

ASSESSMENT NOTES

Calculation Type: New Build (As Designed)

Property Reference	7358-0001-GF-82CR-B		Issued on Date	25/09/2020
Assessment Reference	Proposed	Prop Type Ref		
Property	House B, 82 Chichester Road, , Tilehurst, ,			

SAP Rating	88 B	DER	13.59	TER	17.16
Environmental	90 B	% DER<TER	20.80		
CO ₂ Emissions (t/year)	0.82	DFEE	42.64	TFEE	45.09
General Requirements Compliance	Pass	% DFEE<TFEE	5.44		

Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com	Assessor ID	7358-0001
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Client	Greg Farrell, 052
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ASSESSMENT NOTES - Last time updated on: 25.09.2020

Cavity walls to have 125mm Dritherm 32

IG Hi therm or Catnic thermally broken lintels (alternatively independent lintels) to be used

Celcon Accredited Construction Details to be used to limit thermal bridging. Sap Assessor will need written confirmation that this has been done along with signed ACD sheets on completion

100% low energy light fittings

Space heating and hot water provided by mains gas combi boiler with time and temperature zone control of space heating. Delayed start thermostat to control space heating.

External doors, glazed doors and windows to have U value no worse than 1.4W/m².K, If possible windows and doors should have BFRC/WER datasheet

Air tightness to achieve 5.0m³/hr/m²

U values of walls, floor and roof as per U value calculation sheets.

A minimum 0.66Kw solar PV to South elevation roof

BASIC COMPLIANCE REPORT

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		TFEE	45.09
		% DFEE<TFEE	5.44
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Client	Greg Farrell, 052		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.16	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.59	kgCO ₂ /m ²	Pass
	-3.57 (-20.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.09	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.64	kWh/m ² /yr	
	-2.5 (-5.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

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Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 28CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

7.37 m², No overhang

Windows facing South

3.31 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Floor U-value

0.12

W/m²K

Photovoltaic array

0.66

kW

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

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			7358-0001
Client	Greg Farrell, 052		

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

Orientation	South						
Property Tenure	Unknown						
Transaction Type	New dwelling						
Terrain Type	Suburban						
1.0 Property Type	House, Mid-Terrace						
2.0 Number of Storeys	2						
3.0 Date Built	2020						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
		Ground Floor:	8.90 m	41.66 m ²	2.40 m		
		1st Storey:	8.90 m	41.66 m ²	2.65 m		
7.0 Living Area	20.91			m ²			
8.0 Thermal Mass Parameter	Precise calculation			kJ/m ² K			
Thermal Mass	303.24						
9.0 External Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Cavity Wall	Other		0.22	67.84	44.94	32.30
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill		0.00	140.00	94.57	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Other				75.00	56.45	
Internal Wall 2	Plasterboard on timber frame				9.00	96.06	
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Plane Roof	Other		0.14	12.17	41.66	41.66

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	41.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Other	0.12	65.52	41.66

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	41.66

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External door	Manufacture	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacture	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Glazed doors	Manufacture	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Velux roof lights	Manufacture	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.30
Flat roof light	Manufacture	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Half Glazed Door	[1] External Wall 1	South							1.96	
Opening 2	Window	[1] External Wall 1	North	None	0.00					4.20	
Opening 3	Window	[1] External Wall 1	North	None	0.00					3.17	
Opening 4	Window	[1] External Wall 1	South	None	0.00					3.31	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

Yes

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	9.10	0.050	No	IG hi therm or independent lin
Independently assessed	E3 Sill	8.17	0.034	No	CD0027
Independently assessed	E4 Jamb	21.00	0.040	No	CD0028
Independently assessed	E5 Ground floor (normal)	8.90	0.060	No	CD0022
Independently assessed	E6 Intermediate floor within a dwelling	8.90	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	8.90	0.105	No	CD0033
Independently assessed	E18 Party wall between dwellings	20.20	0.067	No	CD0037
Table K1 - Default	P1 Party wall - Ground floor	18.72	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	18.72	0.000	No	
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	18.72	0.240	No	

Y-value	0.093	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

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19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1		Database	
Description		Gas boiler	
Percentage of Heat		100	%
Database Ref. No.		17511	
Fuel Type		Mains gas	
Main Heating		BGW	
SAP Code		104	
In Winter		90.7	
In Summer		87.2	
Controls		CBE Programmer, room thermostat and TRVs	
PCDF Controls		0	
Delayed Start Stat		Yes	
Sap Code		2106	
Flue Type		Balanced	
Fan Assisted Flue		Yes	
Is MHS Pumped		Pump in heated space	
Heat Emitter		Radiators	
Flow Temperature		36° - 45°C	
Combi boiler type		Standard Combi	
Combi keep hot type		Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

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Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit	One Dwelling
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PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.66	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£30	B 89	

THERMAL BRIDGING

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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	9.10	0.46	IG hi therm or independent lin
External wall	E3 Sill	Independently assessed	0.034	8.17	0.28	CD0027
External wall	E4 Jamb	Independently assessed	0.040	21.00	0.84	CD0028
External wall	E5 Ground floor (normal)	Independently assessed	0.060	8.90	0.53	CD0022
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	8.90	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.105	8.90	0.93	CD0033
External wall	E18 Party wall between dwellings	Independently assessed	0.067	20.20	1.35	CD0037
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	18.72	3.00	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	18.72	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.240	18.72	4.49	

Total: **11.88** W/mK:
Y-Value: **0.093** W/m²K:

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 83 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.16 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.59 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 45.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 42.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 28CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.37 m², No overhang
Windows facing South: 3.31 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K
Photovoltaic array 0.66 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =	0.3337 (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	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25265.6474 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 303.2363 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.8827 (36)
Total fabric heat loss (33) + (36) = 46.3418 (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	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	87.3392	87.0951	86.8560	85.7325	85.5223	84.5438	84.5438	84.3626	84.9207	85.5223	85.9475	86.3921 (39)
Average = Sum(39)m / 12 =												85.7315 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0482	1.0453	1.0424	1.0290	1.0264	1.0147	1.0147	1.0125	1.0192	1.0264	1.0315	1.0369 (40)
HLP (average)												1.0289 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5228 (42)
Average daily hot water use (litres/day) 94.1175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1480.8353 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (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)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198 (61)
Total heat required for water heating calculated for each month											
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (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 (63)
Solar input (sum of months) = Sum (63)m =											0.0000 (63)
Output from w/h	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400 (64)
Total per year (kWh/year) = Sum (64)m =											1779.9784 (64)
Heat gains from water heating, kWh/month	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809 (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	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0623	19.5955	15.9361	12.0647	9.0185	7.6138	8.2270	10.6937	14.3531	18.2246	21.2708	22.6755	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	389.3132	387.0173	372.9195	350.3068	327.3711	305.4059	291.2631	297.5006	309.2513	332.0790	358.2072	377.7766	(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	3.1700				10.6334		0.6300		0.7000		0.7700		10.3016 (74)	
South	3.3100				46.7521		0.6300		0.7000		0.7700		47.2934 (78)	
North	4.2000				10.6334		0.6300		0.7000		0.7700		13.6488 (74)	
Solar gains	71.2437	123.2247	176.4381	236.4372	284.4885	291.9843	277.4617	239.5537	196.5759	138.0254	85.6046	60.8320 (83)		
Total gains	460.5569	510.2420	549.3576	586.7440	611.8596	597.3902	568.7248	537.0542	505.8272	470.1043	443.8118	438.6086 (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	80.3561	80.5813	80.8032	81.8620	82.0632	83.0130	83.0130	83.1913	82.6446	82.0632	81.6572	81.2370
alpha	6.3571	6.3721	6.3869	6.4575	6.4709	6.5342	6.5342	6.5461	6.5096	6.4709	6.4438	6.4158
util living area	0.9996	0.9990	0.9972	0.9889	0.9508	0.8207	0.6394	0.6964	0.9215	0.9923	0.9989	0.9997 (86)
MIT	20.0214	20.1247	20.3018	20.5505	20.7899	20.9499	20.9917	20.9862	20.8820	20.5840	20.2615	20.0052 (87)
Th 2	20.0433	20.0457	20.0481	20.0593	20.0614	20.0711	20.0711	20.0729	20.0674	20.0614	20.0571	20.0527 (88)
util rest of house	0.9994	0.9986	0.9959	0.9831	0.9235	0.7358	0.5127	0.5702	0.8676	0.9873	0.9984	0.9995 (89)
MIT 2	19.1466	19.2517	19.4303	19.6857	19.9138	20.0485	20.0692	20.0693	20.0005	19.7220	19.3981	19.1383 (90)
Living area fraction	19.3661	19.4708	19.6490	19.9027	20.1336	20.2747	20.3008	20.2994	20.2217	19.9383	19.6147	19.3558 (92)
MIT	19.3661	19.4708	19.6490	19.9027	20.1336	20.2747	20.3008	20.2994	20.2217	19.9383	19.6147	19.3558 (92)
Temperature adjustment	19.2161	19.3208	19.4990	19.7527	19.9836	20.1247	20.1508	20.1494	20.0717	19.7883	19.4647	-0.1500
adjusted MIT	19.2161	19.3208	19.4990	19.7527	19.9836	20.1247	20.1508	20.1494	20.0717	19.7883	19.4647	19.2058 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9991	0.9981	0.9948	0.9806	0.9206	0.7414	0.5240	0.5813	0.8679	0.9852	0.9979	0.9994 (94)
Useful gains	460.1557	509.2667	546.5111	575.3393	563.3021	442.8807	297.9975	312.1699	439.0293	463.1569	442.8798	438.3312 (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	1302.7634	1255.9796	1129.0408	930.4332	708.4357	467.0796	300.1943	316.3106	507.1221	785.8033	1062.7195	1296.3853 (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	626.9001	501.7911	433.4021	255.6676	107.9794	0.0000	0.0000	0.0000	0.0000	240.0490	446.2846	638.3923 (98)
Space heating												3250.4661 (98)
Space heating per m2												(98) / (4) = 39.0118 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.1000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3491.3707	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	626.9001	501.7911	433.4021	255.6676	107.9794	0.0000	0.0000	0.0000	0.0000	240.0490	446.2846	638.3923	(98)	
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)	
Space heating fuel (main heating system)	673.3621	538.9808	465.5232	274.6161	115.9822	0.0000	0.0000	0.0000	0.0000	257.8399	479.3605	685.7060	(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	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)	
Efficiency of water heater (217)m	89.8986	89.8395	89.7115	89.3992	88.6824	87.2000	87.2000	87.2000	87.2000	89.3166	89.7427	89.9264	(216)	
Fuel for water heating, kWh/month	199.1021	175.0536	182.7996	162.6251	159.3286	142.8518	135.3603	151.0669	151.5993	168.8854	180.0036	193.6452	(219)	
Water heating fuel used												2002.3214	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3491.3707	(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)													389.6266	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890			-569.9890	(233)
Total delivered energy for all uses													5388.3298	(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	3491.3707	0.2160	754.1361	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2002.3214	0.2160	432.5014	(264)
Space and water heating			1186.6375	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.6266	0.5190	202.2162	(268)
Energy saving/generation technologies				
PV Unit	-569.9890	0.5190	-295.8243	(269)
Total CO2, kg/year			1131.9544	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5900	(273)

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

DER			13.5900	ZC1
Total Floor Area		TFA	83.3200	
Assumed number of occupants		N	2.5228	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.0903	ZC2
CO2 emissions from cooking, equation (L16)			2.1549	ZC3
Total CO2 emissions			31.8352	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			31.8352	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =		0.3337 (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	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9600	1.2000	2.3520		(26a)
TER Opening Type (Uw = 1.40)			10.6800	1.3258	14.1591		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158		(28a)
External Wall 1	44.9400	12.6400	32.3000	0.1800	5.8140		(29a)
External Roof 1	41.6600		41.6600	0.1300	5.4158		(30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.1567		(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)							8.8275 (36)
Total fabric heat loss						(33) + (36) =	41.9842 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020
Heat transfer coeff	82.9815	82.7375	82.4983	81.3749	81.1647	80.1862	80.1862
Average = Sum(39)m / 12 =							
HLP	0.9959	0.9930	0.9901	0.9767	0.9741	0.9624	0.9624
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5228 (42)
Average daily hot water use (litres/day)												94.1175 (43)
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)
Energy content (annual)										Total = Sum(45)m =		1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	45.9190	48.9205	45.4858	45.0836	41.7727	43.1651	45.0836	45.4858	48.9205	49.1990	50.9589 (61)
Solar input	204.4898	180.1982	187.4845	166.2893	160.9974	141.7975	135.8528	151.4441	153.1166	174.3538	186.1192	199.6454 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	204.4898	180.1982	187.4845	166.2893	160.9974	141.7975	135.8528	151.4441	153.1166	174.3538	186.1192	199.6454 (64)
	63.7888	56.1276	58.3027	51.5386	49.8122	43.7014	41.6099	46.6358	47.1587	53.9367	57.8257	62.1780 (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	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0623	19.5955	15.9361	12.0647	9.0185	7.6138	8.2270	10.6937	14.3531	18.2246	21.2708	22.6755	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	85.7376	83.5232	78.3638	71.5814	66.9519	60.6964	55.9273	62.6825	65.4982	72.4956	80.3135	83.5726	(72)
Total internal gains	397.8817	395.5481	380.8134	357.5651	333.9911	311.3887	297.2506	304.1248	316.5159	339.9792	366.7416	386.3476	(73)

6. Solar gains

[Jan]													Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF Access factor Table 6d		Gains W	
North													7.3700		10.6334		0.6300		0.7000		0.7700		23.9503	(74)
South													3.3100		46.7521		0.6300		0.7000		0.7700		47.2934	(78)
Solar gains	71.2437	123.2247	176.4381	236.4372	284.4885	291.9843	277.4617	239.5537	196.5759	138.0254	85.6046			60.8320	(83)									
Total gains	469.1254	518.7728	557.2514	594.0023	618.4796	603.3731	574.7123	543.6785	513.0918	478.0046	452.3462			447.1796	(84)									

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.7277	69.9333	70.1361	71.1044	71.2885	72.1585	72.1585	72.3219	71.8209	71.2885	70.9170	70.5327	
alpha	5.6485	5.6622	5.6757	5.7403	5.7526	5.8106	5.8106	5.8215	5.7881	5.7526	5.7278	5.7022	
util living area	0.9985	0.9971	0.9930	0.9774	0.9224	0.7762	0.5995	0.6527	0.8846	0.9832	0.9969	0.9989	(86)
MIT	19.9361	20.0545	20.2536	20.5297	20.7853	20.9477	20.9903	20.9846	20.8810	20.5643	20.2052	19.9174	(87)
Th 2	20.0867	20.0892	20.0916	20.1028	20.1049	20.1148	20.1148	20.1166	20.1110	20.1049	20.1007	20.0962	(88)
util rest of house	0.9981	0.9961	0.9904	0.9684	0.8903	0.6963	0.4864	0.5394	0.8269	0.9748	0.9956	0.9985	(89)
MIT 2	18.6569	18.8316	19.1234	19.5294	19.8805	20.0771	20.1109	20.1096	20.0086	19.5839	19.0607	18.6365	(90)
Living area fraction	18.9779	19.1385	19.4070	19.7805	20.1076	20.2956	20.3316	20.3292	20.2275	19.8299	19.3479	18.9580	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9779	19.1385	19.4070	19.7805	20.1076	20.2956	20.3316	20.3292	20.2275	19.8299	19.3479	18.9580	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	467.8062	515.9680	550.4291	572.7908	550.6807	430.8103	295.9487	308.7601	428.8017	464.2970	449.6906	446.2149	(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	1217.9962	1178.0563	1064.8077	885.3952	682.4001	456.7047	299.2199	314.3572	493.6526	749.1435	999.3071	1210.6643	(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	558.1414	444.9233	382.6977	225.0752	97.9992	0.0000	0.0000	0.0000	0.0000	211.9258	395.7238	568.7504	(98)
Space heating												2885.2368	(98)
Space heating per m2												34.6284	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3089.1187 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	558.1414	444.9233	382.6977	225.0752	97.9992	0.0000	0.0000	0.0000	0.0000	211.9258	395.7238	568.7504	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	597.5817	476.3633	409.7406	240.9799	104.9242	0.0000	0.0000	0.0000	0.0000	226.9013	423.6872	608.9404	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	204.4898	180.1982	187.4845	166.2893	160.9974	141.7975	135.8528	151.4441	153.1166	174.3538	186.1192	199.6454	(64)
Efficiency of water heater	87.4507	87.2370	86.8097	85.8139	83.8445	80.3000	80.3000	80.3000	80.3000	85.5435	86.9035	87.5392	(217)
Fuel for water heating, kWh/month	233.8346	206.5615	215.9718	193.7791	192.0190	176.5847	169.1816	188.5979	190.6807	203.8188	214.1676	228.0639	(219)
Water heating fuel used												2413.2612	(219)
Annual totals kWh/year													
Space heating fuel - main system												3089.1187	(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)												389.6266	(232)
Total delivered energy for all uses												5967.0065	(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	3089.1187	0.2160	667.2496 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2413.2612	0.2160	521.2644 (264)
Space and water heating			1188.5141 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.6266	0.5190	202.2162 (268)
Total CO2, kg/m2/year			1429.6553 (272)
Emissions per m2 for space and water heating			14.2645 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4270 (272b)
Emissions per m2 for pumps and fans			0.4672 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2645 * 1.00) + 2.4270 + 0.4672, rounded to 2 d.p.			17.1600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =	0.3337 (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	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (28a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			9.0000	374.9400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24890.7074 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							298.7363 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.8827 (36)
Total fabric heat loss						(33) + (36) =	46.3418 (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	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	87.3392	87.0951	86.8560	85.7325	85.5223	84.5438	84.5438	84.3626	84.9207	85.5223	85.9475	86.3921 (39)
Average = Sum(39)m / 12 =												85.7315 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0482	1.0453	1.0424	1.0290	1.0264	1.0147	1.0147	1.0125	1.0192	1.0264	1.0315	1.0369 (40)
HLP (average)												1.0289 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5228 (42)
Average daily hot water use (litres/day)												94.1175 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1480.8353 (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	32.6253	28.5343	29.4449	25.6707	24.6317	21.2553	19.6961	22.6016	22.8715	26.6546	29.0956	31.5959 (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	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0623	19.5955	15.9361	12.0647	9.0185	7.6138	8.2270	10.6937	14.3531	18.2246	21.2708	22.6755	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	43.8512	42.4618	39.5764	35.6538	33.1071	29.5212	26.4733	30.3785	31.7660	35.8260	40.4105	42.4676	(72)
Total internal gains	352.9953	351.4868	339.0260	318.6374	297.1463	277.2135	264.7965	268.8208	279.7837	300.3097	323.8386	342.2426	(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					3.1700	10.6334	0.6300	0.7000	0.7700		10.3016 (74)		
South					3.3100	46.7521	0.6300	0.7000	0.7700		47.2934 (78)		
North					4.2000	10.6334	0.6300	0.7000	0.7700		13.6488 (74)		
Solar gains	71.2437	123.2247	176.4381	236.4372	284.4885	291.9843	277.4617	239.5537	196.5759	138.0254	85.6046	60.8320 (83)	
Total gains	424.2390	474.7114	515.4641	555.0747	581.6347	569.1979	542.2582	508.3745	476.3597	438.3351	409.4432	403.0746 (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	79.1636	79.3854	79.6040	80.6472	80.8454	81.7811	81.7811	81.9568	81.4181	80.8454	80.4454	80.0315	
alpha	6.2776	6.2924	6.3069	6.3765	6.3897	6.4521	6.4521	6.4638	6.4279	6.3897	6.3630	6.3354	
util living area	0.9997	0.9993	0.9979	0.9913	0.9596	0.8429	0.6659	0.7270	0.9371	0.9945	0.9993	0.9998	(86)
MIT	19.9732	20.0786	20.2598	20.5150	20.7637	20.9388	20.9891	20.9815	20.8608	20.5482	20.2182	19.9575	(87)
Th 2	20.0433	20.0457	20.0481	20.0593	20.0614	20.0711	20.0711	20.0729	20.0674	20.0614	20.0571	20.0527	(88)
util rest of house	0.9996	0.9990	0.9969	0.9867	0.9363	0.7619	0.5364	0.5996	0.8906	0.9908	0.9989	0.9997	(89)
MIT 2	19.0994	19.2067	19.3895	19.6520	19.8915	20.0423	20.0685	20.0679	19.9851	19.6880	19.3558	19.0915	(90)
Living area fraction	19.3187	19.4255	19.6079	19.8686	20.1104	20.2673	20.2996	20.2972	20.2048	19.9039	19.5723	19.3088	(92)
MIT	19.3187	19.4255	19.6079	19.8686	20.1104	20.2673	20.2996	20.2972	20.2048	19.9039	19.5723	19.3088	(93)
Temperature adjustment													
adjusted MIT	19.3187	19.4255	19.6079	19.8686	20.1104	20.2673	20.2996	20.2972	20.2048	19.9039	19.5723	19.3088	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	423.9988	474.0893	513.5530	547.0216	545.4583	444.6217	308.9093	321.5531	428.2813	433.9197	408.8887	402.9117	(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	1311.7207	1265.1013	1138.5029	940.3651	719.2781	479.1339	312.7743	328.7749	518.4278	795.6879	1071.9593	1305.2839	(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	660.4651	531.5600	464.9627	283.2073	129.3219	0.0000	0.0000	0.0000	0.0000	269.1555	477.4109	671.3650	(98)
Space heating												3487.4484	(98)
Space heating per m2												41.8561	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	794.7116	625.6240	641.1556	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8460	0.9215	0.8953	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.3268	576.4858	573.9958	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	760.4691	727.0807	689.3407	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	63.4624	112.0426	85.8166	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												261.3217 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	15.8656	28.0106	21.4542	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												65.3304 (107)
Space cooling per m2												0.7841 (108)
Energy for space heating												41.8561 (99)
Energy for space cooling												0.7841 (108)
Total												42.6402 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =	0.3337 (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	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9600	1.2000	2.3520		(26a)
TER Opening Type (Uw = 1.40)			10.6800	1.3258	14.1591		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158		(28a)
External Wall 1	44.9400	12.6400	32.3000	0.1800	5.8140		(29a)
External Roof 1	41.6600		41.6600	0.1300	5.4158		(30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.1567		(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)							8.8275 (36)
Total fabric heat loss						(33) + (36) =	41.9842 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Average = Sum(39)m / 12 =	82.9815	82.7375	82.4983	81.3749	81.1647	80.1862	80.1862	80.0050	80.5631	81.1647	81.5899	82.0344 (39)
												81.3739 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9959	0.9930	0.9901	0.9767	0.9741	0.9624	0.9624	0.9602	0.9669	0.9741	0.9792	0.9846 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5228 (42)
Average daily hot water use (litres/day)												94.1175 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy content (annual)	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1480.8353 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
	32.6253	28.5343	29.4449	25.6707	24.6317	21.2553	19.6961	22.6016	22.8715	26.6546	29.0956	31.5959	(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	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0623	19.5955	15.9361	12.0647	9.0185	7.6138	8.2270	10.6937	14.3531	18.2246	21.2708	22.6755	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	43.8512	42.4618	39.5764	35.6538	33.1071	29.5212	26.4733	30.3785	31.7660	35.8260	40.4105	42.4676	(72)
Total internal gains	352.9953	351.4868	339.0260	318.6374	297.1463	277.2135	264.7965	268.8208	279.7837	300.3097	323.8386	342.2426	(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	7.3700				10.6334		0.6300		0.7000		0.7700		23.9503 (74)
South	3.3100				46.7521		0.6300		0.7000		0.7700		47.2934 (78)

Solar gains	71.2437	123.2247	176.4381	236.4372	284.4885	291.9843	277.4617	239.5537	196.5759	138.0254	85.6046	60.8320 (83)	
Total gains	424.2390	474.7114	515.4641	555.0747	581.6347	569.1979	542.2582	508.3745	476.3597	438.3351	409.4432	403.0746 (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	69.7277	69.9333	70.1361	71.1044	71.2885	72.1585	72.1585	72.3219	71.8209	71.2885	70.9170	70.5327		
alpha	5.6485	5.6622	5.6757	5.7403	5.7526	5.8106	5.8106	5.8215	5.7881	5.7526	5.7278	5.7022		
util living area	0.9991	0.9981	0.9952	0.9834	0.9381	0.8056	0.6309	0.6897	0.9099	0.9888	0.9981	0.9994	(86)	
MIT	19.8844	20.0041	20.2068	20.4893	20.7564	20.9362	20.9875	20.9797	20.8572	20.5218	20.1561	19.8664	(87)	
Th 2	20.0867	20.0892	20.0916	20.1028	20.1049	20.1148	20.1148	20.1166	20.1110	20.1049	20.1007	20.0962	(88)	
util rest of house	0.9988	0.9975	0.9934	0.9765	0.9107	0.7282	0.5141	0.5739	0.8596	0.9829	0.9974	0.9991	(89)	
MIT 2	19.0589	19.1804	19.3843	19.6726	19.9274	20.0824	20.1112	20.1101	20.0238	19.7083	19.3417	19.0487	(90)	
Living area fraction	19.2661	19.3871	19.5907	19.8776	20.1354	20.2967	20.3311	20.3283	20.2329	19.9124	19.5461	19.2539	(92)	
MIT	19.2661	19.3871	19.5907	19.8776	20.1354	20.2967	20.3311	20.3283	20.2329	19.9124	19.5461	19.2539	(93)	
Temperature adjustment														
adjusted MIT	19.2661	19.3871	19.5907	19.8776	20.1354	20.2967	20.3311	20.3283	20.2329	19.9124	19.5461	19.2539	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9985	0.9968	0.9921	0.9743	0.9118	0.7457	0.5438	0.6033	0.8678	0.9812	0.9967	0.9989	(94)	
Useful gains	423.5911	473.1955	511.3858	540.8090	530.3214	424.4406	294.8759	306.7014	413.3842	430.1120	408.0958	402.6161	(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	1241.9090	1198.6274	1079.9599	893.3004	684.6575	456.7968	299.1854	314.2858	494.0891	755.8417	1015.4769	1234.9413	(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	608.8285	487.4902	423.0191	253.7939	114.8260	0.0000	0.0000	0.0000	0.0000	242.3429	437.3143	619.2499	(98)	
Space heating												3186.8649	(98)	
Space heating per m2												(98) / (4) =	38.2485	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	753.7500	593.3776	608.0377	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8569	0.9247	0.9012	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	645.9095	548.6704	547.9879	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	760.4691	727.0807	689.3407	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	82.4829	132.7373	105.1665	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												320.3867	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	20.6207	33.1843	26.2916	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											80.0967 (107)
Space cooling per m2											0.9613 (108)
Energy for space heating											38.2485 (99)
Energy for space cooling											0.9613 (108)
Total											39.2098 (109)
Target Fabric Energy Efficiency (TFEE)											45.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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)	=	0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3504	0.3337	0.3337	0.3087	0.3087	0.2753	0.2837	0.2670	0.2753	0.2920	0.2920	0.3170 (22b)
	0.5614	0.5557	0.5557	0.5476	0.5476	0.5379	0.5402	0.5356	0.5379	0.5426	0.5426	0.5503 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25265.6474 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 303.2363 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.8827 (36)
Total fabric heat loss (33) + (36) = 46.3418 (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	38.9751	38.5789	38.5789	38.0208	38.0208	37.3443	37.5062	37.1872	37.3443	37.6729	37.6729	38.2020 (38)
Heat transfer coeff	85.3169	84.9207	84.9207	84.3626	84.3626	83.6861	83.8480	83.5290	83.6861	84.0147	84.0147	84.5438 (39)
Average = Sum(39)m / 12 =												84.2672 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0240	1.0192	1.0192	1.0125	1.0125	1.0044	1.0063	1.0025	1.0044	1.0083	1.0083	1.0147 (40)
HLP (average)												1.0114 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5228 (42)
Average daily hot water use (litres/day) 94.1175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030	(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)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518	(61)
Total heat required for water heating calculated for each month	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(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	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)
												Total per year (kWh/year) = Sum (64)m =	1779.9784 (64)
RHI water heating demand	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012	(65)
Heat gains from water heating, kWh/month												1780	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1557	48.9888	39.8404	30.1617	22.5462	19.0345	20.5674	26.7343	35.8828	45.5614	53.1769	56.6886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	576.1119	571.2722	548.7715	514.1484	478.8129	447.3810	429.2414	438.0227	458.1763	493.0144	531.5425	560.5785	(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	3.1700				11.9814		0.6300		0.7000		0.7700		11.6075 (74)	
South	3.3100				50.9848		0.6300		0.7000		0.7700		51.5752 (78)	
North	4.2000				11.9814		0.6300		0.7000		0.7700		15.3791 (74)	
Solar gains	78.5618	122.6238	174.6266	243.2996	286.7610	315.4876	296.3641	260.6673	211.6479	146.9737	96.7715	66.3989	(83)	
Total gains	654.6737	693.8961	723.3981	757.4479	765.5739	762.8686	725.6055	698.6900	669.8242	639.9881	628.3140	626.9774	(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	82.2608	82.6446	82.6446	83.1913	83.1913	83.8638	83.7019	84.0215	83.8638	83.5358	83.5358	83.0130	
alpha	6.4841	6.5096	6.5096	6.5461	6.5461	6.5909	6.5801	6.6014	6.5909	6.5691	6.5691	6.5342	
util living area	0.9954	0.9924	0.9817	0.9403	0.8070	0.5437	0.3580	0.3821	0.6985	0.9402	0.9886	0.9963	(86)
MIT	20.3063	20.3902	20.5620	20.7789	20.9437	20.9964	20.9998	20.9997	20.9827	20.8145	20.5353	20.2908	(87)
Th 2	20.0634	20.0674	20.0674	20.0729	20.0729	20.0797	20.0781	20.0812	20.0797	20.0764	20.0764	20.0711	(88)
util rest of house	0.9935	0.9893	0.9739	0.9151	0.7397	0.4463	0.2517	0.2727	0.6003	0.9094	0.9832	0.9949	(89)
MIT 2	19.4472	19.5335	19.7018	19.9102	20.0430	20.0787	20.0780	20.0812	20.0735	19.9480	19.6849	19.4384	(90)
Living area fraction	19.6628	19.7485	19.9177	20.1282	20.2690	20.3090	20.3094	20.3117	20.3017	20.1655	19.8983	19.6523	(92)
MIT	19.6628	19.7485	19.9177	20.1282	20.2690	20.3090	20.3094	20.3117	20.3017	20.1655	19.8983	19.6523	(92)
Temperature adjustment	19.5128	19.5985	19.7677	19.9782	20.1190	20.1590	20.1594	20.1617	20.1517	20.0155	19.7483	19.5023	(93)
adjusted MIT	19.5128	19.5985	19.7677	19.9782	20.1190	20.1590	20.1594	20.1617	20.1517	20.0155	19.7483	19.5023	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9921	0.9873	0.9707	0.9120	0.7434	0.4548	0.2611	0.2823	0.6084	0.9069	0.9807	0.9936	(94)
Useful gains	649.4889	685.0566	702.2321	690.7729	569.1175	346.9772	189.4230	197.2390	407.5369	580.4250	616.1656	622.9740	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1229.6550	1188.7595	1050.2708	850.2217	600.5791	348.0536	189.4434	197.2725	414.3862	707.0229	987.0304	1217.6285	(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	431.6436	338.4883	258.9407	114.8031	23.4074	0.0000	0.0000	0.0000	0.0000	94.1888	267.0226	442.4230	(98)
Space heating												1970.9176	(98)
RHI space heating demand												1971	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =	0.3337 (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	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25265.6474 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 303.2363 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.8827 (36)
Total fabric heat loss (33) + (36) = 46.3418 (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	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	87.3392	87.0951	86.8560	85.7325	85.5223	84.5438	84.5438	84.3626	84.9207	85.5223	85.9475	86.3921 (39)
Average = Sum(39)m / 12 =												85.7315 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0482	1.0453	1.0424	1.0290	1.0264	1.0147	1.0147	1.0125	1.0192	1.0264	1.0315	1.0369 (40)
HLP (average)												1.0289 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5228 (42)
Average daily hot water use (litres/day) 94.1175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1480.8353 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (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)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198 (61)
Total heat required for water heating calculated for each month											
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (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 (63)
Solar input (sum of months) = Sum (63)m =	0.0000 (63)										
Output from w/h	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400 (64)
Heat gains from water heating, kWh/month	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809 (65)
Total per year (kWh/year) = Sum (64)m =	1779.9784 (64)										

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1557	48.9888	39.8404	30.1617	22.5462	19.0345	20.5674	26.7343	35.8828	45.5614	53.1769	56.6886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	576.1119	571.2722	548.7715	514.1484	478.8129	447.3810	429.2414	438.0227	458.1763	493.0144	531.5425	560.5785	(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	3.1700				10.6334		0.6300		0.7000		0.7700		10.3016 (74)	
South	3.3100				46.7521		0.6300		0.7000		0.7700		47.2934 (78)	
North	4.2000				10.6334		0.6300		0.7000		0.7700		13.6488 (74)	
Solar gains	71.2437	123.2247	176.4381	236.4372	284.4885	291.9843	277.4617	239.5537	196.5759	138.0254	85.6046	60.8320 (83)		
Total gains	647.3556	694.4969	725.2096	750.5856	763.3014	739.3654	706.7031	677.5764	654.7523	631.0398	617.1471	621.4105 (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	80.3561	80.5813	80.8032	81.8620	82.0632	83.0130	83.0130	83.1913	82.6446	82.0632	81.6572	81.2370
alpha	6.3571	6.3721	6.3869	6.4575	6.4709	6.5342	6.5342	6.5461	6.5096	6.4709	6.4438	6.4158
util living area	0.9968	0.9942	0.9873	0.9624	0.8833	0.7036	0.5226	0.5663	0.8142	0.9658	0.9931	0.9975 (86)
MIT	20.2027	20.3019	20.4668	20.6903	20.8808	20.9795	20.9974	20.9957	20.9480	20.7246	20.4282	20.1834 (87)
Th 2	20.0433	20.0457	20.0481	20.0593	20.0614	20.0711	20.0711	20.0729	20.0674	20.0614	20.0571	20.0527 (88)
util rest of house	0.9956	0.9920	0.9821	0.9462	0.8363	0.6143	0.4145	0.4558	0.7353	0.9478	0.9899	0.9966 (89)
MIT 2	19.3272	19.4277	19.5923	19.8169	19.9859	20.0629	20.0706	20.0719	20.0424	19.8537	19.5630	19.3159 (90)
Living area fraction	19.5469	19.6471	19.8118	20.0361	20.2105	20.2929	20.3032	20.3038	20.2697	20.0723	19.7801	19.5336 (92)
MIT	19.5469	19.6471	19.8118	20.0361	20.2105	20.2929	20.3032	20.3038	20.2697	20.0723	19.7801	19.5336 (91)
Temperature adjustment	19.3969	19.4971	19.6618	19.8861	20.0605	20.1429	20.1532	20.1538	20.1197	19.9223	19.6301	-0.1500
adjusted MIT	19.3969	19.4971	19.6618	19.8861	20.0605	20.1429	20.1532	20.1538	20.1197	19.9223	19.6301	19.3836 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9903	0.9793	0.9425	0.8362	0.6216	0.4242	0.4656	0.7403	0.9444	0.9880	0.9956	(94)
Useful gains	643.7567	687.7317	710.1972	707.4584	638.2935	459.6099	299.7512	315.5121	484.6859	595.9443	609.7412	618.6906	(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	1318.5524	1271.3350	1143.1781	941.8644	715.0061	468.6198	300.3972	316.6762	511.1959	797.2643	1076.9345	1311.7420	(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	502.0480	392.1814	322.1378	168.7723	57.0742	0.0000	0.0000	0.0000	0.0000	149.7821	336.3792	515.6303	(98)
Space heating												2444.0052	(98)
Space heating per m2												29.3328	(99)
										(98) / (4) =			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.1000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2625.1399	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	502.0480	392.1814	322.1378	168.7723	57.0742	0.0000	0.0000	0.0000	0.0000	149.7821	336.3792	515.6303	(98)	
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)	
Space heating fuel (main heating system)	539.2567	421.2475	346.0127	181.2806	61.3041	0.0000	0.0000	0.0000	0.0000	160.8831	361.3096	553.8456	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)	
Efficiency of water heater (217)m	89.7532	89.6698	89.4883	89.0460	88.1790	87.2000	87.2000	87.2000	87.2000	88.9094	89.5341	89.7901	(216)	
Fuel for water heating, kWh/month	199.4246	175.3849	183.2555	163.2702	160.2381	142.8518	135.3603	151.0669	151.5993	169.6588	180.4229	193.9392	(219)	
Water heating fuel used												2006.4726	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2625.1399	(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)													389.6266	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890		-569.9890	(233)	
Total delivered energy for all uses												4526.2501	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2625.1399	3.4800	91.3549 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2006.4726	3.4800	69.8252 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	389.6266	13.1900	51.3918 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			267.2828 (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] =	0.8748 (257)
SAP value		87.7961
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2625.1399	0.2160	567.0302 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.4726	0.2160	433.3981 (264)
Space and water heating			1000.4283 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.6266	0.5190	202.2162 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			945.7452 (272)
CO2 emissions per m2			11.3500 (273)
EI value			90.1239
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8860 = 3.928$, stars = 4
Water heating environmental impact	$0.216 / 0.8860 = 0.2438$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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)	=	0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3504	0.3337	0.3337	0.3087	0.3087	0.2753	0.2837	0.2670	0.2753	0.2920	0.2920	0.3170 (22b)
	0.5614	0.5557	0.5557	0.5476	0.5476	0.5379	0.5402	0.5356	0.5379	0.5426	0.5426	0.5503 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25265.6474 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 303.2363 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.8827 (36)
Total fabric heat loss (33) + (36) = 46.3418 (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	38.9751	38.5789	38.5789	38.0208	38.0208	37.3443	37.5062	37.1872	37.3443	37.6729	37.6729	38.2020 (38)
Heat transfer coeff	85.3169	84.9207	84.9207	84.3626	84.3626	83.6861	83.8480	83.5290	83.6861	84.0147	84.0147	84.5438 (39)
Average = Sum(39)m / 12 =												84.2672 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0240	1.0192	1.0192	1.0125	1.0125	1.0044	1.0063	1.0025	1.0044	1.0083	1.0083	1.0147 (40)
HLP (average)												1.0114 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5228 (42)
Average daily hot water use (litres/day) 94.1175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum (45)m = 1480.8353 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (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)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198 (61)
Total heat required for water heating calculated for each month											
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (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 (63)
Solar input (sum of months) = Sum (63)m =	0.0000 (63)										
Output from w/h	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400 (64)
Total per year (kWh/year) = Sum (64)m =	1779.9784 (64)										
Heat gains from water heating, kWh/month	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809 (65)
57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (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	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1557	48.9888	39.8404	30.1617	22.5462	19.0345	20.5674	26.7343	35.8828	45.5614	53.1769	56.6886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	576.1119	571.2722	548.7715	514.1484	478.8129	447.3810	429.2414	438.0227	458.1763	493.0144	531.5425	560.5785	(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					3.1700	11.9814	0.6300	0.7000			0.7700			11.6075 (74)
South					3.3100	50.9848	0.6300	0.7000			0.7700			51.5752 (78)
North					4.2000	11.9814	0.6300	0.7000			0.7700			15.3791 (74)
Solar gains	78.5618	122.6238	174.6266	243.2996	286.7610	315.4876	296.3641	260.6673	211.6479	146.9737	96.7715	66.3989 (83)		
Total gains	654.6737	693.8961	723.3981	757.4479	765.5739	762.8686	725.6055	698.6900	669.8242	639.9881	628.3140	626.9774 (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	82.2608	82.6446	82.6446	83.1913	83.1913	83.8638	83.7019	84.0215	83.8638	83.5358	83.5358	83.0130
alpha	6.4841	6.5096	6.5096	6.5461	6.5461	6.5909	6.5801	6.6014	6.5909	6.5691	6.5691	6.5342
util living area	0.9954	0.9924	0.9817	0.9403	0.8070	0.5437	0.3580	0.3821	0.6985	0.9402	0.9886	0.9963 (86)
MIT	20.3063	20.3902	20.5620	20.7789	20.9437	20.9964	20.9998	20.9997	20.9827	20.8145	20.5353	20.2908 (87)
Th 2	20.0634	20.0674	20.0674	20.0729	20.0729	20.0797	20.0781	20.0812	20.0797	20.0764	20.0764	20.0711 (88)
util rest of house	0.9935	0.9893	0.9739	0.9151	0.7397	0.4463	0.2517	0.2727	0.6003	0.9094	0.9832	0.9949 (89)
MIT 2	19.4472	19.5335	19.7018	19.9102	20.0430	20.0787	20.0780	20.0812	20.0735	19.9480	19.6849	19.4384 (90)
Living area fraction									fLA = Living area / (4) =			0.2510 (91)
MIT	19.6628	19.7485	19.9177	20.1282	20.2690	20.3090	20.3094	20.3117	20.3017	20.1655	19.8983	19.6523 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5128	19.5985	19.7677	19.9782	20.1190	20.1590	20.1594	20.1617	20.1517	20.0155	19.7483	19.5023 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	649.4889	685.0566	702.2321	690.7729	569.1175	346.9772	189.4230	197.2390	407.5369	580.4250	616.1656	622.9740	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1229.6550	1188.7595	1050.2708	850.2217	600.5791	348.0536	189.4434	197.2725	414.3862	707.0229	987.0304	1217.6285	(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	431.6436	338.4883	258.9407	114.8031	23.4074	0.0000	0.0000	0.0000	0.0000	94.1888	267.0226	442.4230	(98)
Space heating												1970.9176	(98)
Space heating per m2												23.6548	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.1000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2116.9899 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	431.6436	338.4883	258.9407	114.8031	23.4074	0.0000	0.0000	0.0000	0.0000	94.1888	267.0226	442.4230	(98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)
Space heating fuel (main heating system)	463.6344	363.5750	278.1318	123.3116	25.1422	0.0000	0.0000	0.0000	0.0000	101.1695	286.8127	475.2126	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)
Efficiency of water heater (217)m	89.6453	89.5597	89.3100	88.7104	87.6809	87.2000	87.2000	87.2000	87.2000	88.5129	89.3482	87.2000	(216)
Fuel for water heating, kWh/month	199.6646	175.6006	183.6214	163.8877	161.1485	142.8518	135.3603	151.0669	151.5993	170.4187	180.7983	194.1702	(219)
Annual totals kWh/year												2010.1884	(219)
Space heating fuel - main system												2116.9899	(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)													389.6266 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1140 * 1.00) =										-601.9727		-601.9727	(233)
Total delivered energy for all uses												3989.8323	(238)

10a. Fuel costs - using BEDF prices (465)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2116.9899	3.9500	83.6211 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2010.1884	3.9500	79.4024 (247)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	389.6266	18.7000	72.8602 (250)
Additional standing charges			91.0000 (251)
Energy saving/generation technologies			
PV Unit	-601.9727	18.7000	-112.5689 (252)
Total energy cost			228.3398 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2116.9899	0.2160	457.2698 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2010.1884	0.2160	434.2007 (264)
Space and water heating			891.4705 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.6266	0.5190	202.2162 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	0.5190	-312.4238 (269)
Total kg/year			820.1879 (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	2116.9899	1.2200	2582.7277 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2010.1884	1.2200	2452.4299 (264)
Space and water heating			5035.1575 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	389.6266	3.0700	1196.1538 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	3.0700	-1848.0561 (269)
Primary energy kWh/year			4613.5052 (272)
Primary energy kWh/m2/year			55.3709 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 30	-187 kg (22.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	2.25 kg/m²	B 89 A 92
Total Savings	£30	2.25 kg/m²	
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			A 92

Fuel prices for cost data on this page from database revision number 465 TEST (04 Sep 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£87	£96	-£9
Mains gas	£254	£215	£39
Space heating	£189	£189	£0
Water heating	£79	£50	£30
Lighting	£73	£73	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£228	£198	£30
Total cost of uses	£228	£199	£30
Delivered energy	48 kWh/m²	37 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	43 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =	0.3337 (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	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 25265.6474 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							303.2363 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.8827 (36)
Total fabric heat loss							(33) + (36) = 46.3418 (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	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	87.3392	87.0951	86.8560	85.7325	85.5223	84.5438	84.5438	84.3626	84.9207	85.5223	85.9475	86.3921 (39)
Average = Sum(39)m / 12 =												85.7315 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0482	1.0453	1.0424	1.0290	1.0264	1.0147	1.0147	1.0125	1.0192	1.0264	1.0315	1.0369 (40)
HLP (average)												1.0289 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5228 (42)
Average daily hot water use (litres/day)												94.1175 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1480.8353 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (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)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518 (61)
Total heat required for water heating calculated for each month	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (62)
Aperture area of solar collector	3.0000 (H1)											
Zero-loss collector efficiency	0.7000 (H2)											
Collector heat loss coefficient	1.8000 (H3)											
Collector 2nd order heat loss coefficient	0.0050 (H3a)											
Collector effective heat loss coefficient	1.8063 (H3b)											
Collector performance ratio	2.5804 (H4)											
Annual solar radiation per m2	1079.5246 (H5)											
Overshading factor	0.8000 (H6)											
Solar energy available	1813.6014 (H7)											
Adjustment factor for showers	1.0000 (H7a)											
Solar-to-load ratio	1.2247 (H8)											
Utilisation factor	0.5580 (H9)											
Collector performance factor	0.8793 (H10)											
Dedicated solar storage volume	75.0000 (H11)											
Effective solar volume	75.0000 (H13)											
Daily hot water demand	94.1175 (H14)											
Volume ratio Veff/V	0.7969 (H15)											
Solar storage volume factor	0.9546 (H16)											
Solar input	-849.4750 (H17)											
Solar input	-24.6331	-41.1055	-70.0074	-93.8238	-115.9113	-113.9593	-112.4533	-98.2510	-76.9502	-52.5480	-29.2184	-20.6137 (63)
	Solar input (sum of months) = Sum(63)m = -849.4750 (63)											
Output from w/h	154.3569	116.1618	93.9849	51.5618	25.3850	10.6075	5.5809	33.4794	55.2443	98.2947	132.3217	153.5246 (64)
	Total per year (kWh/year) = Sum(64)m = 930.5034 (64)											
Heat gains from water heating, kWh/month	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (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	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1557	48.9888	39.8404	30.1617	22.5462	19.0345	20.5674	26.7343	35.8828	45.5614	53.1769	56.6886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	576.1119	571.2722	548.7715	514.1484	478.8129	447.3810	429.2414	438.0227	458.1763	493.0144	531.5425	560.5785	(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				3.1700	10.6334	0.6300	0.7000	0.7700	10.3016 (74)			
South				3.3100	46.7521	0.6300	0.7000	0.7700	47.2934 (78)			
North				4.2000	10.6334	0.6300	0.7000	0.7700	13.6488 (74)			

Solar gains	71.2437	123.2247	176.4381	236.4372	284.4885	291.9843	277.4617	196.5759	138.0254	85.6046	60.8320 (83)	
Total gains	647.3556	694.4969	725.2096	750.5856	763.3014	739.3654	706.7031	677.5764	654.7523	631.0398	617.1471	621.4105 (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	80.3561	80.5813	80.8032	81.8620	82.0632	83.0130	83.0130	83.1913	82.6446	82.0632	81.6572	81.2370
alpha	6.3571	6.3721	6.3869	6.4575	6.4709	6.5342	6.5342	6.5461	6.5096	6.4709	6.4438	6.4158
util living area	0.9968	0.9942	0.9873	0.9624	0.8833	0.7036	0.5226	0.5663	0.8142	0.9658	0.9931	0.9975 (86)
MIT	20.2027	20.3019	20.4668	20.6903	20.8808	20.9795	20.9974	20.9957	20.9480	20.7246	20.4282	20.1834 (87)
Th 2	20.0433	20.0457	20.0481	20.0593	20.0614	20.0711	20.0711	20.0729	20.0674	20.0614	20.0571	20.0527 (88)
util rest of house	0.9956	0.9920	0.9821	0.9462	0.8363	0.6143	0.4145	0.4558	0.7353	0.9478	0.9899	0.9966 (89)
MIT 2	19.3272	19.4277	19.5923	19.8169	19.9859	20.0629	20.0706	20.0719	20.0424	19.8537	19.5630	19.3159 (90)
Living area fraction	fLA = Living area / (4) =											0.2510 (91)
MIT	19.5469	19.6471	19.8118	20.0361	20.2105	20.2929	20.3032	20.3038	20.2697	20.0723	19.7801	19.5336 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3969	19.4971	19.6618	19.8861	20.0605	20.1429	20.1532	20.1538	20.1197	19.9223	19.6301	19.3836 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9903	0.9793	0.9425	0.8362	0.6216	0.4242	0.4656	0.7403	0.9444	0.9880	0.9956	(94)
Useful gains	643.7567	687.7317	710.1972	707.4584	638.2935	459.6099	299.7512	315.5121	484.6859	595.9443	609.7412	618.6906	(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	1318.5524	1271.3350	1143.1781	941.8644	715.0061	468.6198	300.3972	316.6762	511.1959	797.2643	1076.9345	1311.7420	(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	502.0480	392.1814	322.1378	168.7723	57.0742	0.0000	0.0000	0.0000	0.0000	149.7821	336.3792	515.6303	(98)
Space heating												2444.0052	(98)
Space heating per m2												(98) / (4) =	29.3328 (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 %)													93.1000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2625.1399 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	502.0480	392.1814	322.1378	168.7723	57.0742	0.0000	0.0000	0.0000	0.0000	149.7821	336.3792	515.6303	(98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)
Space heating fuel (main heating system)	539.2567	421.2475	346.0127	181.2806	61.3041	0.0000	0.0000	0.0000	0.0000	160.8831	361.3096	553.8456	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	154.3569	116.1618	93.9849	51.5618	25.3850	10.6075	5.5809	33.4794	55.2443	98.2947	132.3217	153.5246	(64)
Efficiency of water heater	89.8519	89.8757	89.8852	89.8560	89.5930	87.2000	87.2000	87.2000	87.2000	89.2801	89.6838	89.8724	(217)
Fuel for water heating, kWh/month	171.7903	129.2472	104.5611	57.3827	28.3337	12.1646	6.4001	38.3938	63.3536	110.0969	147.5425	170.8251	(219)
Water heating fuel used												1040.0916	(219)
Annual totals kWh/year													
Space heating fuel - main system												2625.1399	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													389.6266 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890		-569.9890	(233)
Total delivered energy for all uses												3609.8691	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2625.1399	3.4800	91.3549 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1040.0916	3.4800	36.1952 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	389.6266	13.1900	51.3918 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			240.2478 (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] =	0.7863 (257)
SAP value		89.0305
SAP rating (Section 12)		89 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2625.1399	0.2160	567.0302 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1040.0916	0.2160	224.6598 (264)
Space and water heating			791.6900 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	389.6266	0.5190	202.2162 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			762.9569 (272)
CO2 emissions per m2			9.1600 (273)
EI value			92.0327
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6600 (1b)	x 2.4000 (2b)	= 99.9840 (1b) - (3b)
First floor	41.6600 (1c)	x 2.6500 (2c)	= 110.3990 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (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) =		0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3504	0.3337	0.3337	0.3087	0.3087	0.2753	0.2837	0.2670	0.2753	0.2920	0.2920	0.3170 (22b)
Effective ac	0.5614	0.5557	0.5557	0.5476	0.5476	0.5379	0.5402	0.5356	0.5379	0.5426	0.5426	0.5503 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			6.4800	1.3258	8.5909		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1200	4.9992	65.5200	2729.5632 (28a)
External Wall 1	44.9400	12.6400	32.3000	0.2200	7.1060	67.8400	2191.2320 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			128.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4591		(33)
Party Wall 1			94.5700	0.0000	0.0000	140.0000	13239.8000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 25265.6474 (34)
303.2363 (35)
11.8827 (36)
(33) + (36) = 46.3418 (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	38.9751	38.5789	38.5789	38.0208	38.0208	37.3443	37.5062	37.1872	37.3443	37.6729	37.6729	38.2020 (38)
Heat transfer coeff	85.3169	84.9207	84.9207	84.3626	84.3626	83.6861	83.8480	83.5290	83.6861	84.0147	84.0147	84.5438 (39)
Average = Sum(39)m / 12 =												84.2672 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0240	1.0192	1.0192	1.0125	1.0125	1.0044	1.0063	1.0025	1.0044	1.0083	1.0083	1.0147 (40)
HLP (average)												1.0114 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5228 (42)
94.1175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m =											1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (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)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518 (61)
Total heat required for water heating calculated for each month												
	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2934 (H8)
Utilisation factor												0.5384 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.1175 (H14)
Volume ratio Veff/V												0.7969 (H15)
Solar storage volume factor												0.9546 (H16)
Solar input												-865.6375 (H17)
Solar input	-26.6439	-40.0457	-67.4421	-93.2256	-112.2749	-118.1645	-115.3271	-102.9878	-80.3823	-54.6826	-32.3863	-22.0746 (63)
												-865.6375 (63)
Solar input (sum of months) = Sum(63)m =												
Output from w/h	152.3461	117.2216	96.5503	52.1600	29.0215	6.4023	2.7071	28.7426	51.8122	96.1600	129.1537	152.0636 (64)
Total per year (kWh/year) = Sum(64)m =												914.3409 (64)
Heat gains from water heating, kWh/month												
	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (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	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1557	48.9888	39.8404	30.1617	22.5462	19.0345	20.5674	26.7343	35.8828	45.5614	53.1769	56.6886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(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)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	576.1119	571.2722	548.7715	514.1484	478.8129	447.3810	429.2414	438.0227	458.1763	493.0144	531.5425	560.5785	(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				3.1700	11.9814	0.6300	0.7000	0.7700	11.6075 (74)			
South				3.3100	50.9848	0.6300	0.7000	0.7700	51.5752 (78)			
North				4.2000	11.9814	0.6300	0.7000	0.7700	15.3791 (74)			

Solar gains	78.5618	122.6238	174.6266	243.2996	286.7610	315.4876	296.3641	260.6673	211.6479	146.9737	96.7715	66.3989 (83)
Total gains	654.6737	693.8961	723.3981	757.4479	765.5739	762.8686	725.6055	698.6900	669.8242	639.9881	628.3140	626.9774 (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	82.2608	82.6446	82.6446	83.1913	83.1913	83.8638	83.7019	84.0215	83.8638	83.5358	83.5358	83.0130
alpha	6.4841	6.5096	6.5096	6.5461	6.5461	6.5909	6.5801	6.6014	6.5909	6.5691	6.5691	6.5342
util living area	0.9954	0.9924	0.9817	0.9403	0.8070	0.5437	0.3580	0.3821	0.6985	0.9402	0.9886	0.9963 (86)
MIT	20.3063	20.3902	20.5620	20.7789	20.9437	20.9964	20.9998	20.9997	20.9827	20.8145	20.5353	20.2908 (87)
Th 2	20.0634	20.0674	20.0674	20.0729	20.0729	20.0797	20.0781	20.0812	20.0797	20.0764	20.0764	20.0711 (88)
util rest of house	0.9935	0.9893	0.9739	0.9151	0.7397	0.4463	0.2517	0.2727	0.6003	0.9094	0.9832	0.9949 (89)
MIT 2	19.4472	19.5335	19.7018	19.9102	20.0430	20.0787	20.0780	20.0812	20.0735	19.9480	19.6849	19.4384 (90)
Living area fraction	19.6628	19.7485	19.9177	20.1282	20.2690	20.3090	20.3094	20.3117	20.3017	20.1655	19.8983	19.6523 (92)
Temperature adjustment	19.5128	19.5985	19.7677	19.9782	20.1190	20.1590	20.1594	20.1617	20.1517	20.0155	19.7483	-0.1500
adjusted MIT	19.5128	19.5985	19.7677	19.9782	20.1190	20.1590	20.1594	20.1617	20.1517	20.0155	19.7483	19.5023 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9921	0.9873	0.9707	0.9120	0.7434	0.4548	0.2611	0.2823	0.6084	0.9069	0.9807	0.9936	(94)
Useful gains	649.4889	685.0566	702.2321	690.7729	569.1175	346.9772	189.4230	197.2390	407.5369	580.4250	616.1656	622.9740	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1229.6550	1188.7595	1050.2708	850.2217	600.5791	348.0536	189.4434	197.2725	414.3862	707.0229	987.0304	1217.6285	(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	431.6436	338.4883	258.9407	114.8031	23.4074	0.0000	0.0000	0.0000	0.0000	94.1888	267.0226	442.4230	(98)
Space heating												1970.9176	(98)
Space heating per m2												(98) / (4) =	23.6548 (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 %)													93.1000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2116.9899 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	431.6436	338.4883	258.9407	114.8031	23.4074	0.0000	0.0000	0.0000	0.0000	94.1888	267.0226	442.4230	(98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)
Space heating fuel (main heating system)	463.6344	363.5750	278.1318	123.3116	25.1422	0.0000	0.0000	0.0000	0.0000	101.1695	286.8127	475.2126	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	152.3461	117.2216	96.5503	52.1600	29.0215	6.4023	2.7071	28.7426	51.8122	96.1600	129.1537	152.0636	(64)
Efficiency of water heater	89.7601	89.7731	89.7219	89.5768	88.7286	87.2000	87.2000	87.2000	87.2000	88.8975	89.5285	89.7783	(216)
(217)m	169.7257	130.5754	107.6106	58.2293	32.7081	7.3421	3.1044	32.9616	59.4177	108.1696	144.2598	169.3769	(219)
Fuel for water heating, kWh/month												1023.4813	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													2116.9899 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													389.6266 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1140 * 1.00) =													-601.9727 (233)
Total delivered energy for all uses													3053.1252 (238)

10a. Fuel costs - using BEDF prices (465)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2116.9899	3.9500	83.6211 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1023.4813	3.9500	40.4275 (247)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Pump for solar water heating	50.0000	18.7000	9.3500 (249)
Energy for lighting	389.6266	18.7000	72.8602 (250)
Additional standing charges			91.0000 (251)
Energy saving/generation technologies			
PV Unit	-601.9727	18.7000	-112.5689 (252)
Total energy cost			198.7149 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2116.9899	0.2160	457.2698 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1023.4813	0.2160	221.0720 (264)
Space and water heating			678.3418 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	389.6266	0.5190	202.2162 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	0.5190	-312.4238 (269)

FULL SAP CALCULATION PRINTOUT

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Total kg/year 633.0092 (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	2116.9899	1.2200	2582.7277 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1023.4813	1.2200	1248.6472 (264)
Space and water heating			3831.3749 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	389.6266	3.0700	1196.1538 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	3.0700	-1848.0561 (269)
Primary energy kWh/year			3563.2226 (272)
Primary energy kWh/m2/year			42.7655 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	303.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	277.71 (P1)
Transmission heat loss coefficient	46.34 (37)
Summer heat loss coefficient	324.05 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.1700	81.1852	0.6300	0.7000	0.9000	91.9305
South	3.3100	112.2060	0.6300	0.7000	0.9000	132.6685
North	4.2000	81.1852	0.6300	0.7000	0.9000	121.8007
total:						346.3996

	Jun	Jul	Aug	
Solar gains	369	346	305	(P3)
Internal gains	444	426	435	
Total summer gains	813	773	740	(P5)
Summer gain/loss ratio	2.51	2.38	2.28	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 303.2)	0.00	0.00	0.00	
Threshold temperature	18.51	20.28	20.08	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			