof 1 sloping	77.6100	7.6700	69.9400	0.2100	14.6874		(30)
Roof 2 horz	11.6300		11.6300	0.1400	1.6282		(30)
Roof 3 "attic"	36.2900		36.2900	0.1500	5.4435		(30)
Total net area of external elements Aum(A, m ²)			505.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 157.5490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.5620 (36)
Total fabric heat loss						(33) + (36) =	192.1110 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	114.5002	113.0055	111.9422	109.3485	109.3485	107.9061	107.6341	107.6341	109.0491	111.9422	113.0055	114.5002 (38)
Heat transfer coeff	306.6112	305.1165	304.0532	301.4595	301.4595	300.0171	299.7451	299.7451	301.1601	304.0532	305.1165	306.6112 (39)
Average = Sum(39)m / 12 =												302.9290 (39)
HLP	1.2560	1.2499	1.2455	1.2349	1.2349	1.2290	1.2279	1.2279	1.2337	1.2455	1.2499	1.2560 (40)
HLP (average)												1.2409 (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												3.0593 (42)
Average daily hot water use (litres/day)												106.8580 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	117.5438	113.2695	108.9952	104.7209	100.4466	96.1722	96.1722	100.4466	104.7209	108.9952	113.2695	117.5438 (44)
Energy content (annual)	174.3141	152.4562	157.3212	137.1564	131.6049	113.5650	105.2347	120.7583	122.2005	142.4130	155.4549	168.8139 (45)
Distribution loss (46)m = 0.15 x (45)m												1681.2931 (45)
Water storage loss:	26.1471	22.8684	23.5982	20.5735	19.7407	17.0347	15.7852	18.1137	18.3301	21.3619	23.3182	25.3221 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2312 (55)
Total storage loss												
If cylinder contains dedicated solar storage	38.1672	34.4736	38.1672	36.9360	38.1672	36.9360	38.1672	38.1672	36.9360	38.1672	36.9360	38.1672 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435 (64)
Heat gains from water heating, kWh/month	107.1031	95.0795	101.4530	93.1629	92.9023	85.3188	84.1342	89.2958	88.1901	96.4960	99.2471	105.2743 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572	183.5572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.6071	83.1410	67.6148	51.1887	38.2642	32.3042	34.9059	45.3720	60.8982	77.3242	90.2488	96.2087 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	613.8160	620.1855	604.1346	569.9641	526.8300	486.2900	459.2068	452.8373	468.8883	503.0587	546.1928	586.7328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150	56.4150 (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)	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714	-122.3714 (71)
Water heating gains (Table 5)	143.9558	141.4874	136.3615	129.3929	124.8687	118.4983	113.0836	120.0213	122.4862	129.6989	137.8433	141.4977 (72)
Total internal gains	971.9796	965.4146	928.7116	871.1465	810.5636	757.6933	727.7970	738.8313	772.8734	830.6826	894.8856	945.0400 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m ²	Table 6a	Specific data	Specific data	factor	W					
			W/m ²	or Table 6b	or Table 6c	Table 6d						
Northeast		2.9900	15.4538	0.7600	0.7000	0.7700	17.0354 (75)					
Southeast		9.3600	47.2368	0.7600	0.7000	0.7700	163.0051 (77)					
Southwest		1.9800	47.2368	0.7600	0.7000	0.7700	34.4819 (79)					
Northwest		20.4000	15.4538	0.7600	0.7000	0.7700	116.2279 (81)					
Northeast		0.7600	24.0812	0.7600	0.7000	1.0000	8.7628 (82)					
Southeast		2.1500	50.8937	0.7600	0.7000	1.0000	52.3910 (82)					
Southwest		1.0800	50.8937	0.7600	0.7000	1.0000	26.3173 (82)					
Northwest		3.6800	24.0812	0.7600	0.7000	1.0000	42.4306 (82)					
Solar gains	460.6521	742.2828	1180.8762	1778.5286	2121.3329	2353.4750	1982.7200	1807.4229	1408.1154	879.0529	545.8693	396.6125 (83)
Total gains	1432.6317	1707.6974	2109.5878	2649.6751	2931.8965	3111.1682	2710.5170	2546.2542	2180.9888	1709.7355	1440.7549	1341.6524 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	22.1163	22.2247	22.3024	22.4943	22.4943	22.6024	22.6229	22.6229	22.5166	22.3024	22.2247	22.1163
alpha	2.4744	2.4816	2.4868	2.4996	2.4996	2.5068	2.5082	2.5082	2.5011	2.4868	2.4816	2.4744
util living area	0.9556	0.9357	0.8883	0.7946	0.6819	0.5308	0.4581	0.4647	0.6381	0.8413	0.9299	0.9588 (86)
MIT	18.9145	19.1087	19.5490	20.0965	20.5140	20.8086	20.9023	20.9034	20.7261	20.1881	19.5088	18.9428 (87)
Th 2	19.8755	19.8803	19.8838	19.8922	19.8922	19.8969	19.8978	19.8978	19.8932	19.8838	19.8803	19.8755 (88)
util rest of house	0.9474	0.9244	0.8692	0.7617	0.6316	0.4596	0.3641	0.3653	0.5575	0.8025	0.9144	0.9509 (89)
MIT 2	17.1654	17.4441	18.0689	18.8259	19.3744	19.7306	19.8335	19.8368	19.6562	18.9779	18.0271	17.2080 (90)
Living area fraction									fLA = Living area / (4) =			0.1201 (91)
MIT	17.3754	17.6440	18.2466	18.9784	19.5112	19.8600	19.9618	19.9648	19.7846	19.1232	18.2050	17.4163 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2254	17.4940	18.0966	18.8284	19.3612	19.7100	19.8118	19.8148	19.6346	18.9732	18.0550	17.2663 (93)

8. Space heating requirement

Utilisation	0.9178	0.8896	0.8287	0.7238	0.6043	0.4465	0.3562	0.3572	0.5361	0.7615	0.8777	0.9224 (94)
Useful gains	1314.8834	1519.0893	1748.1670	1917.7485	1771.7205	1389.1427	965.5719	909.4819	1169.1915	1301.9050	1264.5719	1237.5122 (95)
Ext temp.	6.9000	7.0000	8.1000	9.8000	12.1000	14.6000	16.4000	16.6000	15.1000	12.5000	9.7000	7.3000 (96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Heat loss rate W	3165.8779	3201.8867	3039.4921	2721.7038	2188.9575	1533.0861	1022.6835	963.6264	1365.6483	1968.2111	2549.2551	3055.7637	(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	1377.1399	1130.8398	960.7459	578.8478	310.4243	0.0000	0.0000	0.0000	0.0000	495.7317	924.9719	1352.7791	(98)
Space heating												7131.4805	(98)
Space heating per m2												(98) / (4) =	29.2130 (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 %)														93.5000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														7627.2519	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1377.1399	1130.8398	960.7459	578.8478	310.4243	0.0000	0.0000	0.0000	0.0000	495.7317	924.9719	1352.7791	(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)	1472.8769	1209.4544	1027.5357	619.0886	332.0046	0.0000	0.0000	0.0000	0.0000	530.1944	989.2747	1446.8226	(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	235.7437	207.9410	218.7508	196.6044	193.0345	173.0130	166.6643	182.1879	181.6485	203.8426	214.9029	230.2435	(64)		
Efficiency of water heater (217)m	88.7604	88.6537	88.3041	87.5246	86.0748	79.8000	79.8000	79.8000	79.8000	87.0971	88.2686	79.8000	(216)		
Fuel for water heating, kWh/month	265.5955	234.5544	247.7244	224.6277	224.2635	216.8083	208.8524	228.3056	227.6298	234.0405	243.4646	259.3743	(219)		
Water heating fuel used													2815.2409	(219)	
Annual totals kWh/year															
Space heating fuel - main system													7627.2519	(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)														661.2522	(232)
Energy saving/generation technologies (Appendices M, N and Q)															
PV Unit 0 (0.80 * 2.50 * 1229 * 0.80) =										-1966.2029				-1966.2029	(233)
Total delivered energy for all uses														9212.5421	(238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7627.2519	3.6300	276.8692 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2815.2409	3.6300	102.1932 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	661.2522	19.4400	128.5474 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1966.2029	19.4400	-382.2299 (252)
Total energy cost			234.9601 (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	7627.2519	0.2160	1647.4864 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2815.2409	0.2160	608.0920 (264)
Space and water heating			2255.5785 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	661.2522	0.5190	343.1899 (268)
Energy saving/generation technologies			
PV Unit	-1966.2029	0.5190	-1020.4593 (269)
Total kg/year			1617.2340 (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	7627.2519	1.2200	9305.2473 (261)

FULL SAP CALCULATION PRINTOUT

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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2815.2409	1.2200	3434.5940 (264)
Space and water heating			12739.8413 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	661.2522	3.0700	2030.0442 (268)
Energy saving/generation technologies			
PV Unit	-1966.2029	3.0700	-6036.2430 (269)
Primary energy kWh/year			8963.8925 (272)
Primary energy kWh/m2/year			36.7192 (273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	AMAZON-1879-22 P9	Issued on Date	28/02/2022
Assessment Reference	DS	Prop Type Ref	
Property	Plot 9, Fairfield Phase 2, Parklands, St Merryn, Padstow, Cornwall, PL28 8FQ		
SAP Rating	87 B	DER	13.69
Environmental	85 B	TER	14.11
CO₂ Emissions (t/year)	2.64	% DER<TER	2.95
General Requirements Compliance	Pass	DFEE	50.53
		TFEE	55.88
		% DFEE<TFEE	9.57
Assessor Details	Mr. Stuart Thomas, Energy Access (Southwest) Ltd, Tel: 01736 367474, s.thomas@energyaccess.org.uk	Assessor ID	V220-0003
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	14.11	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.69	kgCO ₂ /m ²	Pass
	-0.42 (-3.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.88	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.53	kWh/m ² /yr	
	-5.4 (-9.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.28 (max. 0.70)	Pass
Floor	0.21 (max. 0.25)	0.22 (max. 0.70)	Pass
Roof	0.18 (max. 0.20)	0.21 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	2.00 (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	4.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC plus 637 VU 386/5-5 (H-GB) R6 Efficiency: 89.5% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.28 kWh/day
Permitted by DBSCG 2.86

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South West England)

Medium

Pass

Based on:

Overshading

Average

Windows facing North East

2.99 m², No overhang

Windows facing South East

9.36 m², No overhang

Windows facing South West

1.98 m², No overhang

Windows facing North West

20.40 m², No overhang

Air change rate

1.00 ach

Blinds/curtains

Light-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.00 (design value)

Maximum

10.0

Pass

10 Key features

None

N/A

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.