

ASSESSMENT NOTES

Calculation Type: New Build (As Designed)

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

SAP Rating	87 B	DER	15.42	TER	19.59
Environmental	89 B	% DER<TER	21.27		
CO ₂ Emissions (t/year)	0.89	DFEE	51.80	TFEE	57.17
General Requirements Compliance	Pass	% DFEE<TFEE	9.39		

Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com	Assessor ID	7358-0001
------------------	--	-------------	-----------

Client	Greg Farrell, 052
--------	-------------------

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

Calculation Type: New Build (As Designed)

Property Reference	7358-0001-GF-82CR-C	Issued on Date	25/09/2020
Assessment Reference	Proposed	Prop Type Ref	
Property	House C, 82 Chichester Road, , Tilehurst, ,		
SAP Rating	87 B	DER	15.42
Environmental	89 B	TER	19.59
CO₂ Emissions (t/year)	0.89	% DER<TER	21.27
General Requirements Compliance	Pass	DFEE	51.80
		TFEE	57.17
		% DFEE<TFEE	9.39
Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com		Assessor ID 7358-0001
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)	19.59	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.42	kgCO ₂ /m ²	Pass
	-4.17 (-21.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.17	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.80	kWh/m ² /yr	
	-5.4 (-9.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.18 (max. 0.35)	Pass
Openings	1.39 (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

Calculation Type: New Build (As Designed)

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)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

7.37 m², No overhang

Windows facing East

3.21 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

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.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	7358-0001-GF-82CR-C				Issued on Date	25/09/2020
Assessment Reference	Proposed		Prop Type Ref			
Property	House C, 82 Chichester Road, , Tilehurst, ,					
SAP Rating	87 B	DER	15.42	TER	19.59	
Environmental	89 B	% DER<TER	21.27			
CO ₂ Emissions (t/year)	0.89	DFEE	51.80	TFEE	57.17	
General Requirements Compliance	Pass	% DFEE<TFEE	9.39			
Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com				Assessor ID	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, End-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:	19.00 m	38.31 m ²	2.40 m
	1st Storey:	19.00 m	38.31 m ²	2.65 m

7.0 Living Area	27.93	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	262.92	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
External Wall 1	Cavity Wall	Other	0.22	67.84	94.95	79.10

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill	0.00	140.00	47.28

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
Internal Wall 1	Other		75.00	43.91
Internal Wall 2	Plasterboard on timber frame		9.00	57.65

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
External Roof 1	External Plane Roof	Other	0.14	12.17	33.99	33.99
External Roof 2	External Slope Roof	Plasterboard, insulated slope	0.18	9.00	5.83	4.97

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	38.31

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	0.13	65.52	38.31

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	38.31

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

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	
Opening 5	Window	[1] External Wall 1	East	None	0.00					3.21	
Opening 6	Roof Window	[2] External Roof 2	South	None						0.86	

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	12.16	0.050	No	IG Hi therm or independent lin
Independently assessed	E3 Sill	11.23	0.034	No	CD0027
Independently assessed	E4 Jamb	27.30	0.040	No	CD0028
Independently assessed	E5 Ground floor (normal)	19.00	0.060	No	CD0022
Independently assessed	E6 Intermediate floor within a dwelling	19.00	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	3.63	0.105	No	CD0033
Independently assessed	E11 Eaves (insulation at rafter level)	3.63	0.005	No	CBA-309
Independently assessed	E12 Gable (insulation at ceiling level)	9.36	0.069	No	CD0031
Independently assessed	E13 Gable (insulation at rafter level)	3.20	0.075	No	CBA-311
Independently assessed	E16 Corner (normal)	15.15	0.058	No	CD0035
Independently assessed	E18 Party wall between dwellings	10.10	0.067	Yes	CD0037
Table K1 - Default	P1 Party wall - Ground floor	9.36	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.36	0.000	No	
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	9.36	0.240	No	
Table K1 - Default	R1 Head of roof window	1.10	0.080	No	
Table K1 - Default	R2 Sill of roof window	1.10	0.060	No	
Table K1 - Default	R3 Jamb of roof window	3.12	0.080	No	
Table K1 - Default	R6 Flat ceiling	3.63	0.060	No	

Y-value	0.060	W/m ² K
---------	------------------------------------	--------------------

18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

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

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
--------------------------------	---------------------------------------

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

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

32.0 Photovoltaic Unit

One Dwelling

PV Cells kWp

0.66

Orientation

South

Elevation

30°

Overshading

None Or Little

Connected to Dwelling

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	£29	B 88	

THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	7358-0001-GF-82CR-C				Issued on Date	25/09/2020
Assessment Reference	Proposed		Prop Type Ref			
Property	House C, 82 Chichester Road, , Tilehurst, ,					
SAP Rating	87 B	DER	15.42	TER	19.59	
Environmental	89 B	% DER<TER	21.27			
CO ₂ Emissions (t/year)	0.89	DFEE	51.80	TFEE	57.17	
General Requirements Compliance	Pass	% DFEE<TFEE	9.39			
Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com				Assessor ID	7358-0001
Client	Greg Farrell, 052					

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	12.16	0.61	IG Hi therm or independent lin
External wall	E3 Sill	Independently assessed	0.034	11.23	0.38	CD0027
External wall	E4 Jamb	Independently assessed	0.040	27.30	1.09	CD0028
External wall	E5 Ground floor (normal)	Independently assessed	0.060	19.00	1.14	CD0022
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	19.00	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.105	3.63	0.38	CD0033
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.005	3.63	0.02	CBA-309
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.069	9.36	0.65	CD0031
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.075	3.20	0.24	CBA-311
External wall	E16 Corner (normal)	Independently assessed	0.058	15.15	0.88	CD0035
External wall	E18 Party wall between dwellings	Independently assessed	0.067	10.10	0.68	CD0037
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	9.36	1.50	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	9.36	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.240	9.36	2.25	
External roof	R1 Head of roof window	Table K1 - Default	0.080	1.10	0.09	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	1.10	0.07	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	3.12	0.25	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	3.63	0.22	

Total: **10.43** W/mK:
Y-Value: **0.060** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	7358-0001-GF-82CR-C				Issued on Date	25/09/2020
Assessment Reference	Proposed	Prop Type Ref				
Property	House C, 82 Chichester Road, , Tilehurst, ,					
SAP Rating	87 B	DER	15.42	TER	19.59	
Environmental	89 B	% DER<TER	21.27			
CO ₂ Emissions (t/year)	0.89	DFEE	51.80	TFEE	57.17	
General Requirements Compliance	Pass	% DFEE<TFEE	9.39			
Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com				Assessor ID	7358-0001
Client	Greg Farrell, 052					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 77 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.59 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.42 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 51.8 kWh/m²/yr OK

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	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.39 (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): Slight OK
Based on:
Overshading: Average
Windows facing North: 7.37 m², No overhang
Windows facing East: 3.21 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
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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.4390	0.4304	0.4218	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4046 (22b)
Effective ac	0.5964	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818 (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)			9.6900	1.3258	12.8466		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712 (28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440 (29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583 (30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300 (31)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.9457		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			43.9100			75.0000	3293.2500 (32c)
Internal Wall 2			57.6500			9.0000	518.8500 (32c)
Internal Floor 1			38.3100			18.0000	689.5800 (32d)
Internal Ceiling 1			38.3100			18.0000	689.5800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 20145.0635 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							262.9217 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4278 (36)
Total fabric heat loss							(33) + (36) = 60.3735 (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	38.0736	37.8347	37.6005	36.5007	36.2950	35.3371	35.3371	35.1597	35.7060	36.2950	36.7112	37.1464 (38)
Average = Sum(39)m / 12 =	98.4470	98.2081	97.9740	96.8742	96.6684	95.7105	95.7105	95.5332	96.0795	96.6684	97.0847	97.5199 (39)
												96.8732 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2849	1.2818	1.2787	1.2643	1.2617	1.2492	1.2492	1.2468	1.2540	1.2617	1.2671	1.2728 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1433.2873 (45)
	22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869 (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	25.4516	22.9755	25.4157	24.5715	25.3728	24.5340	25.3391	25.3610	24.5544	25.3979	24.6069	25.4446 (61)
Total heat required for water heating calculated for each month												
	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (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												
	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (64)
								Total per year (kWh/year) = Sum (64)m =				1732.3121 (64)
Heat gains from water heating, kWh/month												
	55.7728	48.9581	50.9471	45.0203	43.6470	38.3239	36.1639	40.5696	40.7767	46.7169	50.2159	54.2120 (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	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1104	16.9736	13.8039	10.4504	7.8118	6.5951	7.1262	9.2629	12.4327	15.7861	18.4247	19.6415 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.2317	214.4340	208.8843	197.0696	182.1556	168.1386	158.7744	156.5721	162.1218	173.9365	188.8505	202.8675 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780 (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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240 (71)
Water heating gains (Table 5)	74.9635	72.8543	68.4773	62.5282	58.6654	53.2276	48.6074	54.5290	56.6344	62.7915	69.7443	72.8656 (72)
Total internal gains	368.2396	366.1960	353.0995	331.9823	310.5669	289.8953	276.4420	282.2980	293.1229	314.4482	338.9536	357.3086 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains
	m2	Table 6a	W/m2	or Table 6b	Specific data	factor	W
					or Table 6c	Table 6d	
North	3.1700	10.6334	0.6300		0.7000	0.7700	10.3016 (74)
East	3.2100	19.6403	0.6300		0.7000	0.7700	19.2674 (76)
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)
South	0.8600	45.6416	0.6300		0.7000	1.0000	15.5790 (82)

Solar gains	106.0902	189.0181	280.2785	382.9071	460.9231	471.5517	448.8254	388.5731	315.5415	214.7838	128.5944	89.8004 (83)
Total gains	474.3298	555.2141	633.3781	714.8894	771.4899	761.4470	725.2674	670.8712	608.6644	529.2320	467.5479	447.1090 (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	56.8412	56.9795	57.1157	57.7641	57.8871	58.4664	58.4664	58.5750	58.2419	57.8871	57.6389	57.3816
alpha	4.7894	4.7986	4.8077	4.8509	4.8591	4.8978	4.8978	4.9050	4.8828	4.8591	4.8426	4.8254
util living area												
	0.9982	0.9957	0.9885	0.9625	0.8860	0.7295	0.5629	0.6241	0.8634	0.9785	0.9961	0.9986 (86)
MIT	19.6532	19.8163	20.0849	20.4411	20.7512	20.9339	20.9851	20.9760	20.8411	20.4369	19.9802	19.6260 (87)
Th 2	19.8527	19.8552	19.8576	19.8689	19.8710	19.8809	19.8809	19.8827	19.8771	19.8710	19.8667	19.8622 (88)
util rest of house												
	0.9975	0.9941	0.9840	0.9469	0.8389	0.6309	0.4289	0.4878	0.7896	0.9668	0.9944	0.9981 (89)
MIT 2	18.6355	18.7999	19.0681	19.4236	19.7062	19.8519	19.8774	19.8764	19.7910	19.4268	18.9729	18.6159 (90)
Living area fraction												
MIT	19.0065	19.1704	19.4388	19.7945	20.0871	20.2463	20.2812	20.2772	20.1738	19.7950	19.3401	18.9841 (91)
Temperature adjustment												
adjusted MIT	18.8565	19.0204	19.2888	19.6445	19.9371	20.0963	20.1312	20.1272	20.0238	19.6450	19.1901	18.8341 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9966	0.9925	0.9810	0.9431	0.8422	0.6515	0.4600	0.5193	0.8010	0.9637	0.9930	0.9975 (94)
Useful gains	472.7359	551.0753	621.3622	674.1818	649.7215	496.0900	333.6388	348.4166	487.5416	510.0029	464.2719	445.9728 (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												
	1433.0452	1386.7388	1252.9693	1040.8668	796.2707	526.0536	337.9749	356.0726	569.1510	874.3696	1173.7646	1427.1133 (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												
	714.4701	561.5659	469.9156	264.0132	109.0326	0.0000	0.0000	0.0000	0.0000	271.0888	510.8348	729.9686 (98)
Space heating												3630.8896 (98)
Space heating per m2												(98) / (4) = 47.3883 (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																	3899.9888 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Space heating requirement	714.4701	561.5659	469.9156	264.0132	109.0326	0.0000	0.0000	0.0000	0.0000	271.0888	510.8348	729.9686	(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)	767.4222	603.1857	504.7429	283.5803	117.1134	0.0000	0.0000	0.0000	0.0000	291.1802	548.6947	784.0693	(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	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570	(64)				
Efficiency of water heater (217)m	89.9924	89.9274	89.7866	89.4473	88.7136	87.2000	87.2000	87.2000	87.2000	89.4389	89.8516	90.0196	(216)				
Fuel for water heating, kWh/month	193.4083	170.0740	177.6774	158.1894	155.0661	139.1595	131.9388	147.1403	147.6253	164.1385	174.8780	188.1335	(219)				
Water heating fuel used												1947.4292	(219)				
Annual totals kWh/year																	
Space heating fuel - main system												3899.9888	(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)												337.4948	(232)				
Energy saving/generation technologies (Appendices M, N and Q)																	
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =											-569.9890						
Total delivered energy for all uses												-569.9890	(233)				
												5689.9238	(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	3899.9888	0.2160	842.3976	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1947.4292	0.2160	420.6447	(264)
Space and water heating			1263.0423	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	337.4948	0.5190	175.1598	(268)
Energy saving/generation technologies				
PV Unit	-569.9890	0.5190	-295.8243	(269)
Total CO2, kg/year			1181.3028	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4200	(273)

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

DER			15.4200	ZC1
Total Floor Area		TFA	76.6200	
Assumed number of occupants		N	2.3956	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.4140	ZC2
CO2 emissions from cooking, equation (L16)			2.3035	ZC3
Total CO2 emissions			34.1375	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			34.1375	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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (5)

2. Ventilation rate

										main	secondary	other		total	m3 per hour		
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =		0.1551 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4051 (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) =				0.3443 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4390	0.4304	0.4218	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4046	(22b)				
Effective ac	0.5964	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			1.9600	1.2000	2.3520			(26a)					
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148			(27)					
TER Room Window (Uw = 1.70)			0.8600	1.5918	1.3689			(27a)					
Heat Loss Floor 1			38.3100	0.1300	4.9803			(28a)					
External Wall 1	94.9500	15.8500	79.1000	0.1800	14.2380			(29a)					
External Roof 1	33.9900		33.9900	0.1300	4.4187			(30)					
External Roof 2	5.8300	0.8600	4.9700	0.1300	0.6461			(30)					
Total net area of external elements Aum(A, m2)			173.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4188			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								11.2180 (36)					
Total fabric heat loss						(33) + (36) =		57.6368 (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	38.0736	37.8347	37.6005	36.5007	36.2950	35.3371	35.3371	35.1597	35.7060	36.2950	36.7112	37.1464	(38)
Heat transfer coeff	95.7103	95.4715	95.2373	94.1375	93.9317	92.9739	92.9739	92.7965	93.3428	93.9317	94.3480	94.7832	(39)
Average = Sum(39)m / 12 =												94.1365	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2492	1.2460	1.2430	1.2286	1.2259	1.2134	1.2134	1.2111	1.2183	1.2259	1.2314	1.2371	(40)
HLP (average)												1.2286	(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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan 100.2051	Feb 96.5613	Mar 92.9174	Apr 89.2736	May 85.6298	Jun 81.9860	Jul 81.9860	Aug 85.6298	Sep 89.2736	Oct 92.9174	Nov 96.5613	Dec 100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1433.2873 (45)
22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869	(46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	44.4446	47.3497	44.0253	43.6360	40.4314	41.7792	43.6360	44.0253	47.3497	47.6192	50.9589 (61)
Solar input	199.5601	174.4122	181.4646	160.9500	155.8280	137.2446	131.4907	146.5814	148.2002	168.7555	180.1431	194.8713 (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	199.5601	174.4122	181.4646	160.9500	155.8280	137.2446	131.4907	146.5814	148.2002	168.7555	180.1431	194.8713 (64)
	62.1496	54.3254	56.4306	49.8838	48.2128	42.2982	40.2739	45.1383	45.6445	52.2048	55.9690	60.5906 (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	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1104	16.9736	13.8039	10.4504	7.8118	6.5951	7.1262	9.2629	12.4327	15.7861	18.4247	19.6415	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.2317	214.4340	208.8843	197.0696	182.1556	168.1386	158.7744	156.5721	162.1218	173.9365	188.8505	202.8675	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	(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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	(71)
Water heating gains (Table 5)	83.5345	80.8413	75.8476	69.2830	64.8022	58.7475	54.1316	60.6698	63.3951	70.1678	77.7347	81.4390	(72)
Total internal gains	376.8106	374.1830	360.4699	338.7371	316.7037	295.4153	281.9662	288.4388	299.8836	321.8245	346.9440	365.8820	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	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)
East				3.2100	19.6403	0.6300		0.7000		0.7700		19.2674 (76)
South				3.3100	46.7521	0.6300		0.7000		0.7700		47.2934 (78)
South				0.8600	45.6416	0.6300		0.7000		1.0000		15.5790 (82)
Solar gains	106.0902	189.0181	280.2785	382.9071	460.9231	471.5517	448.8254	388.5731	315.5415	214.7838	128.5944	89.8004 (83)
Total gains	482.9007	563.2012	640.7484	721.6442	777.6267	766.9669	730.7916	677.0120	615.4251	536.6083	475.5383	455.6823 (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	55.5931	55.7322	55.8692	56.5219	56.6457	57.2293	57.2293	57.3387	57.0031	56.6457	56.3958	56.1369	
alpha	4.7062	4.7155	4.7246	4.7681	4.7764	4.8153	4.8153	4.8226	4.8002	4.7764	4.7597	4.7425	
util living area	0.9975	0.9944	0.9856	0.9552	0.8712	0.7094	0.5442	0.6035	0.8459	0.9734	0.9949	0.9981	(86)
MIT	19.6555	19.8230	20.0967	20.4565	20.7630	20.9383	20.9862	20.9778	20.8505	20.4504	19.9874	19.6274	(87)
Th 2	19.8809	19.8833	19.8858	19.8972	19.8993	19.9093	19.9093	19.9111	19.9054	19.8993	19.8950	19.8905	(88)
util rest of house	0.9966	0.9925	0.9803	0.9381	0.8229	0.6138	0.4172	0.4738	0.7711	0.9600	0.9928	0.9975	(89)
MIT 2	18.0999	18.3456	18.7441	19.2630	19.6686	19.8687	19.9043	19.9022	19.7860	19.2647	18.5946	18.0655	(90)
Living area fraction	0.9966	0.9925	0.9803	0.9381	0.8229	0.6138	0.4172	0.4738	0.7711	0.9600	0.9928	0.9975	(89)
MIT	18.6670	18.8842	19.2372	19.6981	20.0675	20.2586	20.2987	20.2943	20.1740	19.6969	19.1023	18.6349	(92)
Temperature adjustment	18.6670	18.8842	19.2372	19.6981	20.0675	20.2586	20.2987	20.2943	20.1740	19.6969	19.1023	18.6349	(93)
adjusted MIT	18.6670	18.8842	19.2372	19.6981	20.0675	20.2586	20.2987	20.2943	20.1740	19.6969	19.1023	18.6349	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	480.6189	557.6002	625.5359	674.1983	646.4151	495.8194	338.9921	352.9968	487.4128	513.3938	471.0707	454.0262	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1375.0656	1335.0898	1213.0549	1016.5035	785.9756	526.1031	343.8812	361.3740	566.9671	854.4910	1132.3949	1368.1821	(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	665.4683	522.4730	437.1141	246.4597	103.8330	0.0000	0.0000	0.0000	0.0000	253.7763	476.1534	680.1320	(98)
Space heating												3385.4100	(98)
Space heating per m2												44.1844	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3624.6359 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	665.4683	522.4730	437.1141	246.4597	103.8330	0.0000	0.0000	0.0000	0.0000	253.7763	476.1534	680.1320	(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)	712.4929	559.3930	468.0023	263.8755	111.1702	0.0000	0.0000	0.0000	0.0000	271.7091	509.8002	728.1927	(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	199.5601	174.4122	181.4646	160.9500	155.8280	137.2446	131.4907	146.5814	148.2002	168.7555	180.1431	194.8713	(64)
Efficiency of water heater (217)m	87.8509	87.6411	87.1831	86.1207	84.0553	80.3000	80.3000	80.3000	80.3000	86.0760	87.3832	87.9367	(216)
Fuel for water heating, kWh/month	227.1579	199.0072	208.1419	186.8888	185.3874	170.9148	163.7494	182.5422	184.5582	196.0540	206.1531	221.6040	(219)
Water heating fuel used												2332.1589	(219)
Annual totals kWh/year													
Space heating fuel - main system												3624.6359	(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)												337.4948	(232)
Total delivered energy for all uses												6369.2897	(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	3624.6359	0.2160	782.9214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2332.1589	0.2160	503.7463 (264)
Space and water heating			1286.6677 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4948	0.5190	175.1598 (268)
Total CO2, kg/m2/year			1500.7525 (272)
Emissions per m2 for space and water heating			16.7928 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2861 (272b)
Emissions per m2 for pumps and fans			0.5080 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7928 * 1.00) + 2.2861 + 0.5080, rounded to 2 d.p.			19.5900 (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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.4390	0.4304	0.4218	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4046 (22b)
Effective ac	0.5964	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818 (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)			9.6900	1.3258	12.8466		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712 (28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440 (29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583 (30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300 (31)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9457		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			43.9100			75.0000	3293.2500 (32c)
Internal Wall 2			57.6500			9.0000	518.8500 (32c)
Internal Floor 1			38.3100			18.0000	689.5800 (32d)
Internal Ceiling 1			38.3100			9.0000	344.7900 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		19800.2735 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							258.4217 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4278 (36)
Total fabric heat loss					(33) + (36) =		60.3735 (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	38.0736	37.8347	37.6005	36.5007	36.2950	35.3371	35.3371	35.1597	35.7060	36.2950	36.7112	37.1464 (38)
Average = Sum(39)m / 12 =	98.4470	98.2081	97.9740	96.8742	96.6684	95.7105	95.7105	95.5332	96.0795	96.6684	97.0847	97.5199 (39)
												96.8732 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2849	1.2818	1.2787	1.2643	1.2617	1.2492	1.2492	1.2468	1.2540	1.2617	1.2671	1.2728 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1433.2873 (45)
	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												
	31.5778	27.6181	28.4994	24.8465	23.8408	20.5728	19.0637	21.8759	22.1372	25.7987	28.1613	30.5814 (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	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	19.1104	16.9736	13.8039	10.4504	7.8118	6.5951	7.1262	9.2629	12.4327	15.7861	18.4247	19.6415 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	212.2317	214.4340	208.8843	197.0696	182.1556	168.1386	158.7744	156.5721	162.1218	173.9365	188.8505	202.8675 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780 (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)												
	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240 (71)
Water heating gains (Table 5)												
	42.4432	41.0984	38.3057	34.5090	32.0441	28.5733	25.6233	29.4031	30.7461	34.6757	39.1130	41.1040 (72)
Total internal gains												
	332.7193	331.4401	319.9279	300.9631	280.9456	262.2410	250.4579	254.1721	264.2346	283.3324	305.3222	322.5470 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	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)		
East				3.2100	19.6403	0.6300		0.7000	0.7700	19.2674 (76)		
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)		
South				0.8600	45.6416	0.6300		0.7000	1.0000	15.5790 (82)		
Solar gains	106.0902	189.0181	280.2785	382.9071	460.9231	471.5517	448.8254	388.5731	315.5415	214.7838	128.5944	89.8004 (83)
Total gains	438.8095	520.4582	600.2064	683.8702	741.8686	733.7927	699.2833	642.7453	579.7760	498.1162	433.9166	412.3474 (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	55.8684	56.0043	56.1381	56.7755	56.8963	57.4657	57.4657	57.5724	57.2451	56.8963	56.6524	56.3995	
alpha	4.7246	4.7336	4.7425	4.7850	4.7931	4.8310	4.8310	4.8382	4.8163	4.7931	4.7768	4.7600	
util living area	0.9986	0.9965	0.9902	0.9669	0.8963	0.7462	0.5804	0.6452	0.8785	0.9823	0.9970	0.9989 (86)	
MIT	19.5939	19.7604	20.0355	20.4021	20.7260	20.9238	20.9821	20.9709	20.8199	20.3958	19.9276	19.5669 (87)	
Th 2	19.8527	19.8552	19.8576	19.8689	19.8710	19.8809	19.8809	19.8827	19.8771	19.8710	19.8667	19.8622 (88)	
util rest of house	0.9981	0.9952	0.9864	0.9531	0.8523	0.6489	0.4438	0.5071	0.8095	0.9725	0.9957	0.9986 (89)	
MIT 2	18.5780	18.7460	19.0210	19.3881	19.6865	19.8465	19.8766	19.8747	19.7766	19.3889	18.9223	18.5586 (90)	
Living area fraction									fLA = Living area / (4) =				0.3645 (91)
MIT	18.9483	19.1157	19.3908	19.7577	20.0654	20.2392	20.2796	20.2743	20.1569	19.7559	19.2888	18.9262 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9483	19.1157	19.3908	19.7577	20.0654	20.2392	20.2796	20.2743	20.1569	19.7559	19.2888	18.9262 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9975	0.9941	0.9844	0.9514	0.8610	0.6826	0.4944	0.5582	0.8296	0.9712	0.9947	0.9981 (94)
Useful gains	437.7031	517.3905	590.8288	650.6256	638.7564	500.8845	345.6965	358.8060	480.9898	483.7538	431.6306	411.5728 (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												
	1442.0852	1396.1017	1262.9658	1051.8353	808.6696	539.7300	352.1747	370.1271	581.9453	885.0892	1183.3425	1436.0957 (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												
	747.2603	590.4939	500.0700	288.8710	126.4154	0.0000	0.0000	0.0000	0.0000	298.5935	541.2325	762.2451 (98)
Space heating												3855.1817 (98)
Space heating per m2										(98) / (4) =		50.3156 (99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	899.6790	708.2580	726.0519	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8444	0.9092	0.8793	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.6501	643.9598	638.4451	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.7178	894.0214	830.6294	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	126.7687	186.0459	142.9851	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													455.7997 (104)
Intermittency factor (Table 10b)													1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	31.6922	46.5115	35.7463	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													113.9499 (107)
Energy for space heating													1.4872 (108)
Energy for space cooling													50.3156 (99)
Total													1.4872 (108)
Dwelling Fabric Energy Efficiency (DFEE)													51.8028 (109)
													51.8 (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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.4390	0.4304	0.4218	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4046 (22b)
Effective ac	0.5964	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818 (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)			13.8900	1.3258	18.4148		(27)
TER Room Window (Uw = 1.70)			0.8600	1.5918	1.3689		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803		(28a)
External Wall 1	94.9500	15.8500	79.1000	0.1800	14.2380		(29a)
External Roof 1	33.9900		33.9900	0.1300	4.4187		(30)
External Roof 2	5.8300	0.8600	4.9700	0.1300	0.6461		(30)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.4188		(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)							11.2180 (36)
Total fabric heat loss						(33) + (36) =	57.6368 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	38.0736	37.8347	37.6005	36.5007	36.2950	35.3371	35.3371	35.1597	35.7060	36.2950	36.7112	37.1464 (38)
Heat transfer coeff	95.7103	95.4715	95.2373	94.1375	93.9317	92.9739	92.9739	92.7965	93.3428	93.9317	94.3480	94.7832 (39)
Average = Sum(39)m / 12 =												94.1365 (39)
HLP	1.2492	1.2460	1.2430	1.2286	1.2259	1.2134	1.2134	1.2111	1.2183	1.2259	1.2314	1.2371 (40)
HLP (average)												1.2286 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy conte	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	96.8131	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Energy content (annual)												1433.2873 (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	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	31.5778	27.6181	28.4994	24.8465	23.8408	20.5728	19.0637	21.8759	22.1372	25.7987	28.1613	30.5814 (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	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	119.7800	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1104	16.9736	13.8039	10.4504	7.8118	6.5951	7.1262	9.2629	12.4327	15.7861	18.4247	19.6415	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.2317	214.4340	208.8843	197.0696	182.1556	168.1386	158.7744	156.5721	162.1218	173.9365	188.8505	202.8675	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	34.9780	(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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	(71)
Water heating gains (Table 5)	42.4432	41.0984	38.3057	34.5090	32.0441	28.5733	25.6233	29.4031	30.7461	34.6757	39.1130	41.1040	(72)
Total internal gains	332.7193	331.4401	319.9279	300.9631	280.9456	262.2410	250.4579	254.1721	264.2346	283.3324	305.3222	322.5470	(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)
East	3.2100	19.6403	0.6300		0.7000	0.7700	19.2674	(76)
South	3.3100	46.7521	0.6300		0.7000	0.7700	47.2934	(78)
South	0.8600	45.6416	0.6300		0.7000	1.0000	15.5790	(82)

Solar gains	106.0902	189.0181	280.2785	382.9071	460.9231	471.5517	448.8254	388.5731	315.5415	214.7838	128.5944	89.8004	(83)
Total gains	438.8095	520.4582	600.2064	683.8702	741.8686	733.7927	699.2833	642.7453	579.7760	498.1162	433.9166	412.3474	(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	55.5931	55.7322	55.8692	56.5219	56.6457	57.2293	57.2293	57.3387	57.0031	56.6457	56.3958	56.1369	
alpha	4.7062	4.7155	4.7246	4.7681	4.7764	4.8153	4.8153	4.8226	4.8002	4.7764	4.7597	4.7425	
util living area	0.9983	0.9960	0.9889	0.9630	0.8869	0.7316	0.5658	0.6300	0.8680	0.9800	0.9965	0.9988	(86)
MIT	19.6030	19.7728	20.0509	20.4193	20.7394	20.9295	20.9837	20.9734	20.8295	20.4091	19.9383	19.5756	(87)
Th 2	19.8809	19.8833	19.8858	19.8972	19.8993	19.9093	19.9093	19.9111	19.9054	19.8993	19.8950	19.8905	(88)
util rest of house	0.9978	0.9946	0.9847	0.9483	0.8420	0.6365	0.4352	0.4973	0.7985	0.9694	0.9951	0.9984	(89)
MIT 2	18.6126	18.7837	19.0616	19.4298	19.7234	19.8770	19.9052	19.9036	19.8098	19.4270	18.9584	18.5927	(90)
Living area fraction									fLA = Living area / (4) =			0.3645	(91)
MIT	18.9736	19.1442	19.4222	19.7905	20.0937	20.2607	20.2984	20.2936	20.1815	19.7850	19.3156	18.9510	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9736	19.1442	19.4222	19.7905	20.0937	20.2607	20.2984	20.2936	20.1815	19.7850	19.3156	18.9510	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9971	0.9933	0.9825	0.9465	0.8511	0.6694	0.4834	0.5463	0.8187	0.9680	0.9940	0.9978	(94)
Useful gains	437.5434	516.9771	589.6950	647.2995	631.3693	491.1778	338.0291	351.1183	474.6886	482.1784	431.3191	411.4581	(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	1404.4167	1359.9172	1230.6777	1025.2049	788.4365	526.2943	343.8510	361.3103	567.6689	862.7652	1152.5182	1398.1479	(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	719.3538	566.4558	476.8912	272.0919	116.8580	0.0000	0.0000	0.0000	0.0000	283.1566	519.2634	734.0972	(98)
Space heating												3688.1677	(98)
Space heating per m2										(98) / (4) =		48.1358	(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	873.9543	688.0066	705.2532	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8550	0.9165	0.8884	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	747.2619	630.5714	626.5379	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.7178	894.0214	830.6294	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	135.6882	196.0068	151.8441	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												483.5391 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	33.9221	49.0017	37.9610	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												120.8848 (107)
Space cooling per m2												1.5777 (108)
Energy for space heating												48.1358 (99)
Energy for space cooling												1.5777 (108)
Total												49.7136 (109)
Target Fabric Energy Efficiency (TFEE)												57.2 (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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.3615	0.3443	0.3443	0.3185	0.3185	0.2841	0.2927	0.2754	0.2841	0.3013	0.3013	0.3271 (22b)
Effective ac	0.5653	0.5593	0.5593	0.5507	0.5507	0.5403	0.5428	0.5379	0.5403	0.5454	0.5454	0.5535 (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)			9.6900	1.3258	12.8466		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712 (28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440 (29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583 (30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300 (30)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.9457		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			43.9100			75.0000	3293.2500 (32c)
Internal Wall 2			57.6500			9.0000	518.8500 (32c)
Internal Floor 1			38.3100			18.0000	689.5800 (32d)
Internal Ceiling 1			38.3100			18.0000	689.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20145.0635 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							262.9217 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4278 (36)
Total fabric heat loss						(33) + (36) =	60.3735 (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	36.0939	35.7060	35.7060	35.1597	35.1597	34.4975	34.6559	34.3437	34.4975	34.8191	34.8191	35.3371 (38)
Average = Sum(39)m / 12 =	96.4674	96.0795	96.0795	95.5332	95.5332	94.8709	95.0294	94.7172	94.8709	95.1926	95.1926	95.7105 (39)
												95.4397 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2590	1.2540	1.2540	1.2468	1.2468	1.2382	1.2403	1.2362	1.2382	1.2424	1.2424	1.2492 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1433.2873 (45)
	22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869 (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	25.4516	22.9755	25.4157	24.5715	25.3728	24.5340	25.3391	25.3610	24.5544	25.3979	24.6069	25.4446 (61)
Total heat required for water heating calculated for each month	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	55.7728	48.9581	50.9471	45.0203	43.6470	38.3239	36.1639	40.5696	40.7767	46.7169	50.2159	54.2120 (65)
												1732 (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	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7759	42.4341	34.5097	26.1261	19.5296	16.4877	17.8155	23.1573	31.0817	39.4653	46.0618	49.1037 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.7638	320.0508	311.7676	294.1337	271.8741	250.9532	236.9767	233.6897	241.9729	259.6068	281.8664	302.7873 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692 (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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240 (71)
Water heating gains (Table 5)	74.9635	72.8543	68.4773	62.5282	58.6654	53.2276	48.6074	54.5290	56.6344	62.7915	69.7443	72.8656 (72)
Total internal gains	542.1844	538.0205	517.4359	485.4693	452.7503	423.3497	406.0808	414.0572	432.3701	464.5449	500.3538	527.4379 (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)		
East				3.2100	22.3313	0.6300	0.7000		0.7700	21.9074 (76)		
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)		
South				0.8600	50.8779	0.6300	0.7000		1.0000	17.3664 (82)		
Solar gains	117.8356	189.3794	278.6845	394.4427	464.0428	508.5524	478.6249	422.8041	340.8335	230.1309	146.4180	98.7256 (83)
Total gains	660.0199	727.3999	796.1205	879.9120	916.7931	931.9020	884.7058	836.8613	773.2037	694.6757	646.7718	626.1635 (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	58.0077	58.2419	58.2419	58.5750	58.5750	58.9838	58.8855	59.0796	58.9838	58.7845	58.7845	58.4664
alpha	4.8672	4.8828	4.8828	4.9050	4.9050	4.9323	4.9257	4.9386	4.9323	4.9190	4.9190	4.8978
util living area	0.9905	0.9839	0.9632	0.8979	0.7474	0.4999	0.3320	0.3606	0.6674	0.9171	0.9799	0.9924 (86)
MIT	19.9830	20.1164	20.3757	20.6870	20.9084	20.9902	20.9990	20.9985	20.9604	20.7013	20.3004	19.9577 (87)
Th 2	19.8731	19.8771	19.8771	19.8827	19.8827	19.8896	19.8879	19.8912	19.8896	19.8862	19.8862	19.8809 (88)
util rest of house	0.9872	0.9783	0.9500	0.8623	0.6710	0.3935	0.2134	0.2365	0.5588	0.8792	0.9716	0.9896 (89)
MIT 2	18.9792	19.1136	19.3653	19.6569	19.8336	19.8869	19.8878	19.8910	19.8747	19.6799	19.3032	18.9606 (90)
Living area fraction	19.3451	19.4791	19.7336	20.0324	20.2254	20.2890	20.2929	20.2947	20.2704	20.0522	19.6667	19.3241 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1951	19.3291	19.5836	19.8824	20.0754	20.1390	20.1429	20.1447	20.1204	19.9022	19.5167	19.1741 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9845	0.9747	0.9457	0.8622	0.6852	0.4179	0.2408	0.2651	0.5828	0.8798	0.9680	0.9873 (94)
Useful gains	649.7976	709.0056	752.8746	758.7009	628.2249	389.4560	212.9934	221.8525	450.6425	611.1980	626.0802	618.2113 (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	1359.7173	1319.0883	1170.5932	953.6510	675.9378	392.6753	213.1394	222.0856	466.8050	790.3110	1096.3061	1347.0387 (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	528.1803	409.9756	310.7826	140.3641	35.4984	0.0000	0.0000	0.0000	0.0000	133.2601	338.5626	542.2475 (98)
Space heating												2438.8713 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

2439 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.4390	0.4304	0.4218	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4046 (22b)
Effective ac	0.5964	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818 (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)			9.6900	1.3258	12.8466		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712 (28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440 (29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583 (30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300 (30)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.9457		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			43.9100			75.0000	3293.2500 (32c)
Internal Wall 2			57.6500			9.0000	518.8500 (32c)
Internal Floor 1			38.3100			18.0000	689.5800 (32d)
Internal Ceiling 1			38.3100			18.0000	689.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20145.0635 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							262.9217 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4278 (36)
Total fabric heat loss						(33) + (36) =	60.3735 (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	38.0736	37.8347	37.6005	36.5007	36.2950	35.3371	35.3371	35.1597	35.7060	36.2950	36.7112	37.1464 (38)
Average = Sum(39)m / 12 =	98.4470	98.2081	97.9740	96.8742	96.6684	95.7105	95.7105	95.5332	96.0795	96.6684	97.0847	97.5199 (39)
												96.8732 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2849	1.2818	1.2787	1.2643	1.2617	1.2492	1.2492	1.2468	1.2540	1.2617	1.2671	1.2728 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1433.2873 (45)
	22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869 (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	25.4516	22.9755	25.4157	24.5715	25.3728	24.5340	25.3391	25.3610	24.5544	25.3979	24.6069	25.4446 (61)
Total heat required for water heating calculated for each month	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (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	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (64)
Heat gains from water heating, kWh/month	55.7728	48.9581	50.9471	45.0203	43.6470	38.3239	36.1639	40.5696	40.7767	46.7169	50.2159	54.2120 (65)
								Total per year (kWh/year) =	Sum (64)m =			1732.3121 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7759	42.4341	34.5097	26.1261	19.5296	16.4877	17.8155	23.1573	31.0817	39.4653	46.0618	49.1037 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.7638	320.0508	311.7676	294.1337	271.8741	250.9532	236.9767	233.6897	241.9729	259.6068	281.8664	302.7873 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692 (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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240 (71)
Water heating gains (Table 5)	74.9635	72.8543	68.4773	62.5282	58.6654	53.2276	48.6074	54.5290	56.6344	62.7915	69.7443	72.8656 (72)
Total internal gains	542.1844	538.0205	517.4359	485.4693	452.7503	423.3497	406.0808	414.0572	432.3701	464.5449	500.3538	527.4379 (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)
East	3.2100	19.6403	0.6300	0.7000	0.7700	19.2674 (76)
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)
South	0.8600	45.6416	0.6300	0.7000	1.0000	15.5790 (82)

Solar gains	106.0902	189.0181	280.2785	382.9071	460.9231	471.5517	448.8254	388.5731	315.5415	214.7838	128.5944	89.8004 (83)
Total gains	648.2746	727.0386	797.7144	868.3764	913.6733	894.9013	854.9062	802.6304	747.9116	679.3287	628.9482	617.2382 (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	56.8412	56.9795	57.1157	57.7641	57.8871	58.4664	58.4664	58.5750	58.2419	57.8871	57.6389	57.3816
alpha	4.7894	4.7986	4.8077	4.8509	4.8591	4.8978	4.8978	4.9050	4.8828	4.8591	4.8426	4.8254
util living area	0.9929	0.9869	0.9717	0.9269	0.8226	0.6467	0.4847	0.5342	0.7764	0.9463	0.9866	0.9944 (86)
MIT	19.8491	20.0059	20.2566	20.5760	20.8297	20.9609	20.9922	20.9877	20.9049	20.5813	20.1588	19.8188 (87)
Th 2	19.8527	19.8552	19.8576	19.8689	19.8710	19.8809	19.8809	19.8827	19.8771	19.8710	19.8667	19.8622 (88)
util rest of house	0.9905	0.9824	0.9617	0.9009	0.7639	0.5493	0.3656	0.4113	0.6882	0.9216	0.9812	0.9924 (89)
MIT 2	18.8300	18.9867	19.2339	19.5453	19.7648	19.8648	19.8792	19.8797	19.8304	19.5589	19.1486	18.8076 (90)
Living area fraction									fLA = Living area /	4.5168		0.3645 (91)
MIT	19.2015	19.3582	19.6067	19.9210	20.1530	20.2644	20.2849	20.2836	20.2221	19.9316	19.5168	19.1762 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0515	19.2082	19.4567	19.7710	20.0030	20.1144	20.1349	20.1336	20.0721	19.7816	19.3668	19.0262 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9883	0.9791	0.9573	0.8983	0.7715	0.5707	0.3932	0.4397	0.7052	0.9191	0.9780	0.9905 (94)
Ext temp.	640.6640	711.8500	763.6582	780.0346	704.9368	510.7186	336.1347	352.9390	527.4135	624.3911	615.1348	611.3780 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1452.2379	1405.1826	1269.4176	1053.1200	802.6362	527.7817	338.3257	356.6798	573.7928	887.5723	1190.9200	1445.8500 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	603.8110	465.9195	376.2850	196.6215	72.6884	0.0000	0.0000	0.0000	0.0000	195.8068	414.5654	620.8472 (98)
Space heating per m2												2946.5447 (98)
										(98) / (4) =		38.4566 (99)

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														3164.9245	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	603.8110	465.9195	376.2850	196.6215	72.6884	0.0000	0.0000	0.0000	0.0000	195.8068	414.5654	620.8472	(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)	648.5618	500.4505	404.1729	211.1938	78.0756	0.0000	0.0000	0.0000	0.0000	210.3188	445.2904	666.8606	(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	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570	(64)		
Efficiency of water heater (217)m	89.8927	89.8091	89.6289	89.2017	88.3791	87.2000	87.2000	87.2000	87.2000	89.1665	89.7103	89.9264	(216)		
Fuel for water heating, kWh/month	193.6230	170.2979	177.9901	158.6249	155.6532	139.1595	131.9388	147.1403	147.6253	164.6400	175.1534	188.3284	(219)		
Water heating fuel used												1950.1747	(219)		
Annual totals kWh/year															
Space heating fuel - main system													3164.9245	(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)													337.4948	(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													4957.6051	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3164.9245	3.4800	110.1394 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1950.1747	3.4800	67.8661 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	337.4948	13.1900	44.5156 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			277.2320 (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] =	0.9574 (257)
SAP value		86.6444
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3164.9245	0.2160	683.6237 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1950.1747	0.2160	421.2377 (264)
Space and water heating			1104.8614 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4948	0.5190	175.1598 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			1023.1220 (272)
CO2 emissions per m2			13.3500 (273)
EI value			88.7273
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, 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	$3.48 / 0.8871 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8871 = 0.2435$, 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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.3615	0.3443	0.3443	0.3185	0.3185	0.2841	0.2927	0.2754	0.2841	0.3013	0.3013	0.3271 (22b)
Effective ac	0.5653	0.5593	0.5593	0.5507	0.5507	0.5403	0.5428	0.5379	0.5403	0.5454	0.5454	0.5535 (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)			9.6900	1.3258	12.8466		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712 (28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440 (29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583 (30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300 (31)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.9457		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			43.9100			75.0000	3293.2500 (32c)
Internal Wall 2			57.6500			9.0000	518.8500 (32c)
Internal Floor 1			38.3100			18.0000	689.5800 (32d)
Internal Ceiling 1			38.3100			18.0000	689.5800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 20145.0635 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							262.9217 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4278 (36)
Total fabric heat loss						(33) + (36) =	60.3735 (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	36.0939	35.7060	35.7060	35.1597	35.1597	34.4975	34.6559	34.3437	34.4975	34.8191	34.8191	35.3371 (38)
Average = Sum(39)m / 12 =	96.4674	96.0795	96.0795	95.5332	95.5332	94.8709	95.0294	94.7172	94.8709	95.1926	95.1926	95.7105 (39)
												95.4397 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2590	1.2540	1.2540	1.2468	1.2468	1.2382	1.2403	1.2362	1.2382	1.2424	1.2424	1.2492 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1433.2873 (45)
	22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869 (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	25.4516	22.9755	25.4157	24.5715	25.3728	24.5340	25.3391	25.3610	24.5544	25.3979	24.6069	25.4446 (61)
Total heat required for water heating calculated for each month	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (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	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (64)
Heat gains from water heating, kWh/month	55.7728	48.9581	50.9471	45.0203	43.6470	38.3239	36.1639	40.5696	40.7767	46.7169	50.2159	54.2120 (65)
								Total per year (kWh/year) =	Sum (64)m =			1732.3121 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7759	42.4341	34.5097	26.1261	19.5296	16.4877	17.8155	23.1573	31.0817	39.4653	46.0618	49.1037 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.7638	320.0508	311.7676	294.1337	271.8741	250.9532	236.9767	233.6897	241.9729	259.6068	281.8664	302.7873 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692 (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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240 (71)
Water heating gains (Table 5)	74.9635	72.8543	68.4773	62.5282	58.6654	53.2276	48.6074	54.5290	56.6344	62.7915	69.7443	72.8656 (72)
Total internal gains	542.1844	538.0205	517.4359	485.4693	452.7503	423.3497	406.0808	414.0572	432.3701	464.5449	500.3538	527.4379 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	Specific data	FF	Access	Gains
		m ²	Table 6a	W/m ²	or Table 6b	or Table 6c	factor	W
							Table 6d	
North		3.1700	11.9814	0.6300		0.7000	0.7700	11.6075 (74)
East		3.2100	22.3313	0.6300		0.7000	0.7700	21.9074 (76)
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)
South		0.8600	50.8779	0.6300		0.7000	1.0000	17.3664 (82)

Solar gains	117.8356	189.3794	278.6845	394.4427	464.0428	508.5524	478.6249	422.8041	340.8335	230.1309	146.4180	98.7256 (83)
Total gains	660.0199	727.3999	796.1205	879.9120	916.7931	931.9020	884.7058	836.8613	773.2037	694.6757	646.7718	626.1635 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	58.0077	58.2419	58.2419	58.5750	58.5750	58.9838	58.8855	59.0796	58.9838	58.7845	58.7845	58.4664
util living area	4.8672	4.8828	4.8828	4.9050	4.9050	4.9323	4.9257	4.9386	4.9323	4.9190	4.9190	4.8978
	0.9905	0.9839	0.9632	0.8979	0.7474	0.4999	0.3320	0.3606	0.6674	0.9171	0.9799	0.9924 (86)
MIT	19.9830	20.1164	20.3757	20.6870	20.9084	20.9902	20.9990	20.9985	20.9604	20.7013	20.3004	19.9577 (87)
Th 2	19.8731	19.8771	19.8771	19.8827	19.8827	19.8896	19.8879	19.8912	19.8896	19.8862	19.8862	19.8809 (88)
util rest of house	0.9872	0.9783	0.9500	0.8623	0.6710	0.3935	0.2134	0.2365	0.5588	0.8792	0.9716	0.9896 (89)
MIT 2	18.9792	19.1136	19.3653	19.6569	19.8336	19.8869	19.8878	19.8910	19.8747	19.6799	19.3032	18.9606 (90)
Living area fraction									fLA = Living area / (4) =			0.3645 (91)
MIT	19.3451	19.4791	19.7336	20.0324	20.2254	20.2890	20.2929	20.2947	20.2704	20.0522	19.6667	19.3241 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1951	19.3291	19.5836	19.8824	20.0754	20.1390	20.1429	20.1447	20.1204	19.9022	19.5167	19.1741 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9845	0.9747	0.9457	0.8622	0.6852	0.4179	0.2408	0.2651	0.5828	0.8798	0.9680	0.9873 (94)
Ext temp.	649.7976	709.0056	752.8746	758.7009	628.2249	389.4560	212.9934	221.8525	450.6425	611.1980	626.0802	618.2113 (95)
Heat loss rate W	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)
Month fracti	1359.7173	1319.0883	1170.5932	953.6510	675.9378	392.6753	213.1394	222.0856	466.8050	790.3110	1096.3061	1347.0387 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	528.1803	409.9756	310.7826	140.3641	35.4984	0.0000	0.0000	0.0000	0.0000	133.2601	338.5626	542.2475 (98)
Space heating per m ²												2438.8713 (98)
										(98) / (4) =		31.8307 (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														2619.6255 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	528.1803	409.9756	310.7826	140.3641	35.4984	0.0000	0.0000	0.0000	0.0000	133.2601	338.5626	542.2475	(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)	567.3258	440.3605	333.8159	150.7670	38.1293	0.0000	0.0000	0.0000	0.0000	143.1365	363.6548	582.4356	(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	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570	(64)	
Efficiency of water heater (217)m	89.8066	89.7216	89.4817	88.9085	87.8957	87.2000	87.2000	87.2000	87.2000	88.8311	89.5605	89.8418	(216)	
Fuel for water heating, kWh/month	193.8086	170.4641	178.2828	159.1479	156.5091	139.1595	131.9388	147.1403	147.6253	165.2617	175.4465	188.5058	(219)	
Water heating fuel used												1953.2904	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2619.6255	(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)												337.4948	(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												4383.4380	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2619.6255	3.9500	103.4752 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1953.2904	3.9500	77.1550 (247)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	337.4948	18.7000	63.1115 (250)
Additional standing charges			91.0000 (251)
Energy saving/generation technologies			
PV Unit	-601.9727	18.7000	-112.5689 (252)
Total energy cost			236.1978 (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	2619.6255	0.2160	565.8391 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1953.2904	0.2160	421.9107 (264)
Space and water heating			987.7498 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	337.4948	0.5190	175.1598 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	0.5190	-312.4238 (269)
Total kg/year			889.4108 (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	2619.6255	1.2200	3195.9431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1953.2904	1.2200	2383.0143 (264)
Space and water heating			5578.9574 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	337.4948	3.0700	1036.1092 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

PV Unit	-601.9727	3.0700	-1848.0561 (269)
Primary energy kWh/year			4997.2604 (272)
Primary energy kWh/m2/year			65.2214 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

(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	+ 1.3	-£ 29	-184 kg (20.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29 2.40 kg/m²	B 88	B 91
Total Savings	£29 2.40 kg/m²		
Potential energy efficiency rating:		B 88	
Potential environmental impact rating:			B 91

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	£77	£86	-£9
Mains gas	£272	£233	£38
Space heating	£209	£209	£0
Water heating	£77	£48	£29
Lighting	£63	£63	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£236	£206	£29
Total cost of uses	£236	£207	£29
Delivered energy	57 kWh/m²	45 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	9 kg/m²	2 kg/m²
Primary energy	65 kWh/m²	52 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	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.4390	0.4304	0.4218	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4046 (22b)
Effective ac	0.5964	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818 (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)			9.6900	1.3258	12.8466		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627		(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712 (28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440 (29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583 (30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300 (31)
Total net area of external elements Aum(A, m ²)			173.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.9457		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			43.9100			75.0000	3293.2500 (32c)
Internal Wall 2			57.6500			9.0000	518.8500 (32c)
Internal Floor 1			38.3100			18.0000	689.5800 (32d)
Internal Ceiling 1			38.3100			18.0000	689.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20145.0635 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							262.9217 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4278 (36)
Total fabric heat loss						(33) + (36) =	60.3735 (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	38.0736	37.8347	37.6005	36.5007	36.2950	35.3371	35.3371	35.1597	35.7060	36.2950	36.7112	37.1464 (38)
Average = Sum(39)m / 12 =	98.4470	98.2081	97.9740	96.8742	96.6684	95.7105	95.7105	95.5332	96.0795	96.6684	97.0847	97.5199 (39)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)
HLP	1.2849	1.2818	1.2787	1.2643	1.2617	1.2492	1.2492	1.2468	1.2540	1.2617	1.2671	1.2728 (40)
HLP (average)												1.2643 (40)
Days in month												

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
Energy content (annual)	148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1433.2873 (45)
	22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869 (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	25.4516	22.9755	25.4157	24.5715	25.3728	24.5340	25.3391	25.3610	24.5544	25.3979	24.6069	25.4446 (61)
Total heat required for water heating calculated for each month	174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (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												1.2653 (H8)
Utilisation factor												0.5463 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.0955 (H14)
Volume ratio Veff/V												0.8233 (H15)
Solar storage volume factor												0.9611 (H16)
Solar input	-24.2797	-40.5159	-69.0031	-92.4778	-114.2485	-112.3245	-110.8401	-96.8416	-75.8464	-51.7941	-28.7992	-837.2890 (H17)
Solar input (sum of months) = Sum (63)m =												-837.2890 (63)
Output from w/h	149.7731	112.4272	90.5274	49.0183	23.3163	9.0226	4.2105	31.4648	52.8829	95.0096	128.3315	149.0390 (64)
Total per year (kWh/year) = Sum (64)m =												895.0232 (64)
Heat gains from water heating, kWh/month	55.7728	48.9581	50.9471	45.0203	43.6470	38.3239	36.1639	40.5696	40.7767	46.7169	50.2159	54.2120 (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	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7759	42.4341	34.5097	26.1261	19.5296	16.4877	17.8155	23.1573	31.0817	39.4653	46.0618	49.1037	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.7638	320.0508	311.7676	294.1337	271.8741	250.9532	236.9767	233.6897	241.9729	259.6068	281.8664	302.7873	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	(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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	(71)
Water heating gains (Table 5)	74.9635	72.8543	68.4773	62.5282	58.6654	53.2276	48.6074	54.5290	56.6344	62.7915	69.7443	72.8656	(72)
Total internal gains	542.1844	538.0205	517.4359	485.4693	452.7503	423.3497	406.0808	414.0572	432.3701	464.5449	500.3538	527.4379	(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)
East	3.2100	19.6403	0.6300	0.7000	0.7700	19.2674 (76)
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)
South	0.8600	45.6416	0.6300	0.7000	1.0000	15.5790 (82)

Solar gains	106.0902	189.0181	280.2785	382.9071	460.9231	471.5517	448.8254	388.5731	315.5415	214.7838	128.5944	89.8004 (83)
Total gains	648.2746	727.0386	797.7144	868.3764	913.6733	894.9013	854.9062	802.6304	747.9116	679.3287	628.9482	617.2382 (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	56.8412	56.9795	57.1157	57.7641	57.8871	58.4664	58.4664	58.5750	58.2419	57.8871	57.6389	57.3816
alpha	4.7894	4.7986	4.8077	4.8509	4.8591	4.8978	4.8978	4.9050	4.8828	4.8591	4.8426	4.8254
util living area	0.9929	0.9869	0.9717	0.9269	0.8226	0.6467	0.4847	0.5342	0.7764	0.9463	0.9866	0.9944 (86)
MIT	19.8491	20.0059	20.2566	20.5760	20.8297	20.9609	20.9922	20.9877	20.9049	20.5813	20.1588	19.8188 (87)
Th 2	19.8527	19.8552	19.8576	19.8689	19.8710	19.8809	19.8809	19.8827	19.8771	19.8710	19.8667	19.8622 (88)
util rest of house	0.9905	0.9824	0.9617	0.9009	0.7639	0.5493	0.3656	0.4113	0.6882	0.9216	0.9812	0.9924 (89)
MIT 2	18.8300	18.9867	19.2339	19.5453	19.7648	19.8648	19.8792	19.8797	19.8304	19.5589	19.1486	18.8076 (90)
Living area fraction									fLA = Living area / (4) =			0.3645 (91)
MIT	19.2015	19.3582	19.6067	19.9210	20.1530	20.2644	20.2849	20.2836	20.2221	19.9316	19.5168	19.1762 (92)
Temperature adjustment												-0.1500

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 19.0515 19.2082 19.4567 19.7710 20.0030 20.1144 20.1349 20.1336 20.0721 19.7816 19.3668 19.0262 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9791	0.9573	0.8983	0.7715	0.5707	0.3932	0.4397	0.7052	0.9191	0.9780	0.9905	(94)
Useful gains	640.6640	711.8500	763.6582	780.0346	704.9368	510.7186	336.1347	352.9390	527.4135	624.3911	615.1348	611.3780	(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	1452.2379	1405.1826	1269.4176	1053.1200	802.6362	527.7817	338.3257	356.6798	573.7928	887.5723	1190.9200	1445.8500	(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	603.8110	465.9195	376.2850	196.6215	72.6884	0.0000	0.0000	0.0000	0.0000	195.8068	414.5654	620.8472	(98)
Space heating												2946.5447	(98)
Space heating per m2										(98) / (4) =		38.4566	(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													3164.9245	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	603.8110	465.9195	376.2850	196.6215	72.6884	0.0000	0.0000	0.0000	0.0000	195.8068	414.5654	620.8472	(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)	648.5618	500.4505	404.1729	211.1938	78.0756	0.0000	0.0000	0.0000	0.0000	210.3188	445.2904	666.8606	(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	149.7731	112.4272	90.5274	49.0183	23.3163	9.0226	4.2105	31.4648	52.8829	95.0096	128.3315	149.0390	(64)	
Efficiency of water heater (217)m	89.9822	89.9978	89.9995	89.9793	89.8244	87.2000	87.2000	87.2000	87.2000	89.5261	89.8475	90.0007	(216)	
Fuel for water heating, kWh/month	166.4475	124.9222	100.5866	54.4773	25.9576	10.3470	4.8286	36.0835	60.6455	106.1250	142.8325	165.5976	(219)	
Water heating fuel used												998.8510	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3164.9245	(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)													337.4948	(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												4056.2813	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3164.9245	3.4800	110.1394	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	998.8510	3.4800	34.7600	(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	337.4948	13.1900	44.5156	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-569.9890	13.1900	-75.1815	(252)
Total energy cost			250.7209	(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] =	0.8658	(257)
SAP value		87.9216	
SAP rating (Section 12)		88	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	3164.9245	0.2160	683.6237 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	998.8510	0.2160	215.7518 (264)
Space and water heating			899.3755 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	337.4948	0.5190	175.1598 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			843.5860 (272)
CO2 emissions per m2			11.0100 (273)
EI value			90.7054
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.3100 (1b)	x 2.4000 (2b)	= 91.9440 (1b) - (3b)
First floor	38.3100 (1c)	x 2.6500 (2c)	= 101.5215 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.4655 (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) = 0.1551 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4051 (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) =	0.3443 (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	0.3615	0.3443	0.3443	0.3185	0.3185	0.2841	0.2927	0.2754	0.2841	0.3013	0.3013	0.3271 (22b)
Effective ac	0.5653	0.5593	0.5593	0.5507	0.5507	0.5403	0.5428	0.5379	0.5403	0.5454	0.5454	0.5535 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
External door			1.9600	1.4000	2.7440			(26a)
Windows (Uw = 1.40)			9.6900	1.3258	12.8466			(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682			(27)
Velux roof lights (Uw = 1.30)			0.8600	1.2357	1.0627			(27a)
Heat Loss Floor 1			38.3100	0.1300	4.9803	65.5200	2510.0712	(28a)
External Wall 1	94.9500	15.8500	79.1000	0.2200	17.4020	67.8400	5366.1440	(29a)
External Roof 1	33.9900		33.9900	0.1308	4.4473	12.1700	413.6583	(30)
External Roof 2	5.8300	0.8600	4.9700	0.1800	0.8946	9.0000	44.7300	(30)
Total net area of external elements Aum(A, m2)			173.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.9457				(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000	(32)
Internal Wall 1			43.9100			75.0000	3293.2500	(32c)
Internal Wall 2			57.6500			9.0000	518.8500	(32c)
Internal Floor 1			38.3100			18.0000	689.5800	(32d)
Internal Ceiling 1			38.3100			18.0000	689.5800	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	20145.0635		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						262.9217		(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						10.4278		(36)
Total fabric heat loss					(33) + (36) =	60.3735		(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	36.0939	35.7060	35.7060	35.1597	35.1597	34.4975	34.6559	34.3437	34.4975	34.8191	34.8191	35.3371 (38)
Average = Sum(39)m / 12 =	96.4674	96.0795	96.0795	95.5332	95.5332	94.8709	95.0294	94.7172	94.8709	95.1926	95.1926	95.7105 (39)
	95.4397 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2590	1.2540	1.2540	1.2468	1.2468	1.2382	1.2403	1.2362	1.2382	1.2424	1.2424	1.2492 (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												2.3956 (42)
Average daily hot water use (litres/day)												91.0955 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	100.2051	96.5613	92.9174	89.2736	85.6298	81.9860	81.9860	85.6298	89.2736	92.9174	96.5613	100.2051 (44)
148.6012	129.9676	134.1149	116.9246	112.1920	96.8131	89.7116	102.9454	104.1749	121.4058	132.5239	143.9124 (45)	
Energy content (annual)										Total = Sum (45)m =		1433.2873 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.2902	19.4951	20.1172	17.5387	16.8288	14.5220	13.4567	15.4418	15.6262	18.2109	19.8786	21.5869 (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	25.4516	22.9755	25.4157	24.5715	25.3728	24.5340	25.3391	25.3610	24.5544	25.3979	24.6069	25.4446 (61)
Total heat required for water heating calculated for each month												
174.0529	152.9431	159.5306	141.4961	137.5648	121.3471	115.0507	128.3063	128.7293	146.8037	157.1307	169.3570 (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												1.3363 (H8)
Utilisation factor												0.5268 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.0955 (H14)
Volume ratio Veff/V												0.8233 (H15)
Solar storage volume factor												0.9611 (H16)
Solar input												-852.7773 (H17)
Solar input	-26.2481	-39.4508	-66.4401	-91.8406	-110.6069	-116.4090	-113.6138	-101.4578	-79.1882	-53.8702	-31.9052	-21.7467 (63)
												-852.7773 (63)
								Solar input (sum of months) = Sum (63)m =				
Output from w/h												
147.8048	113.4923	93.0904	49.6555	26.9579	4.9381	1.4369	26.8485	49.5411	92.9335	125.2255	147.6103 (64)	
												Total per year (kWh/year) = Sum (64)m = 879.5348 (64)
Heat gains from water heating, kWh/month												
55.7728	48.9581	50.9471	45.0203	43.6470	38.3239	36.1639	40.5696	40.7767	46.7169	50.2159	54.2120 (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	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361	143.7361 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7759	42.4341	34.5097	26.1261	19.5296	16.4877	17.8155	23.1573	31.0817	39.4653	46.0618	49.1037 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.7638	320.0508	311.7676	294.1337	271.8741	250.9532	236.9767	233.6897	241.9729	259.6068	281.8664	302.7873 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692	51.7692 (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)	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240	-95.8240 (71)
Water heating gains (Table 5)	74.9635	72.8543	68.4773	62.5282	58.6654	53.2276	48.6074	54.5290	56.6344	62.7915	69.7443	72.8656 (72)
Total internal gains	542.1844	538.0205	517.4359	485.4693	452.7503	423.3497	406.0808	414.0572	432.3701	464.5449	500.3538	527.4379 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
North		3.1700	11.9814	0.6300	0.7000	0.7700	11.6075 (74)
East		3.2100	22.3313	0.6300	0.7000	0.7700	21.9074 (76)
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)
South		0.8600	50.8779	0.6300	0.7000	1.0000	17.3664 (82)

Solar gains	117.8356	189.3794	278.6845	394.4427	464.0428	508.5524	478.6249	422.8041	340.8335	230.1309	146.4180	98.7256 (83)
Total gains	660.0199	727.3999	796.1205	879.9120	916.7931	931.9020	884.7058	836.8613	773.2037	694.6757	646.7718	626.1635 (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	58.0077	58.2419	58.2419	58.5750	58.5750	58.9838	58.8855	59.0796	58.9838	58.7845	58.7845	58.4664
alpha	4.8672	4.8828	4.8828	4.9050	4.9050	4.9323	4.9257	4.9386	4.9323	4.9190	4.9190	4.8978
util living area												
	0.9905	0.9839	0.9632	0.8979	0.7474	0.4999	0.3320	0.3606	0.6674	0.9171	0.9799	0.9924 (86)
MIT	19.9830	20.1164	20.3757	20.6870	20.9084	20.9902	20.9990	20.9985	20.9604	20.7013	20.3004	19.9577 (87)
Th 2	19.8731	19.8771	19.8771	19.8827	19.8827	19.8896	19.8879	19.8912	19.8896	19.8862	19.8862	19.8809 (88)
util rest of house												
	0.9872	0.9783	0.9500	0.8623	0.6710	0.3935	0.2134	0.2365	0.5588	0.8792	0.9716	0.9896 (89)
MIT 2	18.9792	19.1136	19.3653	19.6569	19.8336	19.8869	19.8878	19.8910	19.8747	19.6799	19.3032	18.9606 (90)
Living area fraction												
MIT	19.3451	19.4791	19.7336	20.0324	20.2254	20.2890	20.2929	20.2947	20.2704	20.0522	19.6667	19.3241 (92)
Temperature adjustment												-0.1500

adjusted MIT	19.1951	19.3291	19.5836	19.8824	20.0754	20.1390	20.1429	20.1447	20.1204	19.9022	19.5167	19.1741 (93)
--------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--------------

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9845	0.9747	0.9457	0.8622	0.6852	0.4179	0.2408	0.2651	0.5828	0.8798	0.9680	0.9873 (94)
Useful gains	649.7976	709.0056	752.8746	758.7009	628.2249	389.4560	212.9934	221.8525	450.6425	611.1980	626.0802	618.2113 (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	1359.7173	1319.0883	1170.5932	953.6510	675.9378	392.6753	213.1394	222.0856	466.8050	790.3110	1096.3061	1347.0387 (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	528.1803	409.9756	310.7826	140.3641	35.4984	0.0000	0.0000	0.0000	0.0000	133.2601	338.5626	542.2475 (98)
Space heating												2438.8713 (98)
Space heating per m2												31.8307 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

[illegible]

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2619.6255	3.9500	103.4752 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	982.5227	3.9500	38.8096 (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	337.4948	18.7000	63.1115 (250)
Additional standing charges			91.0000 (251)
Energy saving/generation technologies			
PV Unit	-601.9727	18.7000	-112.5689 (252)
Total energy cost			207.2025 (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	2619.6255	0.2160	565.8391 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	982.5227	0.2160	212.2249 (264)
Space and water heating			778.0640 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)

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 for lighting	337.4948	0.5190	175.1598 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	0.5190	-312.4238 (269)
Total kg/year			705.6750 (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	2619.6255	1.2200	3195.9431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	982.5227	1.2200	1198.6777 (264)
Space and water heating			4394.6207 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	337.4948	3.0700	1036.1092 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	3.0700	-1848.0561 (269)
Primary energy kWh/year			3966.4238 (272)
Primary energy kWh/m2/year			51.7675 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace 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	262.9 (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	255.37 (P1)
Transmission heat loss coefficient	60.37 (P7)
Summer heat loss coefficient	315.75 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
South	1.000	1.00	1.000	1.000 (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
East	3.2100	117.5071	0.6300	0.7000	0.9000	134.7388
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
South	0.8600	196.2427	0.6300	0.7000	1.0000	66.9843
total:						548.1227

	Jun	Jul	Aug	
Solar gains	582	548	484	(P3)
Internal gains	420	403	411	
Total summer gains	1003	951	895	(P5)
Summer gain/loss ratio	3.18	3.01	2.83	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 262.9)	0.16	0.16	0.16	
Threshold temperature	19.34	21.07	20.79	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			