



SAP Report Submission for Building Regulations Compliance

Client: Alex Tryfonos

Project: Belle Vista, Clevedon Road
West Hill, BRISTOL, BS48 1PL

Contact: Laura Meehan
M Sustainability
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Report Issue Date: 10/07/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	000089			Issued on Date	10/07/2024
Assessment Reference	001	Prop Type Ref	Belle Vista		
Property	Belle Vista, Clevedon Road, West Hill, BRISTOL, BS48 1PL				
SAP Rating	95 A	DER	0.97	TER	23.27
Environmental	100 A	% DER<TER	95.83		
CO ₂ Emissions (t/year)	-1.01	DFEE	60.80	TFEE	71.67
General Requirements Compliance	Pass	% DFEE<TFEE	15.16		
Assessor Details	Ms. Laura Meehan, M Sustainability, Tel: 07852802823, laura@msustainability.co.uk			Assessor ID	Z762-0001
Client	Alex Tryfonos, Alex Tryfonos				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuels for main heating	Wood logs, Electricity			
Fuel factor	1.55 (electricity)			
Target Carbon Dioxide Emission Rate (TER)	23.27	kgCO ₂ /m ²		
Dwelling Carbon Dioxide Emission Rate (DER)	0.97	kgCO ₂ /m ²		Pass
	-22.30 (-95.8%)	kgCO ₂ /m ²		

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	71.67	kWh/m ² /yr		
Dwelling Fabric Energy Efficiency (DFEE)	60.80	kWh/m ² /yr		
	-10.9 (-15.2%)	kWh/m ² /yr		Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (max. 0.70)	Pass
Floor	0.15 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	Pass
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	2.02 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system 1	Heat pump with radiators or underfloor - Electric Grant AERONA3 HPID10	
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This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system 2

Room heaters - Wood Logs
Closed room heater

Pass

Efficiency: 65%
Minimum: 65%

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured store loss: 1.49 kWh/day
Permitted by DBSCG 2.55

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls 1

Time and temperature zone control

Pass

Space heating controls 2

Appliance thermostats

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

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 (Severn Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

106.97 m², No overhang

Windows facing East

2.90 m², No overhang

Windows facing South

14.40 m², No overhang

Windows facing West

17.64 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 50% 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

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Thermal bridging y-value

0.020 W/m²K

Air permeability

2.0 m³/m²h

Main heating fuel:

wood logs

Photovoltaic array

13.20 kW

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FULL SAP CALCULATION PRINTOUT

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Environmental	100 A	% DER<TER	95.83		
CO ₂ Emissions (t/year)	-1.01	DFEE	60.80	TFEE	71.67
General Requirements Compliance	Pass	% DFEE<TFEE	15.16		
Assessor Details	Ms. Laura Meehan, M Sustainability, Tel: 07852802823, laura@msustainability.co.uk			Assessor ID	Z762-0001
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FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Detached House, total floor area 555 m²

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

1a TER and DER

Fuels for main heating: Wood logs, Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.27 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 0.97 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 71.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 60.8 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	2.02 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system 1: Heat pump with radiators or underfloor - Electric
Grant AERONA3 HPID10

Main heating system 2: Room heaters - Wood Logs
Closed room heater

Efficiency: 65%
Minimum: 65% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured store loss: 1.49 kWh/day
Permitted by DBSCG 2.55 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls 1: Time and temperature zone control OK

Space heating controls 2: Appliance thermostats OK

Hot water controls: Cylinderstat OK
Independent timer for DHW 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 (Severn Valley): Not significant OK

Based on:

Overshading: Average
Windows facing North: 106.97 m², No overhang
Windows facing East: 2.90 m², No overhang
Windows facing South: 14.40 m², No overhang
Windows facing West: 17.64 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 50% of daylight hours

10 Key features

Thermal bridging y-value 0.020 W/m²K
Air permeability 2.0 m³/m²h
Main heating fuel: wood logs
Photovoltaic array 13.20 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) = 0.0286 (8)
Pressure test					Yes
Measured/design AP50					2.0200
Infiltration rate					0.1296 (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) =				0.1102 (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	0.1405	0.1377	0.1350	0.1212	0.1185	0.1047	0.1047	0.1019	0.1102	0.1185	0.1240	0.1295 (22b)
Effective ac	0.5099	0.5095	0.5091	0.5073	0.5070	0.5055	0.5055	0.5052	0.5061	0.5070	0.5077	0.5084 (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 (Uw = 1.20)			141.9100	1.1450	162.4924		(27)
Heat Loss Floor 1 LG			127.0000	0.1400	17.7800		(28a)
Heat Loss Floor 2			159.2200	0.1500	23.8830		(28a)
Heat Loss Floor 3			89.0000	0.1600	14.2400		(28b)
External Wall 1 LG ext	296.0000	106.9700	189.0300	0.2600	49.1478		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.2389	24.4377		(29a)
External Wall 4 Sheltered g	201.0000	34.9400	166.0600	0.2600	43.1756		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	381.8447		(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)							26.6942 (36)
Total fabric heat loss						(33) + (36) =	408.5389 (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	293.7088	293.4880	293.2716	292.2551	292.0649	291.1796	291.1796	291.0156	291.5206	292.0649	292.4496	292.8518 (38)
Heat transfer coeff	702.2476	702.0268	701.8104	700.7939	700.6038	699.7184	699.7184	699.5545	700.0595	700.6038	700.9885	701.3907 (39)
Average = Sum(39)m / 12 =												700.7930 (39)
HLP	1.2648	1.2644	1.2640	1.2622	1.2618	1.2603	1.2603	1.2600	1.2609	1.2618	1.2625	1.2633 (40)
HLP (average)												1.2622 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.1096	123.4511	118.7925	114.1340	109.4755	104.8169	104.8169	109.4755	114.1340	118.7925	123.4511	128.1096 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Distribution loss (46)m = 0.15 x (45)m	28.4974	24.9240	25.7194	22.4228	21.5152	18.5660	17.2041	19.7419	19.9777	23.2821	25.4143	1832.4205 (45)
Water storage loss:												
Store volume												208.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4900 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.1816 (55)
Total storage loss	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (56)
If cylinder contains dedicated solar storage	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (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	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (64)
Heat gains from water heating, kWh/month	92.4718	81.7151	86.3138	78.0611	76.9945	69.5119	67.4383	73.0639	72.6413	80.9113	84.6922	90.4786 (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	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.2607	50.8585	41.3609	31.3129	23.4067	19.7609	21.3524	27.7547	37.2522	47.3003	55.2064	58.8522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	642.3275	648.9929	632.1964	596.4387	551.3011	508.8780	480.5369	473.8715	490.6680	526.4257	571.5633	613.9864 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186 (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)	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)	124.2901	121.5998	116.0132	108.4182	103.4873	96.5443	90.6429	98.2041	100.8907	108.7517	117.6281	121.6111 (72)
Total internal gains	898.8342	896.4070	864.5263	811.1256	753.1508	700.1390	667.4879	674.7860	703.7666	757.4334	819.3536	869.4054 (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	106.9700	10.6334	0.6400	0.7000	0.7700	353.1385 (74)
East	2.9000	19.6403	0.6400	0.7000	0.7700	17.6830 (76)
South	14.4000	46.7521	0.6400	0.7000	0.7700	209.0136 (78)
West	17.6400	19.6403	0.6400	0.7000	0.7700	107.5616 (80)

Solar gains	687.3967	1262.1812	1986.2929	2923.2803	3716.0704	3888.8261	3665.7753	3040.2822	2303.5511	1463.2725	839.5595	577.9957 (83)
Total gains	1586.2308	2158.5882	2850.8192	3734.4058	4469.2212	4588.9651	4333.2632	3715.0682	3007.3178	2220.7059	1658.9131	1447.4011 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	54.9051	54.9223	54.9393	55.0189	55.0339	55.1035	55.1035	55.1164	55.0767	55.0339	55.0037	54.9721
alpha	4.6603	4.6615	4.6626	4.6679	4.6689	4.6736	4.6736	4.6744	4.6718	4.6689	4.6669	4.6648
util living area	0.9999	0.9996	0.9981	0.9877	0.9387	0.8135	0.6619	0.7599	0.9557	0.9973	0.9998	1.0000 (86)
Tweekday	18.2026	18.3690	18.6715	19.0931	19.4867	19.7046	19.7565	19.7450	19.5531	19.0494	18.5466	18.1707
Tweekend	20.2062	20.2795	20.4131	20.6001	20.7821	20.8982	20.9376	20.9240	20.8090	20.5794	20.3574	20.1917
24 / 16	9	8	6	0	0	0	0	0	0	0	0	9
24 / 9	22	20	17	0	0	0	0	0	0	0	0	22
16 / 9	0	0	5	9	0	0	0	0	0	0	22	0
MIT	21.0000	21.0000	20.8485	20.4674	20.6638	20.8437	20.9037	20.8828	20.7017	20.3509	20.3574	21.0000 (87)
Th 2	19.8685	19.8688	19.8691	19.8706	19.8708	19.8721	19.8721	19.8723	19.8716	19.8708	19.8703	19.8697 (88)
util rest of house	0.9999	0.9995	0.9973	0.9820	0.9085	0.7239	0.5154	0.6197	0.9208	0.9956	0.9997	0.9999 (89)
Tweekday	18.2026	18.3690	18.6715	19.0931	19.4867	19.7046	19.7565	19.7450	19.5531	19.0494	18.5466	18.1707
Tweekend	18.2026	18.3690	18.6715	19.0931	19.4867	19.7046	19.7565	19.7450	19.5531	19.0494	18.5466	18.1707
MIT 2	19.8685	19.8688	19.8691	19.8706	19.8708	19.8721	19.8721	19.8723	19.8716	19.8708	19.8703	19.8697 (88)
Living area fraction												
MIT	19.9358	19.9360	19.9366	19.9372	19.9378	19.9384	19.9390	19.9396	19.9402	19.9408	19.9414	19.9420 (91)
Temperature adjustment												-0.1000
adjusted MIT	19.8358	19.8360	19.8366	19.8372	19.8378	19.8384	19.8390	19.8396	19.8402	19.8408	19.8414	19.8420 (92)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9999	0.9995	0.9970	0.9761	0.8936	0.7047	0.4941	0.5960	0.9045	0.9935	0.9995	0.9999 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Useful gains	1586.0613	2157.5058	2842.2649	3645.2525	3993.6860	3233.7281	2141.1745	2214.2561	2720.0528	2206.2295	1658.0751	1447.3019	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Month fracti	10909.9463	10485.5073	9149.2492	7130.4234	5434.3431	3549.1613	2186.3929	2317.3426	3795.2886	5903.8004	8029.2988	10967.5763	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	6936.9704	5596.4171	4692.3963	2509.3231	1071.8489	0.0000	0.0000	0.0000	0.0000	2750.9927	4587.2810	7083.0841	(98)
Space heating per m2												35228.3136	(98)
											(98) / (4) =	63.4493	(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)													0.0450	(201)
Fraction of space heat from main system(s)													0.9550	(202)
Fraction of main heating from main system 2													0.2500	(203)
Fraction of total heating from main system 1													0.7163	(204)
Fraction of total heating from main system 2													0.2388	(205)
Efficiency of main space heating system 1 (in %)													297.0878	(206)
Efficiency of main space heating system 2 (in %)													65.0000	(207)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													8493.2068	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	6936.9704	5596.4171	4692.3963	2509.3231	1071.8489	0.0000	0.0000	0.0000	0.0000	2750.9927	4587.2810	7083.0841	(98)	
Space heating efficiency (main heating system 1)	297.0878	297.0878	297.0878	297.0878	297.0878	0.0000	0.0000	0.0000	0.0000	297.0878	297.0878	297.0878	(210)	
Space heating fuel (main heating system)	1672.4367	1349.2422	1131.2915	604.9736	258.4124	0.0000	0.0000	0.0000	0.0000	663.2378	1105.9492	1707.6633	(211)	
Space heating efficiency (main heating system 2)	65.0000	65.0000	65.0000	65.0000	65.0000	0.0000	0.0000	0.0000	0.0000	65.0000	65.0000	65.0000	(212)	
Space heating fuel (main heating system 2)	2548.0026	2055.6070	1723.5533	921.6937	393.6983	0.0000	0.0000	0.0000	0.0000	1010.4608	1684.9436	2601.6713	(213)	
Water heating requirement	312.1637	251.8388	211.1578	112.9195	48.2332	0.0000	0.0000	0.0000	0.0000	123.7947	206.4276	318.7388	(215)	
Space heating fuel used, main system 2												12939.6306	(213)	
Water heating														
Water heating requirement	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164	(64)	
Efficiency of water heater (217)m	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	(216)	
Fuel for water heating, kWh/month	87.8593	77.2487	80.6787	71.6998	69.8120	61.7310	58.6691	65.2287	65.3801	74.3791	79.4320	85.5351	(219)	
Water heating fuel used												877.6536	(219)	
Annual totals kWh/year														
Space heating fuel - main system												8493.2068	(211)	
Space heating fuel - secondary												1585.2741	(215)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												1011.2426	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 13.20 * 1080 * 1.00) =										-11399.7800		-11399.7800	(233)	
Total delivered energy for all uses												13507.2277	(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	8493.2068	0.5190	4407.9743	(261)
Space heating - main system 2	12939.6306	0.0190	245.8530	(262)
Space heating - secondary	1585.2741	0.5190	822.7573	(263)
Water heating (other fuel)	877.6536	0.5190	455.5022	(264)
Space and water heating			5932.0868	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	1011.2426	0.5190	524.8349	(268)
Energy saving/generation technologies				
PV Unit	-11399.7800	0.5190	-5916.4858	(269)
Total CO2, kg/year			540.4359	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			0.9700	(273)

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

DER			0.9700	ZC1
Total Floor Area		TFA	555.2200	
Assumed number of occupants		N	3.4637	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			6.8555	ZC2
CO2 emissions from cooking, equation (L16)			0.3641	ZC3
Total CO2 emissions			8.1895	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			8.1895	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0229 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2729 (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) =		0.2320 (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	0.2958	0.2900	0.2842	0.2552	0.2494	0.2204	0.2204	0.2146	0.2320	0.2494	0.2610	0.2726 (22b)
Effective ac	0.5437	0.5420	0.5404	0.5326	0.5311	0.5243	0.5243	0.5230	0.5269	0.5311	0.5341	0.5371 (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 Opening Type (Uw = 1.40)			138.8000	1.3258	184.0152		(27)
Heat Loss Floor 1 LG			127.0000	0.1300	16.5100		(28a)
Heat Loss Floor 2			159.2200	0.1300	20.6986		(28a)
Heat Loss Floor 3			89.0000	0.1300	11.5700		(28b)
External Wall 1 LG ext	296.0000	104.6300	191.3700	0.1800	34.4466		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.1800	18.4140		(29a)
External Wall 4 Sheltered g	201.0000	34.1700	166.8300	0.1800	30.0294		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		362.3720		(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)							40.0576 (36)
Total fabric heat loss						(33) + (36) =	402.4296 (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	313.2195	312.2411	311.2820	306.7775	305.9347	302.0114	302.0114	301.2848	303.5226	305.9347	307.6396	309.4221 (38)
Heat transfer coeff	715.6490	714.6706	713.7116	709.2070	708.3642	704.4409	704.4409	703.7144	705.9521	708.3642	710.0692	711.8516 (39)
Average = Sum(39)m / 12 =												709.2030 (39)
HLP	1.2889	1.2872	1.2855	1.2773	1.2758	1.2688	1.2688	1.2675	1.2715	1.2758	1.2789	1.2821 (40)
HLP (average)												1.2773 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.1096	123.4511	118.7925	114.1340	109.4755	104.8169	104.8169	109.4755	114.1340	118.7925	123.4511	128.1096 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Energy content (annual)										Total = Sum (45)m =		1832.4205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	28.4974	24.9240	25.7194	22.4228	21.5152	18.5660	17.2041	19.7419	19.9777	23.2821	25.4143	27.5982 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	236.5777	208.2459	218.0573	194.5769	190.0294	168.8649	161.2888	178.2079	178.2767	201.8090	214.5202	230.5831 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Output from w/h												
	236.5777	208.2459	218.0573	194.5769	190.0294	168.8649	161.2888	178.2079	178.2767	201.8090	214.5202	230.5831 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				2381.0379 (64)
	100.4452	88.9168	94.2872	85.7773	84.9679	77.2280	75.4117	81.0372	80.3574	88.8846	92.4084	98.4520 (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	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	57.2640	50.8613	41.3632	31.3146	23.4080	19.7621	21.3536	27.7562	37.2543	47.3029	55.2095	58.8555 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	642.3275	648.9929	632.1964	596.4387	551.3011	508.8780	480.5369	473.8715	490.6680	526.4257	571.5633	613.9864 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186 (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)												
	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)												
	135.0070	132.3167	126.7301	119.1351	114.2042	107.2611	101.3598	108.9210	111.6076	119.4686	128.3450	132.3280 (72)
Total internal gains												
	912.5543	910.1267	878.2455	824.8442	766.8690	713.8570	681.2060	688.5045	717.4856	771.1529	833.0736	883.1256 (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					104.6300	10.6334	0.6300	0.7000	0.7700	340.0164	(74)	
East					2.8400	19.6403	0.6300	0.7000	0.7700	17.0466	(76)	
South					14.0800	46.7521	0.6300	0.7000	0.7700	201.1756	(78)	
West					17.2500	19.6403	0.6300	0.7000	0.7700	103.5400	(80)	

Solar gains	661.7786	1215.1555	1912.3232	2814.4681	3577.7879	3744.1303	3529.3728	2927.1300	2217.7838	1408.7639	808.2730	556.4532 (83)
Total gains	1574.3328	2125.2822	2790.5687	3639.3123	4344.6569	4457.9873	4210.5787	3615.6345	2935.2694	2179.9169	1641.3466	1439.5788 (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	53.8769	53.9506	54.0231	54.3663	54.4310	54.7341	54.7341	54.7906	54.6169	54.4310	54.3003	54.1643
alpha	4.5918	4.5967	4.6015	4.6244	4.6287	4.6489	4.6489	4.6527	4.6411	4.6287	4.6200	4.6110
util living area	0.9999	0.9997	0.9982	0.9890	0.9452	0.8276	0.6793	0.7748	0.9598	0.9975	0.9998	0.9999 (86)
MIT	19.2880	19.4518	19.7515	20.1764	20.5897	20.8644	20.9604	20.9278	20.6601	20.1414	19.6400	19.2624 (87)
Th 2	19.8495	19.8509	19.8522	19.8586	19.8598	19.8654	19.8654	19.8664	19.8632	19.8598	19.8574	19.8549 (88)
util rest of house												
	0.9999	0.9995	0.9975	0.9839	0.9171	0.7400	0.5309	0.6352	0.9273	0.9959	0.9997	0.9999 (89)
MIT 2	17.5410	17.7817	18.2212	18.8438	19.4250	19.7659	19.8496	19.8318	19.5368	18.7970	18.0618	17.5071 (90)
Living area fraction												
MIT	17.6448	17.8810	18.3121	18.9230	19.4942	19.8312	19.9157	19.8970	19.6036	18.8769	18.1556	17.6114 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6448	17.8810	18.3121	18.9230	19.4942	19.8312	19.9157	19.8970	19.6036	18.8769	18.1556	17.6114 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9998	0.9991	0.9959	0.9774	0.9051	0.7369	0.5382	0.6397	0.9162	0.9935	0.9994	0.9999 (94)
Useful gains	1573.9987	2123.4087	2779.0200	3557.0718	3932.2878	3284.9669	2266.0066	2312.8460	2689.3671	2165.8142	1640.4063	1439.3798 (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												
	9550.2187	9277.1170	8430.4594	7108.3599	5521.1222	3685.0827	2335.6862	2460.8688	3885.2502	5863.0545	7850.2585	9546.9608 (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												
	5934.3076	4807.2919	4204.6709	2556.9275	1182.0928	0.0000	0.0000	0.0000	0.0000	2750.7468	4471.0935	6032.0402 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating
Space heating per m2

31939.1713 (98)
(98) / (4) = 57.5253 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													34159.5415 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5934.3076	4807.2919	4204.6709	2556.9275	1182.0928	0.0000	0.0000	0.0000	0.0000	2750.7468	4471.0935	6032.0402	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	6346.8531	5141.4887	4496.9742	2734.6818	1264.2703	0.0000	0.0000	0.0000	0.0000	2941.9752	4781.9182	6451.3799	(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	236.5777	208.2459	218.0573	194.5769	190.0294	168.8649	161.2888	178.2079	178.2767	201.8090	214.5202	230.5831	(64)
Efficiency of water heater	90.0372	89.9990	89.9056	89.6499	88.8501	79.8000	79.8000	79.8000	79.8000	89.6781	89.9478	90.0554	(216)
(217)m	90.0372	89.9990	89.9056	89.6499	88.8501	79.8000	79.8000	79.8000	79.8000	89.6781	89.9478	90.0554	(217)
Fuel for water heating, kWh/month	262.7556	231.3870	242.5402	217.0408	213.8765	211.6102	202.1164	223.3181	223.4044	225.0371	238.4940	256.0458	(219)
Water heating fuel used												2747.6261	(219)
Annual totals kWh/year													
Space heating fuel - main system												34159.5415	(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)													1011.2996 (232)
Total delivered energy for all uses													37993.4671 (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	34159.5415	0.2160	7378.4610 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2747.6261	0.2160	593.4872 (264)
Space and water heating			7971.9482 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	1011.2996	0.5190	524.8645 (268)
Total CO2, kg/m2/year			8535.7377 (272)
Emissions per m2 for space and water heating			14.3582 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			0.9453 (272b)
Emissions per m2 for pumps and fans			0.0701 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3582 * 1.55) + 0.9453 + 0.0701, rounded to 2 d.p.			23.2700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 40.0000 / (5) = 0.0229 (8)
Pressure test					Yes
Measured/design AP50					2.0200
Infiltration rate					0.1239 (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) =				0.1053 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.1343	0.1317	0.1290	0.1159	0.1132	0.1001	0.1001	0.0974	0.1053	0.1132	0.1185	0.1238 (22b)
	0.5090	0.5087	0.5083	0.5067	0.5064	0.5050	0.5050	0.5047	0.5055	0.5064	0.5070	0.5077 (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 (Uw = 1.20)			141.9100	1.1450	162.4924		(27)
Heat Loss Floor 1 LG			127.0000	0.1400	17.7800		(28a)
Heat Loss Floor 2			159.2200	0.1500	23.8830		(28a)
Heat Loss Floor 3			89.0000	0.1600	14.2400		(28b)
External Wall 1 LG ext	296.0000	106.9700	189.0300	0.2600	49.1478		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.2389	24.4377		(29a)
External Wall 4 Sheltered g	201.0000	34.9400	166.0600	0.2600	43.1756		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	381.8447		(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)							26.6942 (36)
Total fabric heat loss						(33) + (36) =	408.5389 (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	293.2174	293.0157	292.8180	291.8893	291.7156	290.9068	290.9068	290.7570	291.2183	291.7156	292.0671	292.4345 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	701.7562	701.5545	701.3568	700.4282	700.2545	699.4456	699.4456	699.2959	699.7572	700.2545	700.6059	700.9734 (39)
												700.4274 (39)
HLP	1.2639	1.2636	1.2632	1.2615	1.2612	1.2598	1.2598	1.2595	1.2603	1.2612	1.2619	1.2625 (40)
HLP (average)												1.2615 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.1096	123.4511	118.7925	114.1340	109.4755	104.8169	104.8169	109.4755	114.1340	118.7925	123.4511	128.1096 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Energy content (annual)	Total = Sum (45)m =											1832.4205 (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)
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	40.3713	35.3090	36.4358	31.7656	30.4798	26.3018	24.3725	27.9678	28.3018	32.9830	36.0035	39.0975 (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	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.2607	50.8585	41.3609	31.3129	23.4067	19.7609	21.3524	27.7547	37.2522	47.3003	55.2064	58.8522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	642.3275	648.9929	632.1964	596.4387	551.3011	508.8780	480.5369	473.8715	490.6680	526.4257	571.5633	613.9864 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186 (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)	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)	54.2626	52.5432	48.9728	44.1189	40.9675	36.5302	32.7587	37.5911	39.3080	44.3320	50.0049	52.5504 (72)
Total internal gains	828.8066	827.3503	797.4859	746.8262	690.6311	640.1250	609.6037	614.1730	642.1840	693.0137	751.7304	800.3447 (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	106.9700	10.6334	0.6400	0.7000	0.7700	353.1385 (74)
East	2.9000	19.6403	0.6400	0.7000	0.7700	17.6830 (76)
South	14.4000	46.7521	0.6400	0.7000	0.7700	209.0136 (78)
West	17.6400	19.6403	0.6400	0.7000	0.7700	107.5616 (80)

Solar gains	687.3967	1262.1812	1986.2929	2923.2803	3716.0704	3888.8261	3665.7753	3040.2822	2303.5511	1463.2725	839.5595	577.9957 (83)
Total gains	1516.2033	2089.5315	2783.7788	3670.1065	4406.7014	4528.9511	4275.3790	3654.4552	2945.7351	2156.2862	1591.2898	1378.3404 (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	54.9435	54.9593	54.9748	55.0477	55.0613	55.1250	55.1250	55.1368	55.1005	55.0613	55.0337	55.0049
alpha	4.6629	4.6640	4.6650	4.6698	4.6708	4.6750	4.6750	4.6758	4.6734	4.6708	4.6689	4.6670
util living area	0.9999	0.9997	0.9983	0.9885	0.9414	0.8190	0.6685	0.7675	0.9588	0.9976	0.9998	1.0000 (86)
MIT	19.3092	19.4743	19.7751	20.1964	20.6081	20.8727	20.9636	20.9317	20.6677	20.1492	19.6494	19.2765 (87)
Th 2	19.8692	19.8695	19.8698	19.8711	19.8713	19.8725	19.8725	19.8727	19.8720	19.8713	19.8708	19.8703 (88)
util rest of house	0.9999	0.9996	0.9976	0.9832	0.9122	0.7302	0.5216	0.6279	0.9257	0.9961	0.9997	0.9999 (89)
MIT 2	18.3099	18.4752	18.7759	19.1953	19.5891	19.8093	19.8627	19.8505	19.6545	19.1511	18.6513	18.2780 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3693	18.5346	18.8353	19.2548	19.6497	19.8725	19.9281	19.9148	19.7147	19.2104	18.7107	18.3374 (92)
Temperature adjustment												
adjusted MIT	18.3693	18.5346	18.8353	19.2548	19.6497	19.8725	19.9281	19.9148	19.7147	19.2104	18.7107	18.3374 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9999	0.9994	0.9966	0.9790	0.9047	0.7302	0.5295	0.6340	0.9191	0.9947	0.9996	0.9999 (94)
Useful gains	1515.9971	2088.1769	2774.2415	3593.1688	3986.8316	3307.0668	2263.9964	2317.1062	2707.3362	2144.8853	1590.6604	1378.2213 (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	9873.2117	9565.4126	8651.4581	7252.8223	5566.7848	3687.8582	2327.8497	2457.8804	3928.9106	6029.4681	8134.4908	9909.9330 (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	6217.7676	5024.7024	4372.6491	2634.9505	1175.4852	0.0000	0.0000	0.0000	0.0000	2890.1297	4711.5579	6347.5935 (98)
Space heating												33374.8358 (98)
Space heating per m2												(98) / (4) = 60.1110 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	6574.7890	5175.8977	5314.6485	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7450	0.8270	0.7488	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	4898.2820	4280.4447	3979.4568	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5519.3536	5216.5517	4496.3455	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	447.1715	696.4636	384.5652	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1528.2003	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	111.7929	174.1159	96.1413	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												382.0501	(107)
Space cooling per m2												0.6881	(108)
Energy for space heating												60.1110	(99)
Energy for space cooling												0.6881	(108)
Total												60.7991	(109)
Dwelling Fabric Energy Efficiency (DFEE)												60.8	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0229 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2729 (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) =		0.2320 (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	0.2958	0.2900	0.2842	0.2552	0.2494	0.2204	0.2204	0.2146	0.2320	0.2494	0.2610	0.2726 (22b)
Effective ac	0.5437	0.5420	0.5404	0.5326	0.5311	0.5243	0.5243	0.5230	0.5269	0.5311	0.5341	0.5371 (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 Opening Type (Uw = 1.40)			138.8000	1.3258	184.0152		(27)
Heat Loss Floor 1 LG			127.0000	0.1300	16.5100		(28a)
Heat Loss Floor 2			159.2200	0.1300	20.6986		(28a)
Heat Loss Floor 3			89.0000	0.1300	11.5700		(28b)
External Wall 1 LG ext	296.0000	104.6300	191.3700	0.1800	34.4466		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.1800	18.4140		(29a)
External Wall 4 Sheltered g	201.0000	34.1700	166.8300	0.1800	30.0294		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		362.3720		(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)							40.0576 (36)
Total fabric heat loss						(33) + (36) =	402.4296 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 313.2195	Feb 312.2411	Mar 311.2820	Apr 306.7775	May 305.9347	Jun 302.0114	Jul 302.0114	Aug 301.2848	Sep 303.5226	Oct 305.9347	Nov 307.6396	Dec 309.4221 (38)
Heat transfer coeff	715.6490	714.6706	713.7116	709.2070	708.3642	704.4409	704.4409	703.7144	705.9521	708.3642	710.0692	711.8516 (39)
Average = Sum(39)m / 12 =												709.2030 (39)
HLP	Jan 1.2889	Feb 1.2872	Mar 1.2855	Apr 1.2773	May 1.2758	Jun 1.2688	Jul 1.2688	Aug 1.2675	Sep 1.2715	Oct 1.2758	Nov 1.2789	Dec 1.2821 (40)
HLP (average)												1.2773 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
Daily hot water use	Jan 128.1096	Feb 123.4511	Mar 118.7925	Apr 114.1340	May 109.4755	Jun 104.8169	Jul 104.8169	Aug 109.4755	Sep 114.1340	Oct 118.7925	Nov 123.4511	Dec 128.1096 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Energy content (annual)										Total =	Sum (45)m =	1832.4205 (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)
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	40.3713	35.3090	36.4358	31.7656	30.4798	26.3018	24.3725	27.9678	28.3018	32.9830	36.0035	39.0975 (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	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858	173.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.2640	50.8613	41.3632	31.3146	23.4080	19.7621	21.3536	27.7562	37.2543	47.3029	55.2095	58.8555 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	642.3275	648.9929	632.1964	596.4387	551.3011	508.8780	480.5369	473.8715	490.6680	526.4257	571.5633	613.9864 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186	40.3186 (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)	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)	54.2626	52.5432	48.9728	44.1189	40.9675	36.5302	32.7587	37.5911	39.3080	44.3320	50.0049	52.5504 (72)
Total internal gains	828.8098	827.3532	797.4882	746.8280	690.6324	640.1261	609.6049	614.1745	642.1861	693.0163	751.7335	800.3480 (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				104.6300	10.6334			0.6300		0.7000			0.7700		340.0164 (74)
East				2.8400	19.6403			0.6300		0.7000			0.7700		17.0466 (76)
South				14.0800	46.7521			0.6300		0.7000			0.7700		201.1756 (78)
West				17.2500	19.6403			0.6300		0.7000			0.7700		103.5400 (80)
Solar gains	661.7786	1215.1555	1912.3232	2814.4681	3577.7879	3744.1303	3529.3728	2927.1300	2217.7838	1408.7639	808.2730	556.4532	(83)		
Total gains	1490.5884	2042.5087	2709.8114	3561.2960	4268.4203	4384.2564	4138.9777	3541.3046	2859.9699	2101.7803	1560.0065	1356.8012	(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	53.8769	53.9506	54.0231	54.3663	54.4310	54.7341	54.7341	54.7906	54.6169	54.4310	54.3003	54.1643
alpha	4.5918	4.5967	4.6015	4.6244	4.6287	4.6489	4.6489	4.6527	4.6411	4.6287	4.6200	4.6110
util living area	0.9999	0.9997	0.9984	0.9899	0.9483	0.8343	0.6879	0.7842	0.9633	0.9978	0.9998	1.0000 (86)
MIT	19.2742	19.4381	19.7383	20.1642	20.5800	20.8591	20.9583	20.9238	20.6498	20.1286	19.6266	19.2487 (87)
Th 2	19.8495	19.8509	19.8522	19.8586	19.8598	19.8654	19.8654	19.8664	19.8632	19.8598	19.8574	19.8549 (88)
util rest of house	0.9999	0.9996	0.9978	0.9851	0.9215	0.7480	0.5391	0.6458	0.9330	0.9965	0.9998	0.9999 (89)
MIT 2	18.2595	18.4245	18.7255	19.1538	19.5544	19.7943	19.8539	19.8412	19.6315	19.1215	18.6180	18.2383 (90)
Living area fraction									fLA =	Living area / (4) =		0.0594 (91)
MIT	18.3199	18.4848	18.7857	19.2138	19.6154	19.8576	19.9196	19.9055	19.6920	19.1814	18.6780	18.2983 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3199	18.4848	18.7857	19.2138	19.6154	19.8576	19.9196	19.9055	19.6920	19.1814	18.6780	18.2983 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9999	0.9994	0.9969	0.9813	0.9139	0.7473	0.5470	0.6514	0.9263	0.9952	0.9996	0.9999 (94)
Useful gains	1490.3884	2041.2622	2701.3724	3494.6222	3900.9737	3276.5138	2263.9298	2306.9688	2649.2160	2091.6752	1559.4217	1356.6858 (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	10033.2930	9708.6246	8768.4115	7314.6479	5606.9616	3703.6421	2338.4497	2466.8760	3947.7023	6078.7225	8221.1638	10035.9094 (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	6355.9211	5152.4676	4513.8771	2750.4185	1269.2551	0.0000	0.0000	0.0000	0.0000	2966.3632	4796.4543	6457.3423 (98)
Space heating												34262.0992 (98)
Space heating per m2										(98) / (4) =		61.7091 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	6621.7446	5212.8628	5348.2292	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7257	0.8103	0.7307	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	4805.6776	4223.8212	3907.7643	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5350.2314	5057.1231	4364.0937	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	392.0787	619.9766	339.5091	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1351.5644	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	98.0197	154.9942	84.8773	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												337.8911	(107)
Space cooling per m2												0.6086	(108)
Energy for space heating												61.7091	(99)
Energy for space cooling												0.6086	(108)
Total												62.3176	(109)
Target Fabric Energy Efficiency (TFEE)												71.7	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) = 0.0286 (8)
Pressure test					Yes
Measured/design AP50					2.0200
Infiltration rate					0.1296 (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) =				0.1102 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.5000	5.1000	5.2000	4.7000	4.8000	4.4000	4.5000	4.2000	4.4000	4.8000	4.8000	5.1000 (22)
Wind factor	1.3750	1.2750	1.3000	1.1750	1.2000	1.1000	1.1250	1.0500	1.1000	1.2000	1.2000	1.2750 (22a)
Adj infilt rate	0.1515	0.1405	0.1433	0.1295	0.1322	0.1212	0.1240	0.1157	0.1212	0.1322	0.1322	0.1405 (22b)
Effective ac	0.5115	0.5099	0.5103	0.5084	0.5087	0.5073	0.5077	0.5067	0.5073	0.5087	0.5087	0.5099 (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 (Uw = 1.20)			141.9100	1.1450	162.4924		(27)
Heat Loss Floor 1 LG			127.0000	0.1400	17.7800		(28a)
Heat Loss Floor 2			159.2200	0.1500	23.8830		(28a)
Heat Loss Floor 3			89.0000	0.1600	14.2400		(28b)
External Wall 1 LG ext	296.0000	106.9700	189.0300	0.2600	49.1478		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.2389	24.4377		(29a)
External Wall 4 Sheltered g	201.0000	34.9400	166.0600	0.2600	43.1756		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	381.8447		(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)							26.6942 (36)
Total fabric heat loss						(33) + (36) =	408.5389 (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	294.6356	293.7088	293.9339	292.8518	293.0595	292.2551	292.4496	291.8791	292.2551	293.0595	293.0595	293.7088 (38)
Heat transfer coeff	703.1745	702.2476	702.4728	701.3907	701.5984	700.7939	700.9885	700.4180	700.7939	701.5984	701.5984	702.2476 (39)
Average = Sum(39)m / 12 =												701.6102 (39)
HLP	1.2665	1.2648	1.2652	1.2633	1.2636	1.2622	1.2625	1.2615	1.2622	1.2636	1.2636	1.2648 (40)
HLP (average)												1.2637 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.1096	123.4511	118.7925	114.1340	109.4755	104.8169	104.8169	109.4755	114.1340	118.7925	123.4511	128.1096 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Energy content (annual)										Total =	Sum (45)m =	1832.4205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	28.4974	24.9240	25.7194	22.4228	21.5152	18.5660	17.2041	19.7419	19.9777	23.2821	25.4143	27.5982 (46)
Water storage loss:												
Store volume												208.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4900 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.1816 (55)
Total storage loss												
	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (56)
If cylinder contains dedicated solar storage												
	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
										Solar input (sum of months) =	Sum (63)m =	0.0000 (63)
Output from w/h												
	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (64)
										Total per year (kWh/year) =	Sum (64)m =	2263.6881 (64)
RHI water heating demand												2264 (64)
Heat gains from water heating, kWh/month												
	92.4718	81.7151	86.3138	78.0611	76.9945	69.5119	67.4383	73.0639	72.6413	80.9113	84.6922	90.4786 (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	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	143.1519	127.1462	103.4022	78.2821	58.5168	49.4024	53.3810	69.3866	93.1306	118.2507	138.0160	147.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	958.6978	968.6461	943.5768	890.2071	822.8374	759.5195	717.2192	707.2709	732.3403	785.7099	853.0796	916.3975 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460 (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)												
	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)												
	124.2901	121.5998	116.0132	108.4182	103.4873	96.5443	90.6429	98.2041	100.8907	108.7517	117.6281	121.6111 (72)
Total internal gains												
	1354.6601	1345.9125	1291.5125	1205.4278	1113.3619	1033.9864	989.7634	1003.3820	1054.8819	1141.2327	1237.2441	1313.6594 (73)

6. Solar gains

[Jan]													Gains
				Area	Solar flux			g	FF			Access	
				m2	Table 6a			Specific data	Specific data			factor	W
					W/m2			or Table 6b	or Table 6c			Table 6d	
North				106.9700	12.7500			0.6400	0.7000			0.7700	423.4311 (74)
East				2.9000	23.7835			0.6400	0.7000			0.7700	21.4134 (76)
South				14.4000	54.0600			0.6400	0.7000			0.7700	241.6851 (78)
West				17.6400	23.7835			0.6400	0.7000			0.7700	130.2523 (80)
Solar gains	816.7818	1340.8262	2117.8133	3279.9097	3955.3931	4506.9975	4084.4869	3462.2734	2615.7639	1623.8126	984.2705	663.2298 (83)	
Total gains	2171.4419	2686.7387	3409.3259	4485.3375	5068.7549	5540.9839	5074.2503	4465.6554	3670.6457	2765.0453	2221.5146	1976.8893 (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	54.8327	54.9051	54.8875	54.9721	54.9559	55.0189	55.0037	55.0485	55.0189	54.9559	54.9559	54.9051
alpha	4.6555	4.6603	4.6592	4.6648	4.6637	4.6679	4.6669	4.6699	4.6679	4.6637	4.6637	4.6603
util living area	0.9996	0.9988	0.9950	0.9711	0.8905	0.6866	0.5601	0.6113	0.8903	0.9903	0.9989	0.9997 (86)
Tweekday	18.4141	18.5495	18.8418	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	18.3965
Tweekend	20.3000	20.3594	20.4890	20.6746	20.8359	20.9287	20.9455	20.9426	20.8685	20.6638	20.4550	20.2918
24 / 16	9	8	7	0	0	0	0	0	0	0	0	9
24 / 9	22	20	17	0	0	0	0	0	0	0	0	22
16 / 9	0	0	5	9	0	0	0	0	0	0	22	0
MIT	21.0000	21.0000	20.8846	20.5666	20.7467	20.8905	20.9159	20.9114	20.7947	20.4811	20.4550	21.0000 (87)
Th 2	19.8672	19.8685	19.8682	19.8697	19.8694	19.8706	19.8703	19.8711	19.8706	19.8694	19.8694	19.8685 (88)
util rest of house												
	0.9994	0.9984	0.9929	0.9584	0.8421	0.5794	0.4197	0.4589	0.8182	0.9840	0.9983	0.9996 (89)
Tweekday	18.4141	18.5495	18.8418	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	18.3965
Tweekend	18.4141	18.5495	18.8418	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	18.3965
MIT 2	19.8672	19.8685	19.6364	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	19.8685 (90)
Living area fraction									fLA = Living area / (4) =			0.0594 (91)
MIT	19.9345	19.9358	19.7106	19.3332	19.6578	19.8103	19.8288	19.8280	19.7281	19.3111	18.8672	19.9358 (92)
Temperature adjustment												-0.1000
adjusted MIT	19.8345	19.8358	19.6106	19.2332	19.5578	19.7103	19.7288	19.7280	19.6281	19.2111	18.7672	19.8358 (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 Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.9994	0.9983	0.9923	0.9485	0.8253	0.5625	0.4011	0.4380	0.7976	0.9781	0.9975	0.9996 (94)
Useful gains	2170.1794	2682.2996	3383.0478	4254.3990	4183.3642	3116.9116	2035.0451	1955.7584	2927.6090	2704.6146	2215.8724	1976.1073 (95)
Ext temp.	5.3000	5.7000	7.2000	9.4000	12.3000	15.1000	16.8000	16.9000	14.7000	11.5000	8.2000	5.4000 (96)
Heat loss rate W	10220.3000	9926.7996	8718.1110	6896.8975	5092.0942	3230.8661	2053.0687	1980.7545	3453.5947	5410.0836	7413.9306	10137.4739 (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	5989.2898	4868.3040	3969.2871	1902.5989	676.0951	0.0000	0.0000	0.0000	0.0000	2012.8689	3742.6019	6072.0568 (98)
Space heating												29233.1024 (98)
RHI space heating demand												29233 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) = 0.0286 (8)
Pressure test					Yes
Measured/design AP50					2.0200
Infiltration rate					0.1296 (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) =				0.1102 (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	0.1405	0.1377	0.1350	0.1212	0.1185	0.1047	0.1047	0.1019	0.1102	0.1185	0.1240	0.1295 (22b)
Effective ac	0.5099	0.5095	0.5091	0.5073	0.5070	0.5055	0.5055	0.5052	0.5061	0.5070	0.5077	0.5084 (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 (Uw = 1.20)			141.9100	1.1450	162.4924		(27)
Heat Loss Floor 1 LG			127.0000	0.1400	17.7800		(28a)
Heat Loss Floor 2			159.2200	0.1500	23.8830		(28a)
Heat Loss Floor 3			89.0000	0.1600	14.2400		(28b)
External Wall 1 LG ext	296.0000	106.9700	189.0300	0.2600	49.1478		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.2389	24.4377		(29a)
External Wall 4 Sheltered g	201.0000	34.9400	166.0600	0.2600	43.1756		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	381.8447		(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)							26.6942 (36)
Total fabric heat loss						(33) + (36) =	408.5389 (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	293.7088	293.4880	293.2716	292.2551	292.0649	291.1796	291.1796	291.0156	291.5206	292.0649	292.4496	292.8518 (38)
Heat transfer coeff	702.2476	702.0268	701.8104	700.7939	700.6038	699.7184	699.7184	699.5545	700.0595	700.6038	700.9885	701.3907 (39)
Average = Sum(39)m / 12 =												700.7930 (39)
HLP	1.2648	1.2644	1.2640	1.2622	1.2618	1.2603	1.2603	1.2600	1.2609	1.2618	1.2625	1.2633 (40)
HLP (average)												1.2622 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.1096	123.4511	118.7925	114.1340	109.4755	104.8169	104.8169	109.4755	114.1340	118.7925	123.4511	128.1096 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Energy content (annual)										Total = Sum (45)m =		1832.4205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	28.4974	24.9240	25.7194	22.4228	21.5152	18.5660	17.2041	19.7419	19.9777	23.2821	25.4143	27.5982 (46)
Water storage loss:												
Store volume												208.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4900 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.1816 (55)
Total storage loss												
	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (56)
If cylinder contains dedicated solar storage												
	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Output from w/h												
	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				2263.6881 (64)
	92.4718	81.7151	86.3138	78.0611	76.9945	69.5119	67.4383	73.0639	72.6413	80.9113	84.6922	90.4786 (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	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	143.1519	127.1462	103.4022	78.2821	58.5168	49.4024	53.3810	69.3866	93.1306	118.2507	138.0160	147.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	958.6978	968.6461	943.5768	890.2071	822.8374	759.5195	717.2192	707.2709	732.3403	785.7099	853.0796	916.3975 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460 (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)												
	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)												
	124.2901	121.5998	116.0132	108.4182	103.4873	96.5443	90.6429	98.2041	100.8907	108.7517	117.6281	121.6111 (72)
Total internal gains												
	1354.6601	1345.9125	1291.5125	1205.4278	1113.3619	1033.9864	989.7634	1003.3820	1054.8819	1141.2327	1237.2441	1313.6594 (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				106.9700	10.6334		0.6400	0.7000		0.7700	353.1385 (74)	
East				2.9000	19.6403		0.6400	0.7000		0.7700	17.6830 (76)	
South				14.4000	46.7521		0.6400	0.7000		0.7700	209.0136 (78)	
West				17.6400	19.6403		0.6400	0.7000		0.7700	107.5616 (80)	
Solar gains	687.3967	1262.1812	1986.2929	2923.2803	3716.0704	3888.8261	3665.7753	3040.2822	2303.5511	1463.2725	839.5595	577.9957 (83)
Total gains	2042.0568	2608.0937	3277.8055	4128.7081	4829.4322	4922.8125	4655.5387	4043.6642	3358.4330	2604.5052	2076.8035	1891.6552 (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	54.9051	54.9223	54.9393	55.0189	55.0339	55.1035	55.1035	55.1164	55.0767	55.0339	55.0037	54.9721
alpha	4.6603	4.6615	4.6626	4.6679	4.6689	4.6736	4.6736	4.6744	4.6718	4.6689	4.6669	4.6648
util living area												
	0.9998	0.9992	0.9965	0.9819	0.9217	0.7826	0.6255	0.7189	0.9361	0.9947	0.9994	0.9998 (86)
Tweekday	18.2786	18.4437	18.7414	19.1521	19.5230	19.7161	19.7587	19.7503	19.5901	19.1114	18.6162	18.2448
Tweekend	20.2397	20.3125	20.4441	20.6270	20.8010	20.9070	20.9408	20.9302	20.8288	20.6071	20.3882	20.2244
24 / 16	9	8	6	0	0	0	0	0	0	0	0	9
24 / 9	22	20	17	0	0	0	0	0	0	0	0	22
16 / 9	0	0	5	9	0	0	0	0	0	0	22	0
MIT	21.0000	21.0000	20.8565	20.5033	20.6929	20.8572	20.9087	20.8923	20.7327	20.3936	20.3882	21.0000 (87)
Th 2	19.8685	19.8688	19.8691	19.8706	19.8708	19.8721	19.8721	19.8723	19.8716	19.8708	19.8703	19.8697 (88)
util rest of house												
	0.9997	0.9989	0.9952	0.9738	0.8857	0.6888	0.4826	0.5773	0.8904	0.9915	0.9992	0.9998 (89)
Tweekday	18.2786	18.4437	18.7414	19.1521	19.5230	19.7161	19.7587	19.7503	19.5901	19.1114	18.6162	18.2448
Tweekend	18.2786	18.4437	18.7414	19.1521	19.5230	19.7161	19.7587	19.7503	19.5901	19.1114	18.6162	18.2448
MIT 2	19.8685	19.8688	19.8691	19.8706	19.8708	19.8721	19.8721	19.8723	19.8716	19.8708	19.8703	19.8697 (88)
Living area fraction												
MIT	19.9358	19.9360	19.9361	19.9362	19.9363	19.9364	19.9365	19.9366	19.9367	19.9368	19.9369	19.9370 (91)
Temperature adjustment												
adjusted MIT	19.8358	19.8360	19.8361	19.8362	19.8363	19.8364	19.8365	19.8366	19.8367	19.8368	19.8369	19.8370 (92)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9997	0.9989	0.9947	0.9663	0.8701	0.6704	0.4626	0.5550	0.8723	0.9880	0.9987	0.9998 (94)

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Useful gains	2041.3830	2605.1048	3260.2971	3989.4873	4201.8970	3300.4914	2153.5586	2244.0995	2929.6948	2573.2045	2074.0756	1891.2245	(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	10909.9463	10485.5073	9161.4875	7170.7843	5459.4683	3557.3278	2188.0620	2321.2478	3820.9100	5946.4505	8076.4302	10967.5763	(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	6598.2110	5295.6305	4390.4856	2290.5338	935.6331	0.0000	0.0000	0.0000	0.0000	2509.6950	4321.6954	6752.8058	(98)
Space heating												33094.6901	(98)
Space heating per m2												(98) / (4) =	59.6064 (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)													0.0450 (201)
Fraction of space heat from main system(s)													0.9550 (202)
Fraction of main heating from main system 2													0.2500 (203)
Fraction of total heating from main system 1													0.7163 (204)
Fraction of total heating from main system 2													0.2388 (205)
Efficiency of main space heating system 1 (in %)													297.0878 (206)
Efficiency of main space heating system 2 (in %)													65.0000 (207)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													7978.8107 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6598.2110	5295.6305	4390.4856	2290.5338	935.6331	0.0000	0.0000	0.0000	0.0000	2509.6950	4321.6954	6752.8058	(98)
Space heating efficiency (main heating system 1)	297.0878	297.0878	297.0878	297.0878	297.0878	0.0000	0.0000	0.0000	0.0000	297.0878	297.0878	297.0878	(210)
Space heating fuel (main heating system)	1590.7651	1276.7255	1058.5038	552.2256	225.5721	0.0000	0.0000	0.0000	0.0000	605.0633	1041.9191	1628.0364	(211)
Space heating efficiency (main heating system 2)	65.0000	65.0000	65.0000	65.0000	65.0000	0.0000	0.0000	0.0000	0.0000	65.0000	65.0000	65.0000	(212)
Space heating fuel (main heating system 2)	2423.5737	1945.1258	1612.6591	841.3307	343.6652	0.0000	0.0000	0.0000	0.0000	921.8303	1587.3919	2480.3575	(213)
Water heating requirement	296.9195	238.3034	197.5719	103.0740	42.1035	0.0000	0.0000	0.0000	0.0000	112.9363	194.4763	303.8763	(215)
Space heating fuel used, main system 2												12155.9343	(213)
Water heating													
Water heating requirement	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164	(64)
Efficiency of water heater (217)m	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	(216)
Fuel for water heating, kWh/month	87.8593	77.2487	80.6787	71.6998	69.8120	61.7310	58.6691	65.2287	65.3801	74.3791	79.4320	85.5351	(219)
Water heating fuel used												877.6536	(219)
Annual totals kWh/year													
Space heating fuel - main system												7978.8107	(211)
Space heating fuel - secondary												1489.2611	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												1011.2426	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 13.20 * 1080 * 1.00) =										-11399.7800		-11399.7800	(233)
Total delivered energy for all uses												12113.1223	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7978.8107	13.1900	1052.4051 (240)
Space heating - main system 2	12155.9343	4.2300	514.1960 (241)
Space heating - secondary	1489.2611	13.1900	196.4335 (242)
Water heating (other fuel)	877.6536	13.1900	115.7625 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	1011.2426	13.1900	133.3829 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-11399.7800	13.1900	-1503.6310 (252)
Total energy cost			508.5491 (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] =	0.3559 (257)
SAP value		95.0358
SAP rating (Section 12)		95 (258)
SAP band		A

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

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Calculation Type: New Build (As Built)

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	7978.8107	0.5190	4141.0028 (261)
Space heating - main system 2	12155.9343	0.0190	230.9628 (262)
Space heating - secondary	1489.2611	0.5190	772.9265 (263)
Water heating (other fuel)	877.6536	0.5190	455.5022 (264)
Space and water heating			5600.3942 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	1011.2426	0.5190	524.8349 (268)
Energy saving/generation technologies			
PV Unit	-11399.7800	0.5190	-5916.4858 (269)
Total kg/year			208.7433 (272)
CO2 emissions per m2			0.3800 (273)
EI value			99.5340
EI rating			100 (274)
EI band			A

Calculation of stars for heating and DHW

Main heating 1 energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.9709 = 4.762$, stars = 4
Main heating 2 energy efficiency	$4.23 \times (1 + 0.29 \times 0.50) / 0.6500 = 7.451$, stars = 2
Main heating 1 environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.9709 = 0.1874$, stars = 5
Main heating 2 environmental impact	$0.019 \times (1 + 0.29 \times 0.50) / 0.6500 = 0.0335$, stars = 5
Water heating energy efficiency	$13.19 / 2.5793 = 5.114$, stars = 4
Water heating environmental impact	$0.519 / 2.5793 = 0.2012$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	127.0000 (1b)	x 3.1000 (2b)	= 393.7000 (1b) - (3b)
First floor	222.2200 (1c)	x 2.7000 (2c)	= 599.9940 (1c) - (3c)
Second floor	206.0000 (1d)	x 3.6500 (2d)	= 751.9000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	555.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1745.5940 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) = 0.0286 (8)
Pressure test					Yes
Measured/design AP50					2.0200
Infiltration rate					0.1296 (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) =				0.1102 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.5000	5.1000	5.2000	4.7000	4.8000	4.4000	4.5000	4.2000	4.4000	4.8000	4.8000	5.1000 (22)
Wind factor	1.3750	1.2750	1.3000	1.1750	1.2000	1.1000	1.1250	1.0500	1.1000	1.2000	1.2000	1.2750 (22a)
Adj infilt rate	0.1515	0.1405	0.1433	0.1295	0.1322	0.1212	0.1240	0.1157	0.1212	0.1322	0.1322	0.1405 (22b)
Effective ac	0.5115	0.5099	0.5103	0.5084	0.5087	0.5073	0.5077	0.5067	0.5073	0.5087	0.5087	0.5099 (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 (Uw = 1.20)			141.9100	1.1450	162.4924		(27)
Heat Loss Floor 1 LG			127.0000	0.1400	17.7800		(28a)
Heat Loss Floor 2			159.2200	0.1500	23.8830		(28a)
Heat Loss Floor 3			89.0000	0.1600	14.2400		(28b)
External Wall 1 LG ext	296.0000	106.9700	189.0300	0.2600	49.1478		(29a)
External Wall 2 LG sheltered	102.3000		102.3000	0.2389	24.4377		(29a)
External Wall 4 Sheltered g	201.0000	34.9400	166.0600	0.2600	43.1756		(29a)
External Roof 1 LG	34.7000		34.7000	0.1300	4.5110		(30)
External Roof 2 New roof	93.4000		93.4000	0.1300	12.1420		(30)
External Roof 3 Pitched	56.3200		56.3200	0.1300	7.3216		(30)
External Roof 4 Flat roof	76.8000		76.8000	0.1300	9.9840		(30)
External Roof 5 Pitched	97.9200		97.9200	0.1300	12.7296		(30)
Total net area of external elements Aum(A, m ²)			1333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	381.8447		(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)							26.6942 (36)
Total fabric heat loss						(33) + (36) =	408.5389 (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	294.6356	293.7088	293.9339	292.8518	293.0595	292.2551	292.4496	291.8791	292.2551	293.0595	293.0595	293.7088 (38)
Heat transfer coeff	703.1745	702.2476	702.4728	701.3907	701.5984	700.7939	700.9885	700.4180	700.7939	701.5984	701.5984	702.2476 (39)
Average = Sum(39)m / 12 =												701.6102 (39)
HLP	1.2665	1.2648	1.2652	1.2633	1.2636	1.2622	1.2625	1.2615	1.2622	1.2636	1.2636	1.2648 (40)
HLP (average)												1.2637 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.4637 (42)
Average daily hot water use (litres/day)												116.4633 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.1096	123.4511	118.7925	114.1340	109.4755	104.8169	104.8169	109.4755	114.1340	118.7925	123.4511	128.1096 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Energy conte	189.9828	166.1602	171.4624	149.4851	143.4345	123.7731	114.6939	131.6130	133.1849	155.2141	169.4283	183.9882 (45)
Energy content (annual)										Total =	Sum (45)m =	1832.4205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	28.4974	24.9240	25.7194	22.4228	21.5152	18.5660	17.2041	19.7419	19.9777	23.2821	25.4143	27.5982 (46)
Water storage loss:												
Store volume												208.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4900 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.1816 (55)
Total storage loss												
	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (56)
If cylinder contains dedicated solar storage												
	36.6282	33.0835	36.6282	35.4467	36.6282	35.4467	36.6282	36.6282	35.4467	36.6282	35.4467	36.6282 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
										Solar input (sum of months) =	Sum (63)m =	0.0000 (63)
Output from w/h												
	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (64)
										Total per year (kWh/year) =	Sum (64)m =	2263.6881 (64)
Heat gains from water heating, kWh/month												
	92.4718	81.7151	86.3138	78.0611	76.9945	69.5119	67.4383	73.0639	72.6413	80.9113	84.6922	90.4786 (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	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230	207.8230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	143.1519	127.1462	103.4022	78.2821	58.5168	49.4024	53.3810	69.3866	93.1306	118.2507	138.0160	147.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	958.6978	968.6461	943.5768	890.2071	822.8374	759.5195	717.2192	707.2709	732.3403	785.7099	853.0796	916.3975 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460	59.2460 (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)												
	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486	-138.5486 (71)
Water heating gains (Table 5)												
	124.2901	121.5998	116.0132	108.4182	103.4873	96.5443	90.6429	98.2041	100.8907	108.7517	117.6281	121.6111 (72)
Total internal gains												
	1354.6601	1345.9125	1291.5125	1205.4278	1113.3619	1033.9864	989.7634	1003.3820	1054.8819	1141.2327	1237.2441	1313.6594 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	106.9700	12.7500	0.6400	0.7000	0.7700	423.4311 (74)
East	2.9000	23.7835	0.6400	0.7000	0.7700	21.4134 (76)
South	14.4000	54.0600	0.6400	0.7000	0.7700	241.6851 (78)
West	17.6400	23.7835	0.6400	0.7000	0.7700	130.2523 (80)

Solar gains	816.7818	1340.8262	2117.8133	3279.9097	3955.3931	4506.9975	4084.4869	3462.2734	2615.7639	1623.8126	984.2705	663.2298 (83)
Total gains	2171.4419	2686.7387	3409.3259	4485.3375	5068.7549	5540.9839	5074.2503	4465.6554	3670.6457	2765.0453	2221.5146	1976.8893 (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	54.8327	54.9051	54.8875	54.9721	54.9559	55.0189	55.0037	55.0485	55.0189	54.9559	54.9559	54.9051
alpha	4.6555	4.6603	4.6592	4.6648	4.6637	4.6679	4.6669	4.6699	4.6679	4.6637	4.6637	4.6603
util living area												
	0.9996	0.9988	0.9950	0.9711	0.8905	0.6866	0.5601	0.6113	0.8903	0.9903	0.9989	0.9997 (86)
Tweekday	18.4141	18.5495	18.8418	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	18.3965
Tweekend	20.3000	20.3594	20.4890	20.6746	20.8359	20.9287	20.9455	20.9426	20.8685	20.6638	20.4550	20.2918
24 / 16	9	8	7	0	0	0	0	0	0	0	0	9
24 / 9	22	20	17	0	0	0	0	0	0	0	0	22
16 / 9	0	0	5	9	0	0	0	0	0	0	22	0
MIT	21.0000	21.0000	20.8846	20.5666	20.7467	20.8905	20.9159	20.9114	20.7947	20.4811	20.4550	21.0000 (87)
Th 2	19.8672	19.8685	19.8682	19.8697	19.8694	19.8706	19.8703	19.8711	19.8706	19.8694	19.8694	19.8685 (88)
util rest of house												
	0.9994	0.9984	0.9929	0.9584	0.8421	0.5794	0.4197	0.4589	0.8182	0.9840	0.9983	0.9996 (89)
Tweekday	18.4141	18.5495	18.8418	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	18.3965
Tweekend	18.4141	18.5495	18.8418	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	18.3965
MIT 2	19.8672	19.8685	19.8684	19.2552	19.5890	19.7420	19.7601	19.7595	19.6607	19.2371	18.7669	19.8685 (90)
Living area fraction												
										fLA = Living area / (4) =		0.0594 (91)
MIT	19.9345	19.9358	19.7106	19.3332	19.6578	19.8103	19.8288	19.8280	19.7281	19.3111	18.8672	19.9358 (92)
Temperature adjustment												-0.1000
adjusted MIT	19.8345	19.8358	19.6106	19.2332	19.5578	19.7103	19.7288	19.7280	19.6281	19.2111	18.7672	19.8358 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9994	0.9983	0.9923	0.9485	0.8253	0.5625	0.4011	0.4380	0.7976	0.9781	0.9975	0.9996 (94)

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Useful gains	2170.1794	2682.2996	3383.0478	4254.3990	4183.3642	3116.9116	2035.0451	1955.7584	2927.6090	2704.6146	2215.8724	1976.1073 (95)
Ext temp.	5.3000	5.7000	7.2000	9.4000	12.3000	15.1000	16.8000	16.9000	14.7000	11.5000	8.2000	5.4000 (96)
Heat loss rate W	10220.3000	9926.7996	8718.1110	6896.8975	5092.0942	3230.8661	2053.0687	1980.7545	3453.5947	5410.0836	7413.9306	10137.4739 (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	5989.2898	4868.3040	3969.2871	1902.5989	676.0951	0.0000	0.0000	0.0000	0.0000	2012.8689	3742.6019	6072.0568 (98)
Space heating												29233.1024 (98)
Space heating per m2												(98) / (4) = 52.6514 (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)												0.0450 (201)
Fraction of space heat from main system(s)												0.9550 (202)
Fraction of main heating from main system 2												0.2500 (203)
Fraction of total heating from main system 1												0.7163 (204)
Fraction of total heating from main system 2												0.2388 (205)
Efficiency of main space heating system 1 (in %)												297.0183 (206)
Efficiency of main space heating system 2 (in %)												65.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												7049.4678 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	5989.2898	4868.3040	3969.2871	1902.5989	676.0951	0.0000	0.0000	0.0000	0.0000	2012.8689	3742.6019	6072.0568 (98)
Space heating efficiency (main heating system 1)	297.0183	297.0183	297.0183	297.0183	297.0183	0.0000	0.0000	0.0000	0.0000	297.0183	297.0183	297.0183 (210)
Space heating fuel (main heating system)	1444.2978	1173.9757	957.1807	458.8055	163.0381	0.0000	0.0000	0.0000	0.0000	485.3968	902.5163	1464.2568 (211)
Space heating efficiency (main heating system 2)	65.0000	65.0000	65.0000	65.0000	65.0000	0.0000	0.0000	0.0000	0.0000	65.0000	65.0000	65.0000 (212)
Space heating fuel (main heating system 2)	2199.9122	1788.1655	1457.9497	698.8392	248.3349	0.0000	0.0000	0.0000	0.0000	739.3422	1374.6865	2230.3132 (213)
Water heating requirement	269.5180	219.0737	178.6179	85.6170	30.4243	0.0000	0.0000	0.0000	0.0000	90.5791	168.4171	273.2426 (215)
Space heating fuel used, main system 2												10737.5434 (213)
Water heating												
Water heating requirement	226.6110	199.2437	208.0906	184.9317	180.0627	159.2197	151.3222	168.2412	168.6315	191.8423	204.8750	220.6164 (64)
Efficiency of water heater (217)m	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250	257.9250 (216)
Fuel for water heating, kWh/month	87.8593	77.2487	80.6787	71.6998	69.8120	61.7310	58.6691	65.2287	65.3801	74.3791	79.4320	85.5351 (219)
Water heating fuel used												877.6536 (219)
Annual totals kWh/year												
Space heating fuel - main system												7049.4678 (211)
Space heating fuel - secondary												1315.4896 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												1011.2426 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 13.20 * 1193 * 1.00) =									-12601.2051			-12601.2051 (233)
Total delivered energy for all uses												8390.1919 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	7049.4678	31.0800	2190.9746 (240)
Space heating - main system 2	10737.5434	10.7600	1155.3597 (241)
Space heating - secondary	1315.4896	31.0800	408.8542 (242)
Water heating (other fuel)	877.6536	31.0800	272.7747 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	1011.2426	31.0800	314.2942 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-12601.2051	31.0800	-3916.4545 (252)
Total energy cost			425.8028 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	7049.4678	0.5190	3658.6738 (261)
Space heating - main system 2	10737.5434	0.0190	204.0133 (262)
Space heating - secondary	1315.4896	0.5190	682.7391 (263)
Water heating (other fuel)	877.6536	0.5190	455.5022 (264)
Space and water heating			5000.9284 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	1011.2426	0.5190	524.8349 (268)
Energy saving/generation technologies			

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PV Unit	-12601.2051	0.5190	-6540.0254 (269)
Total kg/year			-1014.2621 (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	7049.4678	3.0700	21641.8660 (261)
Space heating - main system 2	10737.5434	1.0400	11167.0451 (262)
Space heating - secondary	1315.4896	3.0700	4038.5531 (263)
Water heating (other fuel)	877.6536	3.0700	2694.3966 (264)
Space and water heating			39541.8609 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	1011.2426	3.0700	3104.5147 (268)
Energy saving/generation technologies			
PV Unit	-12601.2051	3.0700	-38685.6995 (269)
Primary energy kWh/year			3960.6760 (272)
Primary energy kWh/m2/year			7.1335 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	A 95
Current environmental impact rating:	A 100

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	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
(none)			

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.4	-£ 101	-168 kg (16.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating:	A 95
Potential environmental impact rating:	A 100

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Severn Valley):			
	Current	Potential	Saving
Electricity	£3187	£3187	£0
Wood	£1155	£1155	£0
Space heating	£3755	£3755	£0
Water heating	£273	£273	£0
Lighting	£314	£314	£0
Generated (PV)	-£3916	-£3916	£0

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Total cost of fuels	£426	£426	£0
Total cost of uses	£426	£426	£0
Delivered energy	15 kWh/m ²	15 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	-1.0 tonnes	-1.0 tonnes	0.0 tonnes
CO2 emissions per m ²	-2 kg/m ²	-2 kg/m ²	0 kg/m ²
Primary energy	7 kWh/m ²	7 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	4608.37 (P1)
Transmission heat loss coefficient	408.54 (37)
Summer heat loss coefficient	5016.91 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.925	0.90	1.000	0.833 (P8)
East	0.925	0.90	1.000	0.833 (P8)
South	0.925	0.90	1.000	0.833 (P8)
West	0.925	0.90	1.000	0.833 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	106.9700	82.4373	0.6400	0.7000	0.8325	2959.9929
East	2.9000	119.1985	0.6400	0.7000	0.8325	116.0309
South	14.4000	113.6726	0.6400	0.7000	0.8325	549.4436
West	17.6400	119.1985	0.6400	0.7000	0.8325	705.7877
total:						4331.2551

Solar gains	Jun 4767	Jul 4331	Aug 3660	(P3)
Internal gains	1034	990	1003	
Total summer gains	5800	5321	4663	(P5)
Summer gain/loss ratio	1.16	1.06	0.93	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	16.41	18.01	17.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			