

PREDICTED ENERGY ASSESSMENT

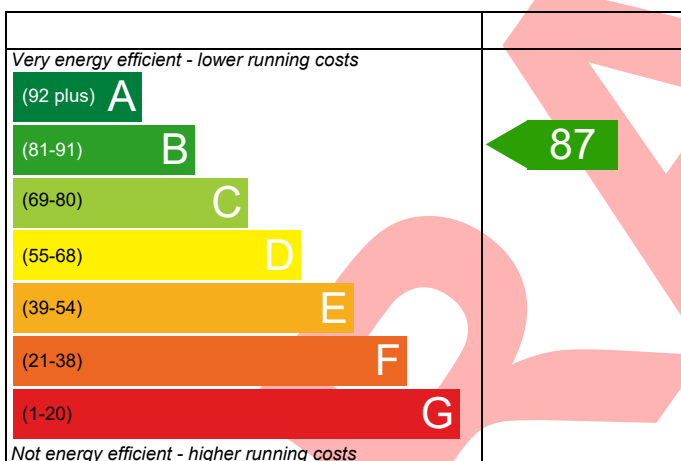
2a, RG4 6RW,
Caversham,
Reading,
RG4 6RW

Dwelling type: House, Detached
Date of assessment: 15/11/2022
Produced by: Paul Taylerson
Total floor area: 100.09 m²

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

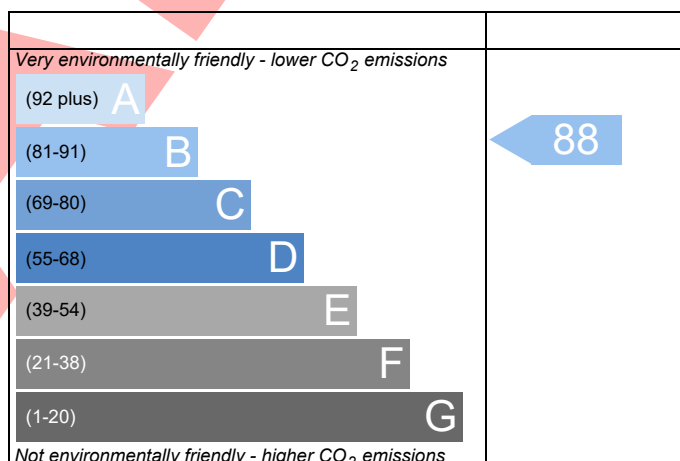


England

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	2 Hadleigh Rise	Issued on Date	15/11/2022
Assessment Reference	As Built	Prop Type Ref	New Build
Property	2a, RG4 6RW, Caversham, Reading, RG4 6RW		
SAP Rating	87 B	DER	15.17
Environmental	88 B	% DER<TER	20.57
CO ₂ Emissions (t/year)	1.21	DFEE	54.94
General Requirements Compliance	Pass	% DFEE<TFEE	12.43
Assessor Details	Mr. Paul Taylerson, Paul Taylerson, Tel: 07904 120 408, paultaylerson@gmail.com	Assessor ID	U796-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.10	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.17	kgCO ₂ /m ²	Pass
	-3.93 (-20.6%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	62.73	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	54.94	kWh/m ² /yr	
	-7.8 (-12.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.20 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Medium

Pass

Based on:

Overshading

Average

Windows facing North

8.32 m², No overhang

Windows facing East

14.28 m², No overhang

Windows facing West

6.72 m², No overhang

Air change rate

2.50 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

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.11

W/m²K

Thermal bridging y-value

0.031

W/m²K

Photovoltaic array

1.00

kW

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	2 Hadleigh Rise			Issued on Date	15/11/2022
Assessment Reference	As Built	Prop Type Ref	New Build		
Property	2a, RG4 6RW, Caversham, Reading, RG4 6RW				
SAP Rating	87 B	DER	15.17	TER	19.10
Environmental	88 B	% DER<TER	20.57		
CO ₂ Emissions (t/year)	1.21	DFEE	54.94	TFEE	62.73
General Requirements Compliance	Pass	% DFEE<TFEE	12.43		
Assessor Details	Mr. Paul Taylerson, Paul Taylerson, Tel: 07904 120 408, paultaylerson@gmail.com			Assessor ID	U796-0001
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 100 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.10 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.17 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 54.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 8.32 m², No overhang
Windows facing East: 14.28 m², No overhang
Windows facing West: 6.72 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.031 W/m²K
Photovoltaic array 1.00 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1180 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3680 (18)		
Number of sides sheltered												2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3128 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
Adj infilt rate	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676 (22b)		
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Opening Type 1			1.8200	1.4000	2.5480			(26a)					
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712			(27)					
Heat Loss Floor 1			53.5000	0.1500	8.0250			(28a)					
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804			(29a)					
External Roof 1	46.5900		46.5900	0.1100	5.1249			(30)					
External Roof 2	6.9100		6.9100	0.2000	1.3820			(30)					
Total net area of external elements Aum(A, m2)			257.6200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.4315			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9690	(36)					
Total fabric heat loss						(33) + (36) =	91.4005	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 48.6138	Feb 48.3547	Mar 48.1007	Apr 46.9079	May 46.6848	Jun 45.6459	Jul 45.6459	Aug 45.4535	Sep 46.0461	Oct 46.6848	Nov 47.1362	Dec 47.6082	(38)
Heat transfer coeff	140.0143	139.7552	139.5013	138.3085	138.0853	137.0464	137.0464	136.8540	137.4466	138.0853	138.5368	139.0088	(39)
Average = Sum(39)m / 12 =												138.3074	(39)
HLP	Jan 1.3989	Feb 1.3963	Mar 1.3938	Apr 1.3818	May 1.3796	Jun 1.3692	Jul 1.3692	Aug 1.3673	Sep 1.3732	Oct 1.3796	Nov 1.3841	Dec 1.3888	(40)
HLP (average)												1.3818	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	Jan 109.2118	Feb 105.2405	Mar 101.2692	Apr 97.2978	May 93.3265	Jun 89.3551	Jul 89.3551	Aug 93.3265	Sep 97.2978	Oct 101.2692	Nov 105.2405	Dec 109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)												Total = Sum(45)m = 1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	14.2169	12.8411	14.2169	13.7583	14.2169	13.7583	14.2169	14.2169	13.7583	14.2169	13.7583	(61)	
Total heat required for water heating calculated for each month													
Solar input	176.1749	154.4906	160.3865	141.1925	136.4931	119.2733	111.9921	126.4154	127.2967	146.5350	158.1939	171.0646 (62)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
FGHRS	-8.9552	-7.8745	-7.2228	-5.9534	-2.3131	0.0000	0.0000	Solar input (sum of months) = Sum(63)m =	0.0000	0.0000	-6.2768	-7.7331	0.0000 (63)
Output from w/h								0.0000	0.0000	-6.2768	-7.7331	-8.9034 eq. (G2)	
	167.2197	146.6161	153.1637	135.2391	134.1799	119.2733	111.9921	126.4154	127.2967	140.2582	150.4608	162.1612 (64)	
								Total per year (kWh/year) = Sum(64)m =				1674.2761 (64)	
Heat gains from water heating, kWh/month													
	57.4053	50.3087	52.1556	45.8114	44.2110	38.5233	36.0645	40.8602	41.1911	47.5500	51.4644	55.7061 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.8648	20.3083	16.5158	12.5035	9.3465	7.8907	8.5262	11.0827	14.8752	18.8875	22.0445	23.5003 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	256.4732	259.1346	252.4280	238.1504	220.1275	203.1885	191.8722	189.2108	195.9175	210.1950	228.2179	245.1569 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018 (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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143 (71)
Water heating gains (Table 5)	77.1576	74.8642	70.1016	63.6270	59.4234	53.5046	48.4738	54.9196	57.2099	63.9113	71.4783	74.8738 (72)
Total internal gains	423.6009	421.4124	406.1508	381.3863	356.0028	331.6892	315.9776	322.3185	335.1079	360.0992	388.8461	410.6363 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					8.3200	10.6334	0.7600	0.7000	0.7700	32.6167 (74)		
East					14.2800	19.6403	0.7600	0.7000	0.7700	103.4000 (76)		
West					6.7200	19.6403	0.7600	0.7000	0.7700	48.6588 (80)		
Solar gains	184.6755	359.7914	595.7906	884.5814	1104.7677	1141.6639	1082.3931	914.7302	697.0898	427.1587	229.8363	152.2366 (83)
Total gains	608.2764	781.2038	1001.9413	1265.9676	1460.7706	1473.3531	1398.3706	1237.0488	1032.1977	787.2579	618.6824	562.8729 (84)

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	49.6428	49.7348	49.8253	50.2550	50.3362	50.7178	50.7178	50.7891	50.5701	50.3362	50.1722	50.0018
alpha	4.3095	4.3157	4.3217	4.3503	4.3557	4.3812	4.3812	4.3859	4.3713	4.3557	4.3448	4.3335
util living area	0.9978	0.9932	0.9752	0.9067	0.7575	0.5689	0.4250	0.4956	0.7778	0.9657	0.9951	0.9984 (86)
MIT	19.7716	19.9444	20.2327	20.5828	20.8178	20.9118	20.9323	20.9271	20.8396	20.4813	20.0535	19.7415 (87)
Th 2	19.7642	19.7662	19.7681	19.7773	19.7790	19.7870	19.7870	19.7885	19.7839	19.7790	19.7755	19.7719 (88)
util rest of house	0.9970	0.9908	0.9664	0.8759	0.6907	0.4720	0.3110	0.3717	0.6867	0.9484	0.9930	0.9978 (89)
MIT 2	18.1352	18.3883	18.8052	19.2949	19.5824	19.6812	19.6946	19.6941	19.6214	19.1726	18.5556	18.0970 (90)
Living area fraction									fLA = Living area / (4) =			0.1957 (91)
MIT	18.4554	18.6928	19.0846	19.5470	19.8242	19.9220	19.9369	19.9354	19.8599	19.4287	18.8488	18.4189 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4554	18.6928	19.0846	19.5470	19.8242	19.9220	19.9369	19.9354	19.8599	19.4287	18.8488	18.4189 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.957	0.9878	0.9599	0.8689	0.6934	0.4833	0.3254	0.3872	0.6932	0.9417	0.9907	0.9969 (94)
Useful gains	605.675	771.7016	961.8130	1100.0557	1012.9216	712.0543	455.0008	479.0108	715.5060	741.3362	612.9141	561.1291 (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	1981.9651	1927.6217	1755.5719	1472.5651	1121.8336	729.3664	457.3052	483.8405	791.6728	1219.1192	1627.6369	1976.5500 (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	1023.9587	776.7783	590.5566	268.2068	81.0306	0.0000	0.0000	0.0000	0.0000	355.4705	730.6004	1053.0732 (98)
Space heating												4879.6751 (98)
Space heating per m2												48.7529 (99)
										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5391.9062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1023.9587	776.7783	590.5566	268.2068	81.0306	0.0000	0.0000	0.0000	0.0000	355.4705	730.6004	1053.0732	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1131.4461	858.3185	652.5488	296.3611	89.5365	0.0000	0.0000	0.0000	0.0000	392.7851	807.2933	1163.6168	(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	167.2197	146.6161	153.1637	135.2391	134.1799	119.2733	111.9921	126.4154	127.2967	140.2582	150.4608	162.1612	(64)
Efficiency of water heater (217)m	90.0367	89.9763	89.8219	89.4015	88.4779	87.3000	87.3000	87.3000	87.3000	89.5711	89.9370	87.3000	(216)
Fuel for water heating, kWh/month	185.7239	162.9496	170.5193	151.2716	151.6535	136.6246	128.2842	144.8057	145.8153	156.5888	167.2957	180.0600	(219)
Water heating fuel used												1881.5922	(219)
Annual totals kWh/year													
Space heating fuel - main system												5391.9062	(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)												403.7990	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 908 * 0.80) =										-581.0267		-581.0267	(233)
Total delivered energy for all uses												7171.2707	(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	5391.9062	0.2160	1164.6517 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1881.5922	0.2160	406.4239 (264)
Space and water heating			1571.0757 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	403.7990	0.5190	209.5717 (268)
Energy saving/generation technologies			
PV Unit	-581.0267	0.5190	-301.5529 (269)
Total CO2, kg/year			1518.0195 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1700 (273)

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

DER		15.1700	ZC1
Total Floor Area	TFA	100.0900	
Assumed number of occupants	N	2.7404	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1844	ZC2
CO2 emissions from cooking, equation (L16)		1.8460	ZC3
Total CO2 emissions		32.2004	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		32.2004	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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1574 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4074 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3463 (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	0.4415	0.4328	0.4242	0.3809	0.3722	0.3289	0.3289	0.3203	0.3463	0.3722	0.3895	0.4069 (22b)
Effective ac	0.5975	0.5937	0.5900	0.5725	0.5693	0.5541	0.5541	0.5513	0.5599	0.5693	0.5759	0.5828 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.8200	1.2000	2.1840		(26a)
TER Opening Type (Uw = 1.40)			23.2000	1.3258	30.7576		(27)
Heat Loss Floor 1			53.5000	0.1300	6.9550		(28a)
External Wall 1	150.6200	25.0200	125.6000	0.1800	22.6080		(29a)
External Roof 1	46.5900		46.5900	0.1300	6.0567		(30)
External Roof 2	6.9100		6.9100	0.1300	0.8983		(30)
Total net area of external elements Aum(A, m ²)			257.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.4596		(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)							13.1814 (36)
Total fabric heat loss						(33) + (36) =	82.6410 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.1164	49.7990	49.4878	48.0264	47.7530	46.4801	46.4801	46.2444	46.9704	47.7530	48.3061	48.8844 (38)
Heat transfer coeff	132.7574	132.4399	132.1288	130.6674	130.3940	129.1211	129.1211	128.8854	129.6114	130.3940	130.9471	131.5254 (39)
Average = Sum(39)m / 12 =												130.6661 (39)
HLP	1.3264	1.3232	1.3201	1.3055	1.3028	1.2900	1.2900	1.2877	1.2949	1.3028	1.3083	1.3141 (40)
HLP (average)												1.3055 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy content (annual)	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	47.9825	47.5582	44.0655	45.5344	47.5582	47.9825	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	212.9169	187.6769	197.1285	175.4167	169.8343	149.5806	143.3096	159.7566	161.5209	183.2770	193.7506	207.8066 (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	212.9169	187.6769	197.1285	175.4167	169.8343	149.5806	143.3096	159.7566	161.5209	183.2770	193.7506	207.8066 (64)
Heat gains from water heating, kWh/month	66.5908	58.6053	61.3411	54.3675	52.5464	46.1001	43.8938	49.1955	49.7472	56.7355	60.3536	64.8916 (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	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.8648	20.3083	16.5158	12.5035	9.3465	7.8907	8.5262	11.0827	14.8752	18.8875	22.0445	23.5003 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	256.4732	259.1346	252.4280	238.1504	220.1275	203.1885	191.8722	189.2108	195.9175	210.1950	228.2179	245.1569 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018 (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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143 (71)
Water heating gains (Table 5)	89.5037	87.2103	82.4477	75.5104	70.6268	64.0280	58.9971	66.1230	69.0933	76.2574	83.8244	87.2199 (72)
Total internal gains	435.9470	433.7585	418.4969	393.2697	367.2062	342.2126	326.5009	333.5219	346.9913	372.4453	401.1922	422.9824 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.5900	10.6334	0.6300	0.7000	0.7700	21.4155 (74)
East	11.3000	19.6403	0.6300	0.7000	0.7700	67.8262 (76)
West	5.3100	19.6403	0.6300	0.7000	0.7700	31.8723 (80)

Solar gains	121.1141	235.9577	390.7327	580.1400	724.5615	748.7677	709.8913	599.9181	457.1701	280.1386	150.7312	99.8403 (83)
Total gains	557.0611	669.7162	809.2296	973.4097	1091.7677	1090.9803	1036.3922	933.4400	804.1614	652.5838	551.9234	522.8227 (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	52.3564	52.4819	52.6054	53.1938	53.3053	53.8308	53.8308	53.9293	53.6272	53.3053	53.0802	52.8468
alpha	4.4904	4.4988	4.5070	4.5463	4.5537	4.5887	4.5887	4.5953	4.5751	4.5537	4.5387	4.5231
util living area	0.9985	0.9962	0.9880	0.9546	0.8602	0.6923	0.5319	0.6039	0.8613	0.9811	0.9969	0.9989 (86)
MIT	19.4901	19.6673	19.9840	20.4052	20.7503	20.9350	20.9846	20.9733	20.8156	20.3465	19.8418	19.4626 (87)
Th 2	19.8202	19.8227	19.8251	19.8365	19.8387	19.8486	19.8486	19.8505	19.8448	19.8387	19.8343	19.8298 (88)
util rest of house	0.9979	0.9949	0.9835	0.9368	0.8081	0.5927	0.4009	0.4680	0.7877	0.9709	0.9956	0.9985 (89)
MIT 2	17.8169	18.0773	18.5391	19.1454	19.5994	19.8070	19.8433	19.8400	19.6959	19.0751	18.3409	17.7832 (90)
Living area fraction	18.1444	18.3885	18.8219	19.3920	19.8246	20.0278	20.0667	20.0618	19.9151	19.3240	18.6346	18.1119 (92)
Temperature adjustment	18.1444	18.3885	18.8219	19.3920	19.8246	20.0278	20.0667	20.0618	19.9151	19.3240	18.6346	18.1119 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9924	0.9780	0.9281	0.8074	0.6095	0.4266	0.4945	0.7931	0.9644	0.9934	0.9975 (94)
Ext temp.	555.2342	664.6239	791.4225	903.4398	881.4793	664.9221	442.1760	461.5628	637.7497	629.3714	548.2790	521.5288 (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	1837.9489	1786.4224	1628.0797	1370.9599	1059.4037	700.8419	447.6240	471.9517	753.7021	1137.5508	1510.4262	1829.7720 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	954.3398	753.8487	622.4730	336.6145	132.3757	0.0000	0.0000	0.0000	0.0000	378.0854	692.7459	973.3329 (98)
												4843.8159 (98)
												48.3946 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5186.0984 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	954.3398	753.8487	622.4730	336.6145	132.3757	0.0000	0.0000	0.0000	0.0000	378.0854	692.7459	973.3329	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1021.7770	807.1185	666.4593	360.4010	141.7299	0.0000	0.0000	0.0000	0.0000	404.8024	741.6980	1042.1123	(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	212.9169	187.6769	197.1285	175.4167	169.8343	149.5806	143.3096	159.7566	161.5209	183.2770	193.7506	207.8066	(64)
Efficiency of water heater (217)m	88.3725	88.1889	87.7455	86.6655	84.4320	80.3000	80.3000	80.3000	80.3000	86.8342	87.9814	88.4428	(216)
Fuel for water heating, kWh/month	240.9313	212.8123	224.6593	202.4065	201.1492	186.2772	178.4677	198.9497	201.1469	211.0656	220.2177	234.9615	(219)
Water heating fuel used												2513.0447	(219)
Annual totals kWh/year													
Space heating fuel - main system												5186.0984	(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)												403.7990	(232)
Total delivered energy for all uses												8177.9421	(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	5186.0984	0.2160	1120.1973 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2513.0447	0.2160	542.8177 (264)
Space and water heating			1663.0149 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	403.7990	0.5190	209.5717 (268)
Total CO2, kg/m2/year			1911.5116 (272)
Emissions per m2 for space and water heating			16.6152 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0938 (272b)
Emissions per m2 for pumps and fans			0.3889 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6152 * 1.00) + 2.0938 + 0.3889, rounded to 2 d.p.			19.1000 (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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1574 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4074 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3463 (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	0.4415	0.4328	0.4242	0.3809	0.3722	0.3289	0.3289	0.3203	0.3463	0.3722	0.3895	0.4069 (22b)
Effective ac	0.5975	0.5937	0.5900	0.5725	0.5693	0.5541	0.5541	0.5513	0.5599	0.5693	0.5759	0.5828 (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
Opening Type 1			1.8200	1.4000	2.5480		(26a)
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712		(27)
Heat Loss Floor 1			53.5000	0.1500	8.0250		(28a)
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804		(29a)
External Roof 1	46.5900		46.5900	0.1100	5.1249		(30)
External Roof 2	6.9100		6.9100	0.2000	1.3820		(30)
Total net area of external elements Aum(A, m ²)			257.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.4315		(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)							7.9690 (36)
Total fabric heat loss						(33) + (36) =	91.4005 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.1164	49.7990	49.4878	48.0264	47.7530	46.4801	46.4801	46.2444	46.9704	47.7530	48.3061	48.8844 (38)
Heat transfer coeff	141.5169	141.1995	140.8884	139.4269	139.1535	137.8807	137.8807	137.6449	138.3709	139.1535	139.7066	140.2849 (39)
Average = Sum(39)m / 12 =												139.4256 (39)
HLP	1.4139	1.4107	1.4076	1.3930	1.3903	1.3776	1.3776	1.3752	1.3825	1.3903	1.3958	1.4016 (40)
HLP (average)												1.3930 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	34.4161	30.1005	31.0610	27.0798	25.9837	22.4219	20.7772	23.8422	24.1269	28.1176	30.6926	33.3301 (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	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.8648	20.3083	16.5158	12.5035	9.3465	7.8907	8.5262	11.0827	14.8752	18.8875	22.0445	23.5003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	256.4732	259.1346	252.4280	238.1504	220.1275	203.1885	191.8722	189.2108	195.9175	210.1950	228.2179	245.1569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	46.2582	44.7924	41.7487	37.6108	34.9243	31.1416	27.9264	32.0459	33.5096	37.7925	42.6286	44.7986	(72)
Total internal gains	389.7015	388.3407	374.7978	352.3701	328.5037	306.3262	292.4302	296.4448	308.4076	330.9803	356.9963	377.5611	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	8.3200	10.6334	0.7600	0.7000	0.7700	32.6167 (74)
East	14.2800	19.6403	0.7600	0.7000	0.7700	103.4000 (76)
West	6.7200	19.6403	0.7600	0.7000	0.7700	48.6588 (80)

Solar gains	184.6755	359.7914	595.7906	884.5814	1104.7677	1141.6639	1082.3931	914.7302	697.0898	427.1587	229.8363	152.2366	(83)
Total gains	574.3770	748.1321	970.5884	1236.9514	1433.2714	1447.9901	1374.8232	1211.1751	1005.4974	758.1391	586.8326	529.7977	(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	49.1156	49.2261	49.3348	49.8519	49.9498	50.4109	50.4109	50.4973	50.2323	49.9498	49.7521	49.5470	
alpha	4.2744	4.2817	4.2890	4.3235	4.3300	4.3607	4.3607	4.3665	4.3488	4.3300	4.3168	4.3031	
util living area	0.9982	0.9942	0.9780	0.9137	0.7687	0.5799	0.4342	0.5076	0.7914	0.9701	0.9960	0.9987	(86)
MIT	19.3975	19.6299	20.0198	20.4997	20.8271	20.9615	20.9913	20.9835	20.8569	20.3602	19.7809	19.3602	(87)
Th 2	19.7527	19.7551	19.7575	19.7687	19.7708	19.7806	19.7806	19.7824	19.7768	19.7708	19.7665	19.7621	(88)
util rest of house	0.9976	0.9922	0.9701	0.8844	0.7025	0.4816	0.3175	0.3807	0.7015	0.9546	0.9943	0.9983	(89)
MIT 2	18.3079	18.5411	18.9273	19.3900	19.6663	19.7653	19.7787	19.7784	19.7047	19.2742	18.7013	18.2779	(90)
Living area fraction									fLA = Living area / (4) =			0.1957	(91)
MIT	18.5211	18.7542	19.1411	19.6072	19.8935	19.9994	20.0160	20.0143	19.9302	19.4867	18.9126	18.4898	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5211	18.7542	19.1411	19.6072	19.8935	19.9994	20.0160	20.0143	19.9302	19.4867	18.9126	18.4898	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9966	0.9899	0.9649	0.8798	0.7098	0.5000	0.3405	0.4057	0.7144	0.9498	0.9925	0.9976	(94)
Useful gains	572.4439	740.5459	936.5267	1088.2670	1017.2762	724.0106	468.0994	491.4101	718.3139	720.0713	582.4573	528.5263	(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	2012.5285	1956.2088	1780.9888	1492.8707	1140.1546	744.4711	471.0071	497.4834	806.7293	1236.6185	1650.2971	2004.6381	(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	1071.4230	816.9255	628.2798	291.3147	91.4215	0.0000	0.0000	0.0000	0.0000	384.3111	768.8446	1098.2272	(98)
Space heating												5150.7473	(98)
Space heating per m2										(98) / (4) =		51.4612	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1296.0781	1020.3168	1046.1015	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9190	0.9547	0.9296	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1191.0377	974.0984	972.4122	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1797.5369	1709.7428	1520.3118	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	436.6794	547.3194	407.6373	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												1391.6362 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	109.1699	136.8299	101.9093	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												347.9090 (107)
Space cooling per m2												3.4760 (108)
Energy for space heating												51.4612 (99)
Energy for space cooling												3.4760 (108)
Total												54.9371 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.9 (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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1574 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4074 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3463 (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	0.4415	0.4328	0.4242	0.3809	0.3722	0.3289	0.3289	0.3203	0.3463	0.3722	0.3895	0.4069 (22b)
Effective ac	0.5975	0.5937	0.5900	0.5725	0.5693	0.5541	0.5541	0.5513	0.5599	0.5693	0.5759	0.5828 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.8200	1.2000	2.1840		(26a)
TER Opening Type (Uw = 1.40)			23.2000	1.3258	30.7576		(27)
Heat Loss Floor 1			53.5000	0.1300	6.9550		(28a)
External Wall 1	150.6200	25.0200	125.6000	0.1800	22.6080		(29a)
External Roof 1	46.5900		46.5900	0.1300	6.0567		(30)
External Roof 2	6.9100		6.9100	0.1300	0.8983		(30)
Total net area of external elements Aum(A, m ²)			257.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.4596		(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)							13.1814 (36)
Total fabric heat loss						(33) + (36) =	82.6410 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.1164	49.7990	49.4878	48.0264	47.7530	46.4801	46.4801	46.2444	46.9704	47.7530	48.3061	48.8844 (38)
Heat transfer coeff	132.7574	132.4399	132.1288	130.6674	130.3940	129.1211	129.1211	128.8854	129.6114	130.3940	130.9471	131.5254 (39)
Average = Sum(39)m / 12 =												130.6661 (39)
HLP	1.3264	1.3232	1.3201	1.3055	1.3028	1.2900	1.2900	1.2877	1.2949	1.3028	1.3083	1.3141 (40)
HLP (average)												1.3055 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	34.4161	30.1005	31.0610	27.0798	25.9837	22.4219	20.7772	23.8422	24.1269	28.1176	30.6926	33.3301 (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	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	137.0179	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.8648	20.3083	16.5158	12.5035	9.3465	7.8907	8.5262	11.0827	14.8752	18.8875	22.0445	23.5003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	256.4732	259.1346	252.4280	238.1504	220.1275	203.1885	191.8722	189.2108	195.9175	210.1950	228.2179	245.1569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	36.7018	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	46.2582	44.7924	41.7487	37.6108	34.9243	31.1416	27.9264	32.0459	33.5096	37.7925	42.6286	44.7986	(72)
Total internal gains	389.7015	388.3407	374.7978	352.3701	328.5037	306.3262	292.4302	296.4448	308.4076	330.9803	356.9963	377.5611	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.5900	10.6334	0.6300	0.7000	0.7700	21.4155 (74)
East	11.3000	19.6403	0.6300	0.7000	0.7700	67.8262 (76)
West	5.3100	19.6403	0.6300	0.7000	0.7700	31.8723 (80)

Solar gains	121.1141	235.9577	390.7327	580.1400	724.5615	748.7677	709.8913	599.9181	457.1701	280.1386	150.7312	99.8403	(83)
Total gains	510.8156	624.2983	765.5305	932.5100	1053.0652	1055.0939	1002.3214	896.3629	765.5777	611.1189	507.7275	477.4014	(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	52.3564	52.4819	52.6054	53.1938	53.3053	53.8308	53.8308	53.9293	53.6272	53.3053	53.0802	52.8468	
alpha	4.4904	4.4988	4.5070	4.5463	4.5537	4.5887	4.5887	4.5953	4.5751	4.5537	4.5387	4.5231	
util living area	0.9989	0.9972	0.9903	0.9607	0.8726	0.7089	0.5479	0.6242	0.8780	0.9853	0.9978	0.9992	(86)
MIT	19.4484	19.6267	19.9463	20.3748	20.7318	20.9283	20.9826	20.9695	20.7969	20.3117	19.8020	19.4215	(87)
Th 2	19.8202	19.8227	19.8251	19.8365	19.8387	19.8486	19.8486	19.8505	19.8448	19.8387	19.8343	19.8298	(88)
util rest of house	0.9986	0.9962	0.9866	0.9449	0.8231	0.6094	0.4140	0.4860	0.8090	0.9771	0.9968	0.9990	(89)
MIT 2	18.4108	18.5907	18.9101	19.3366	19.6611	19.8169	19.8445	19.8421	19.7303	19.2840	18.7751	18.3914	(90)
Living area fraction									fLA = Living area / (4) =			0.1957	(91)
MIT	18.6139	18.7934	19.1129	19.5398	19.8707	20.0344	20.0673	20.0628	19.9391	19.4851	18.9761	18.5930	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6139	18.7934	19.1129	19.5398	19.8707	20.0344	20.0673	20.0628	19.9391	19.4851	18.9761	18.5930	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	509.7909	621.1020	752.9356	876.4239	868.4461	661.4099	441.4932	460.0085	624.6162	594.9688	505.5972	476.6986	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1900.2720	1840.0459	1666.5333	1390.2745	1065.4094	701.6952	447.6969	472.0790	756.8129	1158.5697	1555.1420	1893.0443	(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	1034.5180	819.1303	679.7167	369.9725	146.5407	0.0000	0.0000	0.0000	0.0000	419.3191	755.6722	1053.7612	(98)
Space heating												5278.6306	(98)
Space heating per m2										(98) / (4) =		52.7388	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1213.7383	955.4961	979.5289	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8587	0.9166	0.8810	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1042.2431	875.7724	862.9340	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1338.3076	1274.3511	1152.3495	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	213.1664	296.5425	215.3251	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												725.0341 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	53.2916	74.1356	53.8313	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												181.2585 (107)
Space cooling per m2												1.8110 (108)
Energy for space heating												52.7388 (99)
Energy for space cooling												1.8110 (108)
Total												54.5498 (109)
Target Fabric Energy Efficiency (TFEE)												62.7 (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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1180 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3680 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3597	0.3441	0.3441	0.3206	0.3206	0.2894	0.2894	0.2737	0.2972	0.3285	0.3128	0.3363 (22b)
Effective ac	0.5647	0.5592	0.5592	0.5514	0.5514	0.5419	0.5419	0.5375	0.5442	0.5539	0.5489	0.5565 (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
Opening Type 1			1.8200	1.4000	2.5480		(26a)
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712		(27)
Heat Loss Floor 1			53.5000	0.1500	8.0250		(28a)
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804		(29a)
External Roof 1	46.5900		46.5900	0.1100	5.1249		(30)
External Roof 2	6.9100		6.9100	0.2000	1.3820		(30)
Total net area of external elements Aum(A, m ²)			257.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.4315		(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)							7.9690 (36)
Total fabric heat loss						(33) + (36) =	91.4005 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.3697	46.9079	46.9079	46.2538	46.2538	45.4535	45.4535	45.0841	45.6459	46.4667	46.0461	46.6848 (38)
Heat transfer coeff	138.7702	138.3085	138.3085	137.6544	137.6544	136.8540	136.8540	136.4847	137.0464	137.8673	137.4466	138.0853 (39)
Average = Sum(39)m / 12 =												137.6112 (39)
HLP	1.3865	1.3818	1.3818	1.3753	1.3753	1.3673	1.3673	1.3636	1.3692	1.3774	1.3732	1.3796 (40)
HLP (average)												1.3749 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.7028	13.2660	14.6554	14.1303	14.5593	14.0411	14.4790	14.5310	14.0897	14.6139	14.1916 (61)
Total heat required for water heating calculated for each month											
Solar input	176.6608	154.9155	160.8250	141.5645	136.8354	119.5562	112.2542	126.7295	127.6282	146.9320	158.6272 (62)
	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 =			
Output from w/h	176.6608	154.9155	160.8250	141.5645	136.8354	119.5562	112.2542	126.7295	127.6282	146.9320	158.6272 (64)
								Total per year (kWh/year) = Sum(64)m =			
RHI water heating demand											1734.0635 (64)
Heat gains from water heating, kWh/month											1734 (64)
	57.5267	50.4150	52.2652	45.9044	44.2966	38.5940	36.1300	40.9387	41.2740	47.6492	55.8237 (65)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1619	50.7707	41.2895	31.2588	23.3663	19.7268	21.3156	27.7068	37.1880	47.2187	55.1111	58.7506	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.7958	386.7680	376.7581	355.4483	328.5485	303.2664	286.3765	282.4042	292.4141	313.7239	340.6238	365.9058	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	77.3209	75.0223	70.2490	63.7562	59.5385	53.6028	48.5618	55.0252	57.3249	64.0447	71.6288	75.0319	(72)
Total internal gains	629.2683	624.5507	600.2863	562.4530	523.4430	488.5857	468.2435	477.1258	498.9167	536.9769	579.3534	611.6780	(73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					8.3200	12.7650	0.7600	0.7000	0.7700	39.1553 (74)		
East					14.2800	23.8018	0.7600	0.7000	0.7700	125.3090 (76)		
West					6.7200	23.8018	0.7600	0.7000	0.7700	58.9689 (80)		
Solar gains	223.4332	380.8647	620.2628	943.3032	1140.5036	1246.3591	1170.0177	1014.1911	775.0891	479.1067	267.2015	185.1599 (83)
Total gains	852.7015	1005.4154	1220.5491	1505.7562	1663.9466	1734.9449	1638.2612	1491.3170	1274.0058	1016.0837	846.5549	796.8379 (84)

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	50.0878	50.2550	50.2550	50.4938	50.4938	50.7891	50.7891	50.9266	50.7178	50.4158	50.5701	50.3362
alpha	4.3392	4.3503	4.3503	4.3663	4.3663	4.3859	4.3859	4.3951	4.3812	4.3611	4.3713	4.3557
util living area												
	0.9909	0.9808	0.9458	0.8334	0.6561	0.4348	0.3078	0.3456	0.6402	0.9112	0.9816	0.9930 (86)
MIT	19.9816	20.1374	20.4097	20.7162	20.8757	20.9301	20.9369	20.9361	20.8966	20.6412	20.2545	19.9519 (87)
Th 2	19.7737	19.7773	19.7773	19.7823	19.7823	19.7885	19.7885	19.7913	19.7870	19.7807	19.7839	19.7790 (88)
util rest of house												
	0.9878	0.9745	0.9283	0.7876	0.5810	0.3440	0.2077	0.2368	0.5380	0.8734	0.9743	0.9905 (89)
MIT 2	18.4476	18.6748	19.0589	19.4643	19.6425	19.6943	19.6978	19.7006	19.6712	19.3836	18.8514	18.4088 (90)
Living area fraction												
MIT	18.7479	18.9611	19.3233	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6297	19.1260	18.1708 (91)
Temperature adjustment												
adjusted MIT	18.7479	18.9611	19.3233	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6297	19.1260	18.1708 (93)

[illegible]

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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1180 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3680 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (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	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676 (22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676 (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
Opening Type 1			1.8200	1.4000	2.5480		(26a)
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712		(27)
Heat Loss Floor 1			53.5000	0.1500	8.0250		(28a)
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804		(29a)
External Roof 1	46.5900		46.5900	0.1100	5.1249		(30)
External Roof 2	6.9100		6.9100	0.2000	1.3820		(31)
Total net area of external elements Aum(A, m ²)			257.6200				(32)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.4315		(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)							7.9690 (36)
Total fabric heat loss						(33) + (36) =	91.4005 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.6138	48.3547	48.1007	46.9079	46.6848	45.6459	45.6459	45.4535	46.0461	46.6848	47.1362	47.6082 (38)
Heat transfer coeff	140.0143	139.7552	139.5013	138.3085	138.0853	137.0464	137.0464	136.8540	137.4466	138.0853	138.5368	139.0088 (39)
Average = Sum(39)m / 12 =												138.3074 (39)
HLP	1.3989	1.3963	1.3938	1.3818	1.3796	1.3692	1.3692	1.3673	1.3732	1.3796	1.3841	1.3888 (40)
HLP (average)												1.3818 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.2169	12.8411	14.2169	13.7583	14.2169	13.7583	14.2169	14.2169	13.7583	14.2169	13.7583	14.2169 (61)
Total heat required for water heating calculated for each month	176.1749	154.4906	160.3865	141.1925	136.4931	119.2733	111.9921	126.4154	127.2967	146.5350	158.1939	171.0646 (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)
FGHRS	-8.5381	-7.4731	-6.8495	-5.7588	-1.7170	0.0000	0.0000	Solar input (sum of months) =	Sum (63)m =	0.0000	-7.3186	-8.6117 eq. (G2)
Output from w/h	167.6368	147.0175	153.5370	135.4337	134.7760	119.2733	111.9921	126.4154	127.2967	140.5416	150.8752	162.4529 (64)
Heat gains from water heating, kWh/month	57.4053	50.3087	52.1556	45.8114	44.2110	38.5233	36.0645	40.8602	41.1911	47.5500	51.4644	55.7061 (65)
												1677.2482 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1619	50.7707	41.2895	31.2588	23.3663	19.7268	21.3156	27.7068	37.1880	47.2187	55.1111	58.7506	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.7958	386.7680	376.7581	355.4483	328.5485	303.2664	286.3765	282.4042	292.4141	313.7239	340.6238	365.9058	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	77.1576	74.8642	70.1016	63.6270	59.4234	53.5046	48.4738	54.9196	57.2099	63.9113	71.4783	74.8738	(72)
Total internal gains	629.1050	624.3926	600.1390	562.3238	523.3279	488.4875	468.1554	477.0203	498.8016	536.8435	579.2029	611.5199	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				8.3200	10.6334	0.7600	0.7000	0.7700	32.6167 (74)			
East				14.2800	19.6403	0.7600	0.7000	0.7700	103.4000 (76)			
West				6.7200	19.6403	0.7600	0.7000	0.7700	48.6588 (80)			
Solar gains	184.6755	359.7914	595.7906	884.5814	1104.7677	1141.6639	1082.3931	914.7302	697.0898	427.1587	229.8363	152.2366 (83)
Total gains	813.7805	984.1840	1195.9295	1446.9051	1628.0957	1630.1515	1550.5485	1391.7505	1195.8914	964.0023	809.0392	763.7565 (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	49.6428	49.7348	49.8253	50.2550	50.3362	50.7178	50.7178	50.7891	50.5701	50.3362	50.1722	50.0018	
alpha	4.3095	4.3157	4.3217	4.3503	4.3557	4.3812	4.3812	4.3859	4.3713	4.3557	4.3448	4.3335	
util living area	0.9931	0.9839	0.9551	0.8671	0.7064	0.5210	0.3851	0.4446	0.7094	0.9343	0.9865	0.9947	(86)
MIT	19.9071	20.0740	20.3440	20.6548	20.8472	20.9194	20.9342	20.9309	20.8704	20.5762	20.1766	19.8749	(87)
Th 2	19.7642	19.7662	19.7681	19.7773	19.7790	19.7870	19.7870	19.7885	19.7839	19.7790	19.7755	19.7719	(88)
util rest of house	0.9907	0.9787	0.9406	0.8286	0.6373	0.4295	0.2809	0.3314	0.6141	0.9055	0.9811	0.9929	(89)
MIT 2	18.3322	18.5749	18.9598	19.3839	19.6108	19.6859	19.6952	19.6955	19.6467	19.2975	18.7329	18.2913	(90)
Living area fraction	18.6404	18.8683	19.2307	19.6327	19.8528	19.9273	19.9377	19.9373	19.8862	19.5478	19.0155	18.6012	(91)
MIT	18.6404	18.8683	19.2307	19.6327	19.8528	19.9273	19.9377	19.9373	19.8862	19.5478	19.0155	18.6012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6404	18.8683	19.2307	19.6327	19.8528	19.9273	19.9377	19.9373	19.8862	19.5478	19.0155	18.6012	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	803.8240	958.1020	1115.3828	1191.3114	1044.9339	717.9836	455.8874	481.0147	744.8791	866.2527	790.0050	756.4562	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2007.8646	1952.1444	1775.9525	1484.4211	1125.7794	730.0846	457.4233	484.0997	795.2976	1235.5590	1650.7355	2001.8963	(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	895.8062	667.9965	491.4638	211.0390	60.1490	0.0000	0.0000	0.0000	0.0000	274.7639	619.7260	926.6074	(98)
Space heating												4147.5517	(98)
Space heating per m2												41.4382	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4582.9301 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	895.8062	667.9965	491.4638	211.0390	60.1490	0.0000	0.0000	0.0000	0.0000	274.7639	619.7260	926.6074	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	989.8411	738.1176	543.0539	233.1922	66.4630	0.0000	0.0000	0.0000	0.0000	303.6065	684.7801	1023.8756	(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	167.6368	147.0175	153.5370	135.4337	134.7760	119.2733	111.9921	126.4154	127.2967	140.5416	150.8752	162.4529	(64)
Efficiency of water heater (217)m	89.9801	89.9055	89.7172	89.2216	88.2630	87.3000	87.3000	87.3000	87.3000	89.3912	89.8551	87.3000	(216)
Fuel for water heating, kWh/month	186.3044	163.5244	171.1344	151.7947	152.6981	136.6246	128.2842	144.8057	145.8153	157.2209	167.9094	180.4874	(219)
Water heating fuel used												1886.6036	(219)
Annual totals kWh/year													
Space heating fuel - main system												4582.9301	(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)												403.7990	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 908 * 0.80) =										-581.0267		-581.0267	(233)
Total delivered energy for all uses												6367.3060	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4582.9301	3.4800	159.4860 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1886.6036	3.4800	65.6538 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	403.7990	13.1900	53.2611 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-581.0267	13.1900	-76.6374 (252)
Total energy cost			331.6559 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9601 (257)
SAP value		86.6071
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	4582.9301	0.2160	989.9129 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1886.6036	0.2160	407.5064 (264)
Space and water heating			1397.4193 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	403.7990	0.5190	209.5717 (268)
Energy saving/generation technologies			
PV Unit	-581.0267	0.5190	-301.5529 (269)
Total kg/year			1344.3631 (272)
CO2 emissions per m2			13.4300 (273)
EI value			87.5839
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9050 = 4.124$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9050 = 0.2560$, stars = 4
Water heating energy efficiency	$3.48 / 0.8880 = 3.919$, stars = 5
Water heating environmental impact	$0.216 / 0.8880 = 0.2433$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1180 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3680 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3597	0.3441	0.3441	0.3206	0.3206	0.2894	0.2894	0.2737	0.2972	0.3285	0.3128	0.3363 (22b)
Effective ac	0.5647	0.5592	0.5592	0.5514	0.5514	0.5419	0.5419	0.5375	0.5442	0.5539	0.5489	0.5565 (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
Opening Type 1			1.8200	1.4000	2.5480		(26a)
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712		(27)
Heat Loss Floor 1			53.5000	0.1500	8.0250		(28a)
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804		(29a)
External Roof 1	46.5900		46.5900	0.1100	5.1249		(30)
External Roof 2	6.9100		6.9100	0.2000	1.3820		(31)
Total net area of external elements Aum(A, m ²)			257.6200				(32)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.4315		(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)							7.9690 (36)
Total fabric heat loss						(33) + (36) =	91.4005 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.3697	46.9079	46.9079	46.2538	46.2538	45.4535	45.4535	45.0841	45.6459	46.4667	46.0461	46.6848 (38)
Heat transfer coeff	138.7702	138.3085	138.3085	137.6544	137.6544	136.8540	136.8540	136.4847	137.0464	137.8673	137.4466	138.0853 (39)
Average = Sum(39)m / 12 =												137.6112 (39)
HLP	1.3865	1.3818	1.3818	1.3753	1.3753	1.3673	1.3673	1.3636	1.3692	1.3774	1.3732	1.3796 (40)
HLP (average)												1.3749 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.2169	12.8411	14.2169	13.7583	14.2169	13.7583	14.2169	14.2169	13.7583	14.2169	13.7583	14.2169 (61)
Total heat required for water heating calculated for each month	176.1749	154.4906	160.3865	141.1925	136.4931	119.2733	111.9921	126.4154	127.2967	146.5350	158.1939	171.0646 (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)
FGHRS	-8.2600	-7.2782	-6.6274	-4.6150	-1.1124	0.0000	0.0000	Solar input (sum of months) =	Sum (63)m =	0.0000	-8.3270	eq. (G2)
Output from w/h	167.9149	147.2124	153.7591	136.5775	135.3807	119.2733	111.9921	126.4154	127.2967	140.7372	151.1352	162.7375 (64)
Heat gains from water heating, kWh/month	57.4053	50.3087	52.1556	45.8114	44.2110	38.5233	36.0645	40.8602	41.1911	47.5500	51.4644	55.7061 (65)
Total per year (kWh/year) = Sum (64)m = 1680.4320 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1619	50.7707	41.2895	31.2588	23.3663	19.7268	21.3156	27.7068	37.1880	47.2187	55.1111	58.7506	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.7958	386.7680	376.7581	355.4483	328.5485	303.2664	286.3765	282.4042	292.4141	313.7239	340.6238	365.9058	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	77.1576	74.8642	70.1016	63.6270	59.4234	53.5046	48.4738	54.9196	57.2099	63.9113	71.4783	74.8738	(72)
Total internal gains	629.1050	624.3926	600.1390	562.3238	523.3279	488.4875	468.1554	477.0203	498.8016	536.8435	579.2029	611.5199	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				8.3200	12.7650	0.7600	0.7000	0.7700	39.1553 (74)			
East				14.2800	23.8018	0.7600	0.7000	0.7700	125.3090 (76)			
West				6.7200	23.8018	0.7600	0.7000	0.7700	58.9689 (80)			
Solar gains	223.4332	380.8647	620.2628	943.3032	1140.5036	1246.3591	1170.0177	1014.1911	775.0891	479.1067	267.2015	185.1599 (83)
Total gains	852.5382	1005.2573	1220.4018	1505.6270	1663.8315	1734.8466	1638.1731	1491.2114	1273.8907	1015.9503	846.4044	796.6798 (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	50.0878	50.2550	50.2550	50.4938	50.4938	50.7891	50.7891	50.9266	50.7178	50.4158	50.5701	50.3362
alpha	4.3392	4.3503	4.3503	4.3663	4.3663	4.3859	4.3859	4.3951	4.3812	4.3611	4.3713	4.3557
util living area	0.9909	0.9809	0.9458	0.8335	0.6562	0.4348	0.3079	0.3456	0.6402	0.9112	0.9817	0.9930 (86)
MIT	19.9815	20.1373	20.4097	20.7161	20.8757	20.9301	20.9369	20.9361	20.8965	20.6412	20.2544	19.9518 (87)
Th 2	19.7737	19.7773	19.7773	19.7823	19.7823	19.7885	19.7885	19.7913	19.7870	19.7807	19.7839	19.7790 (88)
util rest of house	0.9878	0.9745	0.9283	0.7877	0.5810	0.3440	0.2077	0.2369	0.5380	0.8735	0.9743	0.9905 (89)
MIT 2	18.4475	18.6747	19.0588	19.4643	19.6425	19.6943	19.6978	19.7006	19.6712	19.3835	18.8513	18.4087 (90)
Living area fraction	18.7477	18.9610	19.3232	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6296	19.1259	18.7107 (91)
MIT	18.7477	18.9610	19.3232	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6296	19.1259	18.7107 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7477	18.9610	19.3232	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6296	19.1259	18.7107 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9843	0.9689	0.9202	0.7846	0.5877	0.3553	0.2203	0.2506	0.5492	0.8677	0.9689	0.9876	(94)
Useful gains	839.1210	973.9703	1123.0695	1181.2838	977.8119	616.3801	360.9604	373.6524	699.6043	881.5398	820.0452	786.7667	(95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000	(96)
Heat loss rate W	1949.4054	1889.4259	1704.4002	1405.3532	1030.1859	620.7938	361.3325	374.2972	727.8550	1175.9594	1584.1968	1934.6694	(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	826.0515	615.1862	432.5100	161.3300	38.9663	0.0000	0.0000	0.0000	0.0000	219.0482	550.1891	854.0396	(98)
Space heating	3697.3210 (98)												
Space heating per m2	(98) / (4) = 36.9400 (99)												

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4085.4376 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	826.0515	615.1862	432.5100	161.3300	38.9663	0.0000	0.0000	0.0000	0.0000	219.0482	550.1891	854.0396	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	912.7641	679.7638	477.9117	178.2652	43.0567	0.0000	0.0000	0.0000	0.0000	242.0422	607.9438	943.6902	(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	167.9149	147.2124	153.7591	136.5775	135.3807	119.2733	111.9921	126.4154	127.2967	140.7372	151.1352	162.7375	(64)
Efficiency of water heater (217)m	89.9430	89.8640	89.6383	89.0043	87.9954	87.3000	87.3000	87.3000	87.3000	89.2207	89.7907	87.3000	(216)
Fuel for water heating, kWh/month	186.6903	163.8170	171.5328	153.4504	153.8497	136.6246	128.2842	144.8057	145.8153	157.7404	168.3194	180.8754	(219)
Water heating fuel used												1891.8053	(219)
Annual totals kWh/year													
Space heating fuel - main system												4085.4376	(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)												403.7990	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 990 * 0.80) =										-633.3750		-633.3750	(233)
Total delivered energy for all uses												5822.6669	(238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4085.4376	3.7400	152.7954 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1891.8053	3.7400	70.7535 (247)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	403.7990	20.4300	82.4961 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-633.3750	20.4300	-129.3985 (252)
Total energy cost			286.9690 (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	4085.4376	0.2160	882.4545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1891.8053	0.2160	408.6299 (264)
Space and water heating			1291.0845 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	403.7990	0.5190	209.5717 (268)
Energy saving/generation technologies			
PV Unit	-633.3750	0.5190	-328.7216 (269)
Total kg/year			1210.8595 (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	4085.4376	1.2200	4984.2338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1891.8053	1.2200	2308.0025 (264)
Space and water heating			7292.2363 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	403.7990	3.0700	1239.6629 (268)
Energy saving/generation technologies			
PV Unit	-633.3750	3.0700	-1944.4613 (269)
Primary energy kWh/year			6817.6880 (272)
Primary energy kWh/m2/year			68.1156 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 27	-190 kg (15.7%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£27	1.89 kg/m²	B 88	B 89
Total Savings	£27	1.89 kg/m²		

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

Fuel prices for cost data on this page from database revision number 506 TEST (30 Sep 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£98	£108	-£10
Mains gas	£319	£281	£37
Space heating	£263	£263	£0
Water heating	£71	£44	£27
Lighting	£82	£82	£0
Generated (PV)	-£129	-£129	£0
Total cost of fuels	£288	£260	£27
Total cost of uses	£287	£260	£27
Delivered energy	58 kWh/m²	49 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	2 kg/m²
Primary energy	68 kWh/m²	57 kWh/m²	11 kWh/m²

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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1180 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3680 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (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	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676 (22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676 (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
Opening Type 1			1.8200	1.4000	2.5480		(26a)
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712		(27)
Heat Loss Floor 1			53.5000	0.1500	8.0250		(28a)
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804		(29a)
External Roof 1	46.5900		46.5900	0.1100	5.1249		(30)
External Roof 2	6.9100		6.9100	0.2000	1.3820		(31)
Total net area of external elements Aum(A, m ²)			257.6200				(32)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	83.4315	(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)							7.9690 (36)
Total fabric heat loss						(33) + (36) =	91.4005 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.6138	48.3547	48.1007	46.9079	46.6848	45.6459	45.6459	45.4535	46.0461	46.6848	47.1362	47.6082 (38)
Heat transfer coeff	140.0143	139.7552	139.5013	138.3085	138.0853	137.0464	137.0464	136.8540	137.4466	138.0853	138.5368	139.0088 (39)
Average = Sum(39)m / 12 =												138.3074 (39)
HLP	1.3989	1.3963	1.3938	1.3818	1.3796	1.3692	1.3692	1.3673	1.3732	1.3796	1.3841	1.3888 (40)
HLP (average)												1.3818 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.2169	12.8411	14.2169	13.7583	14.2169	13.7583	14.2169	14.2169	13.7583	14.2169	13.7583	14.2169	(61)
Total heat required for water heating calculated for each month	176.1749	154.4906	160.3865	141.1925	136.4931	119.2733	111.9921	126.4154	127.2967	146.5350	158.1939	171.0646	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1079.5246 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1813.6014 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.1610 (H8)
Utilisation factor													0.5774 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													99.2835 (H14)
Volume ratio Veff/V													0.7554 (H15)
Solar storage volume factor													0.9439 (H16)
Solar input													-869.1218 (H17)
Solar input	-25.2028	-42.0562	-71.6266	-95.9937	-118.5922	-116.5950	-115.0541	-100.5234	-78.7300	-53.7633	-29.8942	-21.0904	(63)
FGHRS	-8.2436	-6.8416	-5.6110	-2.1791	-0.0765	0.0000	0.0000	Solar input (sum of months) =	0.0000	-5.5511	-6.9777	-8.3387	eq. (G2)
Output from w/h	142.7285	105.5928	83.1489	43.0196	17.8244	2.6783	0.0000	25.8920	48.5668	87.2207	121.3220	141.6354	(64)
Heat gains from water heating, kWh/month	57.4053	50.3087	52.1556	45.8114	44.2110	38.5233	36.0645	40.8602	41.1911	47.5500	51.4644	55.7061	(65)
Total per year (kWh/year) = Sum (64)m =												819.6293	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1619	50.7707	41.2895	31.2588	23.3663	19.7268	21.3156	27.7068	37.1880	47.2187	55.1111	58.7506	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.7958	386.7680	376.7581	355.4483	328.5485	303.2664	286.3765	282.4042	292.4141	313.7239	340.6238	365.9058	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	77.1576	74.8642	70.1016	63.6270	59.4234	53.5046	48.4738	54.9196	57.2099	63.9113	71.4783	74.8738	(72)
Total internal gains	629.1050	624.3926	600.1390	562.3238	523.3279	488.4875	468.1554	477.0203	498.8016	536.8435	579.2029	611.5199	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					8.3200	10.6334		0.7600	0.7000	0.7700		32.6167 (74)	
East					14.2800	19.6403		0.7600	0.7000	0.7700		103.4000 (76)	
West					6.7200	19.6403		0.7600	0.7000	0.7700		48.6588 (80)	

Solar gains	184.6755	359.7914	595.7906	884.5814	1104.7677	1141.6639	1082.3931	914.7302	697.0898	427.1587	229.8363	152.2366 (83)	
Total gains	813.7805	984.1840	1195.9295	1446.9051	1628.0957	1630.1515	1550.5485	1391.7505	1195.8914	964.0023	809.0392	763.7565 (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	49.6428	49.7348	49.8253	50.2550	50.3362	50.7178	50.7178	50.7891	50.5701	50.3362	50.1722	50.0018	
alpha	4.3095	4.3157	4.3217	4.3503	4.3557	4.3812	4.3812	4.3859	4.3713	4.3557	4.3448	4.3335	
util living area	0.9931	0.9839	0.9551	0.8671	0.7064	0.5210	0.3851	0.4446	0.7094	0.9343	0.9865	0.9947	(86)
MIT	19.9071	20.0740	20.3440	20.6548	20.8472	20.9194	20.9342	20.9309	20.8704	20.5762	20.1766	19.8749	(87)
Th 2	19.7642	19.7662	19.7681	19.7773	19.7790	19.7870	19.7870	19.7885	19.7839	19.7790	19.7755	19.7719	(88)
util rest of house	0.9907	0.9787	0.9406	0.8286	0.6373	0.4295	0.2809	0.3314	0.6141	0.9055	0.9811	0.9929	(89)
MIT 2	18.3322	18.5749	18.9598	19.3839	19.6108	19.6859	19.6952	19.6955	19.6467	19.2975	18.7329	18.2913	(90)
Living area fraction	18.6404	18.8683	19.2307	19.6327	19.8528	19.9273	19.9377	19.9373	19.8862	19.5478	19.0155	18.6012	(91)
MIT	18.6404	18.8683	19.2307	19.6327	19.8528	19.9273	19.9377	19.9373	19.8862	19.5478	19.0155	18.6012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6404	18.8683	19.2307	19.6327	19.8528	19.9273	19.9377	19.9373	19.8862	19.5478	19.0155	18.6012	(93)

8. Space heating requirement

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Utilisation	0.9878	0.9735	0.9326	0.8234	0.6418	0.4404	0.2940	0.3456	0.6229	0.8986	0.9765	0.9904 (94)
Useful gains	803.8240	958.1020	1115.3828	1191.3114	1044.9339	717.9836	455.8874	481.0147	744.8791	866.2527	790.0050	756.4562 (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	2007.8646	1952.1444	1775.9525	1484.4211	1125.7794	730.0846	457.4233	484.0997	795.2976	1235.5590	1650.7355	2001.8963 (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	895.8062	667.9965	491.4638	211.0390	60.1490	0.0000	0.0000	0.0000	0.0000	274.7639	619.7260	926.6074 (98)
Space heating												4147.5517 (98)
Space heating per m2											(98) / (4) =	41.4382 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4582.9301 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	895.8062	667.9965	491.4638	211.0390	60.1490	0.0000	0.0000	0.0000	0.0000	274.7639	619.7260	926.6074 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	989.8411	738.1176	543.0539	233.1922	66.4630	0.0000	0.0000	0.0000	0.0000	303.6065	684.7801	1023.8756 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	142.7285	105.5928	83.1489	43.0196	17.8244	2.6783	0.0000	25.8920	48.5668	87.2207	121.3220	141.6354 (64)
Efficiency of water heater	90.0464	90.0495	90.0225	89.9417	89.7480	87.3000	87.3000	87.3000	87.3000	89.7077	89.9601	87.3000 (216)
(217)m	90.0464	90.0495	90.0225	89.9417	89.7480	87.3000	87.3000	87.3000	87.3000	89.7077	89.9601	90.0623 (217)
Fuel for water heating, kWh/month	158.5055	117.2609	92.3646	47.8305	19.8605	3.0680	0.0000	29.6586	55.6321	97.2276	134.8619	157.2638 (219)
Water heating fuel used												913.5340 (219)
Annual totals kWh/year												
Space heating fuel - main system												4582.9301 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												403.7990 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.00 * 908 * 0.80) =									-581.0267			-581.0267 (233)
Total delivered energy for all uses												5444.2364 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4582.9301	3.4800	159.4860 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	913.5340	3.4800	31.7910 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	403.7990	13.1900	53.2611 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-581.0267	13.1900	-76.6374 (252)
Total energy cost			304.3881 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		0.8811 (257)
SAP rating (Section 12)		87.7083
SAP band		88 (258)
		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	4582.9301	0.2160	989.9129 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	913.5340	0.2160	197.3233 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space and water heating			1187.2362 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	403.7990	0.5190	209.5717 (268)
Energy saving/generation technologies			
PV Unit	-581.0267	0.5190	-301.5529 (269)
Total kg/year			1160.1301 (272)
CO2 emissions per m2			11.5900 (273)
EI value			89.2854
EI rating			89 (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	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	46.5900 (1c)	x 2.7000 (2c)	= 125.7930 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.1930 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1180 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3680 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3597	0.3441	0.3441	0.3206	0.3206	0.2894	0.2894	0.2737	0.2972	0.3285	0.3128	0.3363 (22b)
Effective ac	0.5647	0.5592	0.5592	0.5514	0.5514	0.5419	0.5419	0.5375	0.5442	0.5539	0.5489	0.5565 (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
Opening Type 1			1.8200	1.4000	2.5480		(26a)
Opening Type 2 (Uw = 1.40)			29.3200	1.3258	38.8712		(27)
Heat Loss Floor 1			53.5000	0.1500	8.0250		(28a)
External Wall 1	150.6200	31.1400	119.4800	0.2300	27.4804		(29a)
External Roof 1	46.5900		46.5900	0.1100	5.1249		(30)
External Roof 2	6.9100		6.9100	0.2000	1.3820		(31)
Total net area of external elements Aum(A, m ²)			257.6200				(32)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.4315		(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)							7.9690 (36)
Total fabric heat loss						(33) + (36) =	91.4005 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.3697	46.9079	46.9079	46.2538	46.2538	45.4535	45.4535	45.0841	45.6459	46.4667	46.0461	46.6848 (38)
Heat transfer coeff	138.7702	138.3085	138.3085	137.6544	137.6544	136.8540	136.8540	136.4847	137.0464	137.8673	137.4466	138.0853 (39)
Average = Sum(39)m / 12 =												137.6112 (39)
HLP	1.3865	1.3818	1.3818	1.3753	1.3753	1.3673	1.3673	1.3636	1.3692	1.3774	1.3732	1.3796 (40)
HLP (average)												1.3749 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7404 (42)
Average daily hot water use (litres/day)												99.2835 (43)
Daily hot water use	109.2118	105.2405	101.2692	97.2978	93.3265	89.3551	89.3551	93.3265	97.2978	101.2692	105.2405	109.2118 (44)
Energy conte	161.9580	141.6495	146.1696	127.4342	122.2761	105.5150	97.7752	112.1984	113.5384	132.3181	144.4356	156.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1562.1159 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2937	21.2474	21.9254	19.1151	18.3414	15.8273	14.6663	16.8298	17.0308	19.8477	21.6653	23.5272 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.2169	12.8411	14.2169	13.7583	14.2169	13.7583	14.2169	14.2169	13.7583	14.2169	13.7583	14.2169	(61)
Total heat required for water heating calculated for each month	176.1749	154.4906	160.3865	141.1925	136.4931	119.2733	111.9921	126.4154	127.2967	146.5350	158.1939	171.0646	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1162.7634 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1953.4426 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.2505 (H8)
Utilisation factor													0.5505 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													99.2835 (H14)
Volume ratio Veff/V													0.7554 (H15)
Solar storage volume factor													0.9439 (H16)
Solar input													-892.5606 (H17)
Solar input	-28.6896	-41.8741	-70.1912	-96.5728	-115.7710	-120.5079	-117.6830	-105.2490	-82.4627	-56.7248	-32.6943	-24.1403	(63)
FGHRS	-7.9430	-6.7089	-5.6238	-1.7196	-0.0875	0.0000	0.0000	0.0000	0.0000	-5.2522	-6.7264	-8.0332	eq. (G2)
Output from w/h	139.5423	105.9076	84.5715	42.9001	20.6346	0.0000	0.0000	21.1664	44.8341	84.5580	118.7731	138.8911	(64)
Heat gains from water heating, kWh/month	57.4053	50.3087	52.1556	45.8114	44.2110	38.5233	36.0645	40.8602	41.1911	47.5500	51.4644	55.7061	(65)
Total per year (kWh/year) = Sum (64)m = 801.7787 (64)													

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	164.4214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.1619	50.7707	41.2895	31.2588	23.3663	19.7268	21.3156	27.7068	37.1880	47.2187	55.1111	58.7506	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.7958	386.7680	376.7581	355.4483	328.5485	303.2664	286.3765	282.4042	292.4141	313.7239	340.6238	365.9058	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	54.1825	(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)	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	-109.6143	(71)
Water heating gains (Table 5)	77.1576	74.8642	70.1016	63.6270	59.4234	53.5046	48.4738	54.9196	57.2099	63.9113	71.4783	74.8738	(72)
Total internal gains	629.1050	624.3926	600.1390	562.3238	523.3279	488.4875	468.1554	477.0203	498.8016	536.8435	579.2029	611.5199	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				8.3200	12.7650		0.7600	0.7000		0.7700		39.1553 (74)	
East				14.2800	23.8018		0.7600	0.7000		0.7700		125.3090 (76)	
West				6.7200	23.8018		0.7600	0.7000		0.7700		58.9689 (80)	

Solar gains	223.4332	380.8647	620.2628	943.3032	1140.5036	1246.3591	1170.0177	1014.1911	775.0891	479.1067	267.2015	185.1599	(83)
Total gains	852.5382	1005.2573	1220.4018	1505.6270	1663.8315	1734.8466	1638.1731	1491.2114	1273.8907	1015.9503	846.4044	796.6798	(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	50.0878	50.2550	50.2550	50.4938	50.7891	50.7891	50.9266	50.7178	50.4158	50.5701	50.3362	50.3362	(86)
alpha	4.3392	4.3503	4.3503	4.3663	4.3663	4.3859	4.3859	4.3812	4.3611	4.3713	4.3557	4.3557	(87)
util living area	0.9909	0.9809	0.9458	0.8335	0.6562	0.4348	0.3079	0.3456	0.6402	0.9112	0.9817	0.9930	(88)
MIT	19.9815	20.1373	20.4097	20.7161	20.8757	20.9301	20.9369	20.9361	20.8965	20.6412	20.2544	19.9518	(89)
Th 2	19.7737	19.7773	19.7773	19.7823	19.7823	19.7885	19.7885	19.7913	19.7870	19.7807	19.7839	19.7790	(90)
util rest of house	0.9878	0.9745	0.9283	0.7877	0.5810	0.3440	0.2077	0.2369	0.5380	0.8735	0.9743	0.9905	(91)
MIT 2	18.4475	18.6747	19.0588	19.4643	19.6425	19.6943	19.6978	19.7006	19.6712	19.3835	18.8513	18.4087	(92)
Living area fraction	18.7477	18.9610	19.3232	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6296	19.1259	18.7107	(93)
MIT	18.7477	18.9610	19.3232	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6296	19.1259	18.7107	(94)
Temperature adjustment													
adjusted MIT	18.7477	18.9610	19.3232	19.7093	19.8839	19.9362	19.9403	19.9424	19.9110	19.6296	19.1259	18.7107	(95)

8. Space heating requirement

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Utilisation	0.9843	0.9689	0.9202	0.7846	0.5877	0.3553	0.2203	0.2506	0.5492	0.8677	0.9689	0.9876 (94)
Useful gains	839.1210	973.9703	1123.0695	1181.2838	977.8119	616.3801	360.9604	373.6524	699.6043	881.5398	820.0452	786.7667 (95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000 (96)
Heat loss rate W	1949.4054	1889.4259	1704.4002	1405.3532	1030.1859	620.7938	361.3325	374.2972	727.8550	1175.9594	1584.1968	1934.6694 (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	826.0515	615.1862	432.5100	161.3300	38.9663	0.0000	0.0000	0.0000	0.0000	219.0482	550.1891	854.0396 (98)
Space heating												3697.3210 (98)
Space heating per m2												(98) / (4) = 36.9400 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4085.4376 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	826.0515	615.1862	432.5100	161.3300	38.9663	0.0000	0.0000	0.0000	0.0000	219.0482	550.1891	854.0396 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	912.7641	679.7638	477.9117	178.2652	43.0567	0.0000	0.0000	0.0000	0.0000	242.0422	607.9438	943.6902 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	139.5423	105.9076	84.5715	42.9001	20.6346	0.0000	0.0000	21.1664	44.8341	84.5580	118.7731	138.8911 (64)
Efficiency of water heater	90.0231	90.0154	89.9607	89.8085	89.3659	87.3000	87.3000	87.3000	87.3000	89.5854	89.9148	87.3000 (216)
(217)m	90.0231	90.0154	89.9607	89.8085	89.3659	87.3000	87.3000	87.3000	87.3000	89.5854	89.9148	90.0383 (217)
Fuel for water heating, kWh/month	155.0072	117.6550	94.0094	47.7684	23.0900	0.0000	0.0000	24.2456	51.3563	94.3881	132.0951	154.2577 (219)
Water heating fuel used												893.8728 (219)
Annual totals kWh/year												
Space heating fuel - main system												4085.4376 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												403.7990 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.00 * 990 * 0.80) =									-633.3750			-633.3750 (233)
Total delivered energy for all uses												4874.7343 (238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4085.4376	3.7400	152.7954 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	893.8728	3.7400	33.4308 (247)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Pump for solar water heating	50.0000	20.4300	10.2150 (249)
Energy for lighting	403.7990	20.4300	82.4961 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-633.3750	20.4300	-129.3985 (252)
Total energy cost			259.8613 (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	4085.4376	0.2160	882.4545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	893.8728	0.2160	193.0765 (264)
Space and water heating			1075.5310 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	403.7990	0.5190	209.5717 (268)
Energy saving/generation technologies			
PV Unit	-633.3750	0.5190	-328.7216 (269)
Total kg/year			1021.2561 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4085.4376	1.2200	4984.2338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	893.8728	1.2200	1090.5248 (264)
Space and water heating			6074.7586 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	403.7990	3.0700	1239.6629 (268)
Energy saving/generation technologies			
PV Unit	-633.3750	3.0700	-1944.4613 (269)
Primary energy kWh/year			5753.7103 (272)
Primary energy kWh/m2/year			57.4854 (273)