



SAP Report Submission for Building Regulations Compliance

Client:

Project: Proposed new dwelling, 57, Camden Mews
LONDON, NW1 9BY

Contact: Jennifer Bantin
Elmhurst Energy Consultancy
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Report Issue Date: 09/04/2020

EXCELLENCE
IN ENERGY
ASSESSMENT

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	B133228	Issued on Date	09/04/2020
Assessment Reference	19% reduction	Prop Type Ref	
Property	Proposed new dwelling, 57, Camden Mews, LONDON, NW1 9BY		

SAP Rating	87 B	DER	12.23	TER	15.58
Environmental	88 B	% DER<TER	21.48		
CO ₂ Emissions (t/year)	1.92	DFEE	43.80	TFEE	60.84
General Requirements Compliance	Pass	% DFEE<TFEE	28.01		

Assessor Details	Ms. Jennifer Bantin, Elmhurst Energy Consultancy, Tel: 01455 883259, Jennifer.Bantin@elmhurstenergy.co.uk	Assessor ID	A385-0001
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Client	
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SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	4
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	
	Basement:	21.00 m	54.00 m ²	2.40 m
	1st Storey:	20.00 m	56.86 m ²	2.66 m
	2nd Storey:	12.60 m	52.55 m ²	2.78 m
	3rd Storey:	16.20 m	31.38 m ²	2.60 m

7.0 Living Area	54.00	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction			
External Wall 1 basement	Cavity Wall	Other	0.16	124.05	79.48
	Cavity Wall	Other	0.16	56.70	56.70

9.1 Party Walls			U-Value (W/m ² K)	Area (m ²)
Description	Type	Construction		
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	145.44

10.0 External Roofs			U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction			
Basement roof	External Flat Roof	Plasterboard, insulated flat roof	0.10	3.15	0.45
Flat roof	External Flat Roof	Plasterboard, insulated flat roof	0.10	56.86	50.57

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA

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Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Basement floor	Basement Floor	Other	0.10	54.00
Lobby floor	Ground Floor - Timber	Suspended timber, insulation between joists	0.10	4.41

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.90	1.20
Opening Type 2	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.90	1.20
Opening Type 3	Manufacturer	Solid Door							1.00

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	Roof Window	[1] Basement roof	Horizontal	None						2.70	
Opening 2	Window	[1] External Wall 1	South East	None	0.00					18.56	
Opening 3	Window	[1] External Wall 1	South West	None	0.00					3.16	
Opening 4	Roof Window	[2] Flat roof	Horizontal	None						6.29	
Opening 5	Window	[1] External Wall 1	North West	None	0.00					20.87	
Opening 6	Solid Door	[1] External Wall 1	South East							1.98	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

User Input

17.1 List of Bridges

Bridge Type	Length	Imported
E2 Other lintels (including other steel lintels)	24.45	Yes
E3 Sill	8.90	No
E4 Jamb	40.40	Yes
E21 Exposed floor (inverted)	3.60	No
E22 Basement floor	21.00	No
E6 Intermediate floor within a dwelling	23.80	No
E24 Eaves (insulation at ceiling level - inverted)	21.40	No
E15 Flat roof with parapet	46.10	No
E16 Corner (normal)	25.90	No
E17 Corner (inverted – internal area greater than external area)	5.10	No
E18 Party wall between dwellings	10.10	No
E18 Party wall between dwellings	41.76	Yes
E25 Staggered party wall between dwellings	18.20	No
P6 Party wall - Ground floor (inverted)	12.00	No
P2 Party wall - Intermediate floor within a dwelling	41.50	No
P4 Party wall - Roof (insulation at ceiling level)	17.80	No
R1 Head of roof window	3.50	Yes
R2 Sill of roof window	3.50	Yes
R3 Jamb of roof window	22.60	Yes

Y-value

0.150

W/m²K

Description

default which is lower than calculated

18.0 Pressure Testing

Yes

Designed AP₅₀

4.00

m³/(h.m²) @ 50 Pa

Property Tested ?

SUMMARY FOR INPUT DATA

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As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500480
Configuration	5
MVHR Duct Insulated	Yes
Manufacturer SFP	0.72
Duct Type	Rigid
MVHR Efficiency	93.00
Wet Rooms	5

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				0
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	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Manufacturer	
Percentage of Heat	100	%
Main Heating	BGB	
SAP Code	102	
Efficiency (Sedbuk 2009)	89.5	%
Model Name	'A' rated boiler	
Manufacturer	tbc	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Burner Control	Modulating
Flue Type	None or Unknown
Fan Assisted Flue	No
Is MHS Pumped	Pump in heated space
Heat Emitter	Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Unknown
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	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	300.00
Loss	2.25
Pipes insulation	Fully insulated primary pipework

31.0 Thermal Store	None
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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	£46	B 88	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£327	A 94	

BASIC COMPLIANCE REPORT

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General Requirements Compliance	Pass	DFEE	43.80
		TFEE	60.84
		% DFEE<TFEE	28.01
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			A385-0001
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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)	15.58	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.23	kgCO ₂ /m ²	Pass
	-3.35 (-21.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.84	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.80	kWh/m ² /yr	
	-17.0 (-28.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated using user-specified γ -value of 0.150

3 Air permeability

Air permeability at 50 pascals	4.00 (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 manufacturer
tbc 'A' rated boiler

Pass

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.25 kWh/day
Permitted by DBSCG 2.86

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power

0.72

Maximum

1.5

Pass

MVHR efficiency

93 %

Minimum

70 %

Pass

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 South East

18.56 m², No overhang

Windows facing South West

3.16 m², No overhang

Windows facing North West

20.87 m², No overhang

Air change rate

8.00 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

4.00 (design value)

Maximum

10.0

Pass

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.10	W/m ² K
Floor U-value	0.10	W/m ² K
Door U-value	1.00	W/m ² K

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

THERMAL BRIDGING

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Client	
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)		0.050	24.45	1.22	
External wall	E3 Sill		0.040	8.90	0.36	
External wall	E4 Jamb		0.050	40.40	2.02	
External wall	E21 Exposed floor (inverted)		0.320	3.60	1.15	
External wall	E22 Basement floor		0.070	21.00	1.47	
External wall	E6 Intermediate floor within a dwelling		0.070	23.80	1.67	
External wall	E24 Eaves (insulation at ceiling level - inverted)		0.240	21.40	5.14	
External wall	E15 Flat roof with parapet		0.560	46.10	25.82	
External wall	E16 Corner (normal)		0.090	25.90	2.33	
External wall	E17 Corner (inverted – internal area greater than external area)		-0.090	5.10	-0.46	
External wall	E18 Party wall between dwellings		0.060	10.10	0.61	
External wall	E18 Party wall between dwellings		0.060	41.76	2.51	
External wall	E25 Staggered party wall between dwellings		0.120	18.20	2.18	
Party wall	P6 Party wall - Ground floor (inverted)		0.070	12.00	0.84	
Party wall	P2 Party wall - Intermediate floor within a dwelling		0.000	41.50	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)		0.240	17.80	4.27	
External roof	R1 Head of roof window		0.080	3.50	0.28	
External roof	R2 Sill of roof window		0.060	3.50	0.21	
External roof	R3 Jamb of roof window		0.080	22.60	1.81	

Total: **53.42** W/mK:
Y-Value: **0.150** W/m²K:

FULL SAP CALCULATION PRINTOUT

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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

Mid-Terrace House, total floor area 195 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) 15.58 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 43.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.150

3 Air permeability

Air permeability at 50 pascals:	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from manufacturer

tbc 'A' rated boiler

Efficiency: 89.5% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.25 kWh/day	
Permitted by DBSCG 2.86	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power:	0.72	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing South East:	18.56 m ² , No overhang
Windows facing South West:	3.16 m ² , No overhang
Windows facing North West:	20.87 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key Features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.10 W/m ² K
Floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K

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)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
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							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50								Yes				
Infiltration rate								4.0000				
Number of sides sheltered								0.2000 (18)				
Shelter factor								2 (19)				
Infiltration rate adjusted to include shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
							(21) = (18) x (20) =	0.1700 (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)
	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.3215	0.3173	0.3130	0.2918	0.2875	0.2663	0.2663	0.2620	0.2748	0.2875	0.2960	0.3045 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)					
Opening Type 3			1.9800	1.0000	1.9800		(26)					
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)					
Basement floor			54.0000	0.1000	5.4000		(28)					
Lobby floor			4.4100	0.1000	0.4410		(28a)					
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)					
basement	56.7000		56.7000	0.1600	9.0720		(29a)					
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)					
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)					
Total net area of external elements Aum(A, m2)			299.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7729		(33)					
Party Wall 1			145.4400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)					
Total fabric heat loss						(33) + (36) =	138.6484 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.9519	Feb 53.2387	Mar 52.5255	Apr 48.9595	May 48.2463	Jun 44.6802	Jul 44.6802	Aug 43.9670	Sep 46.1067	Oct 48.2463	Nov 49.6727	Dec 51.0991 (38)
Heat transfer coeff	192.6003	191.8871	191.1739	187.6078	186.8946	183.3286	183.3286	182.6154	184.7550	186.8946	188.3211	189.7475 (39)
Average = Sum(39)m / 12 =												187.4295 (39)
HLP	Jan 0.9888	Feb 0.9851	Mar 0.9814	Apr 0.9631	May 0.9595	Jun 0.9412	Jul 0.9412	Aug 0.9375	Sep 0.9485	Oct 0.9595	Nov 0.9668	Dec 0.9741 (40)
HLP (average)												0.9622 (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	2.9951 (42)
Average daily hot water use (litres/day)	105.3345 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680	(44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071	(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													1657.3222
	25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:													
Store volume													300.0000
a) If manufacturer declared loss factor is known (kWh/day):													2.2500
Temperature factor from Table 2b													0.5400
Enter (49) or (54) in (55)													1.2150
Total storage loss													
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage													
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(64)
Heat gains from water heating, kWh/month	105.8750	93.9939	100.3054	92.1239	91.8766	84.3916	83.2336	88.3216	87.2220	95.4191	98.1214	104.0723	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.6351	28.9862	23.5732	17.8464	13.3404	11.2625	12.1696	15.8184	21.2315	26.9583	31.4643	33.5421	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	366.0666	369.8652	360.2928	339.9142	314.1900	290.0128	273.8610	270.0624	279.6348	300.0133	325.7376	349.9147	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	(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)													
	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)													
	142.3051	139.8719	134.8191	127.9499	123.4901	117.2105	111.8731	118.7118	121.1416	128.2515	136.2797	139.8821	(72)
Total internal gains	611.9339	609.6504	589.6121	556.6376	521.9476	489.4130	468.8307	475.5197	492.9350	526.1501	564.4086	594.2660	(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	
Southeast					18.5600	36.7938		0.6300	0.9000	0.7700		268.3300 (77)	
Southwest					3.1600	36.7938		0.6300	0.9000	0.7700		45.6855 (79)	
Northwest					20.8700	11.2829		0.6300	0.9000	0.7700		92.5254 (81)	
Horizontal					8.9900	26.0000		0.6300	0.9000	1.0000		119.2775 (82)	
Solar gains	525.8185	970.9531	1511.5873	2152.2102	2645.5911	2724.4655	2586.2830	2206.7442	1733.4885	1124.1071	643.9299	440.6323 (83)	
Total gains	1137.7523	1580.6034	2101.1994	2708.8478	3167.5387	3213.8785	3055.1138	2682.2639	2226.4235	1650.2572	1208.3385	1034.8983 (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	70.2340	70.4950	70.7580	72.1030	72.3781	73.7860	73.7860	74.0742	73.2163	72.3781	71.8299	71.2899		
alpha	5.6823	5.6997	5.7172	5.8069	5.8252	5.9191	5.9191	5.9383	5.8811	5.8252	5.7887	5.7527		
util living area	0.9982	0.9892	0.9412	0.7685	0.5411	0.3645	0.2640	0.3130	0.5632	0.9135	0.9938	0.9990	(86)	
MIT	20.1770	20.3834	20.6561	20.8827	20.9443	20.9533	20.9540	20.9540	20.9459	20.7899	20.4230	20.1481	(87)	
Th 2	20.0927	20.0958	20.0988	20.1142	20.1172	20.1327	20.1327	20.1357	20.1265	20.1172	20.1111	20.1050	(88)	
util rest of house														
	0.9977	0.9858	0.9254	0.7280	0.4924	0.3154	0.2120	0.2543	0.4958	0.8835	0.9915	0.9986	(89)	
MIT 2	18.9823	19.2846	19.6711	19.9733	20.0415	20.0650	20.0653	20.0686	20.0535	19.8729	19.3562	18.9499	(90)	
Living area fraction														
MIT	19.3135	19.5892	19.9442	20.2254	20.2917	20.3112	20.3117	20.3140	20.3009	20.1271	19.6520	19.2821	(92)	
Temperature adjustment														
adjusted MIT	19.1635	19.4392	19.7942	20.0754	20.1417	20.1612	20.1617	20.1640	20.1509	19.9771	19.5020	19.1321	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9826	0.9191	0.7261	0.4937	0.3170	0.2137	0.2562	0.4977	0.8779	0.9892	0.9981	(94)
Useful gains	1134.1224	1553.1211	1931.1445	1966.8784	1563.9380	1018.7539	652.9035	687.2138	1108.1681	1448.7008	1195.3347	1032.8949	(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	2862.7172	2789.8866	2541.4988	2096.5899	1577.7149	1019.5327	652.9589	687.3713	1117.9355	1752.5323	2335.5485	2833.3270	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	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	1286.0745	831.1064	454.1036	93.3923	10.2500	0.0000	0.0000	0.0000	0.0000	226.0507	820.9539	1339.5215 (98)
Space heating												5061.4528 (98)
Space heating per m2										(98) / (4) =		25.9842 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5413.3185 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1286.0745	831.1064	454.1036	93.3923	10.2500	0.0000	0.0000	0.0000	0.0000	226.0507	820.9539	1339.5215 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1375.4808	888.8838	485.6723	99.8848	10.9626	0.0000	0.0000	0.0000	0.0000	241.7654	878.0256	1432.6433 (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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345 (64)
Efficiency of water heater (217)m	88.6778	88.1583	86.7505	82.9866	80.2843	79.8000	79.8000	79.8000	79.8000	85.1235	88.0744	79.8000 (216)
Fuel for water heating, kWh/month	262.4740	232.8921	248.9963	233.9689	237.4760	214.1702	206.3430	225.5188	224.8374	236.4916	240.9331	256.0852 (219)
Water heating fuel used												2820.1868 (219)
Annual totals kWh/year												
Space heating fuel - main system												5413.3185 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)												
mechanical ventilation fans (SFP = 0.9000)												558.3600 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kWh/year												588.3600 (231)
Electricity for lighting (calculated in Appendix L)												576.3461 (232)
Total delivered energy for all uses												9398.2114 (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	5413.3185	0.2160	1169.2768 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2820.1868	0.2160	609.1603 (264)
Space and water heating			1778.4371 (265)
Pumps and fans	588.3600	0.5190	305.3588 (267)
Energy for lighting	576.3461	0.5190	299.1236 (268)
Total CO2, kg/year			2382.9196 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2300 (273)

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

DER			12.2300 ZC1
Total Floor Area		TFA	194.7900
Assumed number of occupants		N	2.9951
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			11.1363 ZC2
CO2 emissions from cooking, equation (L16)			0.9799 ZC3
Total CO2 emissions			24.3462 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			24.3462 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)
Basement floor	54.0000 (1a)	x 2.4000 (2a)	= 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x 2.6600 (2b)	= 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x 2.7800 (2c)	= 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x 2.6000 (2d)	= 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 508.5246 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0787 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3287 (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) =	0.2794 (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	0.3562	0.3492	0.3422	0.3073	0.3003	0.2654	0.2654	0.2584	0.2794	0.3003	0.3143	0.3282 (22b)
Effective ac	0.5634	0.5610	0.5586	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Opening Type (Uw = 1.40)			38.5700	1.3258	51.1345		(27)
TER Room Window (Uw = 1.70)			8.1500	1.5918	12.9728		(27a)
Basement floor			54.0000	0.1300	7.0200		(28)
Lobby floor			4.4100	0.1300	0.5733		(28a)
External Wall 1	124.0500	40.5500	83.5000	0.1800	15.0300		(29a)
basement	56.7000		56.7000	0.1800	10.2060		(29a)
Basement roof	3.1500	2.4500	0.7000	0.1300	0.0910		(30)
Flat roof	56.8600	5.7000	51.1600	0.1300	6.6508		(30)
Total net area of external elements Aum(A, m ²)			299.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	105.6584		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 48.6111 (36)
Total fabric heat loss (33) + (36) = 154.2695 (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	94.5515	94.1382	93.7330	91.8299	91.4739	89.8163	89.8163	89.5094	90.4548	91.4739	92.1942	92.9472 (38)
Heat transfer coeff	248.8211	248.4077	248.0025	246.0994	245.7434	244.0859	244.0859	243.7789	244.7243	245.7434	246.4637	247.2167 (39)
Average = Sum(39)m / 12 =												246.0977 (39)
HLP	1.2774	1.2753	1.2732	1.2634	1.2616	1.2531	1.2531	1.2515	1.2563	1.2616	1.2653	1.2691 (40)
HLP (average)												1.2634 (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												2.9951 (42)
Average daily hot water use (litres/day)												105.3345 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680 (44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071 (45)
Energy content (annual)										Total = Sum(45)m =		1657.3222 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m												
25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss												
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage												
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
230.4577	203.2377	213.7070	191.9385	188.3573	168.6834	162.3631	177.6654	177.1958	199.0113	209.9760	225.0359	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
230.4577	203.2377	213.7070	191.9385	188.3573	168.6834	162.3631	177.6654	177.1958	199.0113	209.9760	225.0359	(64)
Heat gains from water heating, kWh/month												
104.0361	92.3330	98.4666	90.3444	90.0378	82.6120	81.3947	86.4827	85.4424	93.5802	96.3418	102.2334	(65)
Total per year (kWh/year) = Sum(64)m =												2347.6292 (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	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6351	28.9862	23.5732	17.8464	13.3404	11.2625	12.1696	15.8184	21.2315	26.9583	31.4643	33.5421	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.0666	369.8652	360.2928	339.9142	314.1900	290.0128	273.8610	270.0624	279.6348	300.0133	325.7376	349.9147	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	(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)	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)	139.8335	137.4003	132.3475	125.4783	121.0185	114.7389	109.4015	116.2402	118.6700	125.7799	133.8081	137.4105	(72)
Total internal gains	609.4623	607.1788	587.1405	554.1660	519.4760	486.9414	466.3591	473.0481	490.4634	523.6785	561.9370	591.7944	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Southeast	16.8000	36.7938	0.6300	0.7000	0.7700	188.9105 (77)
Southwest	2.8600	36.7938	0.6300	0.7000	0.7700	32.1598 (79)
Northwest	18.9100	11.2829	0.6300	0.7000	0.7700	65.2057 (81)
Horizontal	8.1500	26.0000	0.6300	0.7000	1.0000	84.1031 (82)

Solar gains	370.3791	683.9683	1064.9004	1516.3341	1864.0288	1919.6332	1822.2588	1554.7894	1221.2701	791.8808	453.5832	310.3698	(83)
Total gains	979.8414	1291.1471	1652.0409	2070.5001	2383.5048	2406.5745	2288.6179	2027.8376	1711.7335	1315.5593	1015.5202	902.1642	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.3647	54.4552	54.5441	54.9659	55.0456	55.4194	55.4194	55.4891	55.2748	55.0456	54.8847	54.7175
alpha	4.6243	4.6303	4.6363	4.6644	4.6697	4.6946	4.6946	4.6993	4.6850	4.6697	4.6590	4.6478
util living area	0.9990	0.9964	0.9851	0.9359	0.8059	0.6164	0.4620	0.5372	0.8184	0.9776	0.9976	0.9994 (86)
MIT	19.5033	19.7212	20.0717	20.5087	20.8277	20.9627	20.9922	20.9848	20.8640	20.4001	19.8606	19.4655 (87)
Th 2	19.8586	19.8603	19.8619	19.8696	19.8711	19.8778	19.8778	19.8790	19.8752	19.8711	19.8681	19.8651 (88)
util rest of house	0.9987	0.9951	0.9797	0.9131	0.7466	0.5217	0.3479	0.4142	0.7372	0.9660	0.9965	0.9991 (89)
MIT 2	17.8622	18.1816	18.6910	19.3098	19.7129	19.8551	19.8752	19.8733	19.7703	19.1738	18.3915	17.8114 (90)
Living area fraction									fLA = Living area / (4) =			0.2772 (91)
MIT	18.3171	18.6084	19.0738	19.6421	20.0219	20.1621	20.1848	20.1814	20.0735	19.5137	18.7988	18.2700 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3171	18.6084	19.0738	19.6421	20.0219	20.1621	20.1848	20.1814	20.0735	19.5137	18.7988	18.2700 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9930	0.9746	0.9075	0.7553	0.5467	0.3797	0.4484	0.7535	0.9609	0.9950	0.9986	(94)
Useful gains	977.8531	1282.1186	1610.0231	1878.9154	1800.3130	1315.7582	869.0588	909.3217	1289.8206	1264.1145	1010.4171	900.9022	(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													
	3487.7521	3405.2706	3118.3308	2643.6364	2045.0637	1357.6352	875.0057	921.8335	1461.8609	2190.4867	2883.3294	3478.3349	(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													
	1867.3648	1426.7581	1122.1810	550.5991	182.0945	0.0000	0.0000	0.0000	0.0000	689.2209	1348.4969	1917.6099	(98)
Space heating													
Space heating per m2													(98) / (4) = 46.7392 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)																		0.0000 (201)
Fraction of space heat from main system(s)																		1.0000 (202)
Efficiency of main space heating system 1 (in %)																		93.5000 (206)
Efficiency of secondary/supplementary heating system, %																		0.0000 (208)
Space heating requirement																		9737.2463 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Space heating requirement	1867.3648	1426.7581	1122.1810	550.5991	182.0945	0.0000	0.0000	0.0000	0.0000	689.2209	1348.4969	1917.6099	(98)					
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)					
Space heating fuel (main heating system)	1997.1816	1525.9445	1200.1935	588.8761	194.7535	0.0000	0.0000	0.0000	0.0000	737.1347	1442.2427	2050.9197	(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	230.4577	203.2377	213.7070	191.9385	188.3573	168.6834	162.3631	177.6654	177.1958	199.0113	209.9760	225.0359	(64)					
Efficiency of water heater (217)m	89.1863	89.0119	88.5995	87.4684	84.7239	79.8000	79.8000	79.8000	79.8000	87.8605	88.8941	89.2432	(216)					
Fuel for water heating, kWh/month	258.4003	228.3265	241.2056	219.4376	222.3191	211.3827	203.4625	222.6384	222.0499	226.5084	236.2093	252.1602	(219)					
Water heating fuel used												2744.1004	(219)					
Annual totals kWh/year																		
Space heating fuel - main system												9737.2463	(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)												576.3461	(232)					
Total delivered energy for all uses												13132.6929	(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	9737.2463	0.2160	2103.2452 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2744.1004	0.2160	592.7257 (264)
Space and water heating			2695.9709 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.3461	0.5190	299.1236 (268)
Total CO2, kg/m2/year			3034.0195 (272)
Emissions per m2 for space and water heating			13.8404 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5356 (272b)
Emissions per m2 for pumps and fans			0.1998 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8404 * 1.00) + 1.5356 + 0.1998, rounded to 2 d.p.			15.5800 (273)

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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)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0787 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2787 (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) =	0.2369 (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	0.3020	0.2961	0.2902	0.2605	0.2546	0.2250	0.2250	0.2191	0.2369	0.2546	0.2665	0.2783 (22b)
Effective ac	0.5456	0.5438	0.5421	0.5339	0.5324	0.5253	0.5253	0.5240	0.5281	0.5324	0.5355	0.5387 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)
Opening Type 3			1.9800	1.0000	1.9800		(26)
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)
Basement floor			54.0000	0.1000	5.4000		(28)
Lobby floor			4.4100	0.1000	0.4410		(28a)
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)
basement	56.7000		56.7000	0.1600	9.0720		(29a)
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)
Total net area of external elements Aum(A, m ²)			299.1700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.7729		(33)
Party Wall 1			145.4400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)
Total fabric heat loss						(33) + (36) =	138.6484 (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	91.5590	91.2618	90.9706	89.6025	89.3465	88.1550	88.1550	87.9343	88.6139	89.3465	89.8643	90.4057 (38)
Heat transfer coeff	230.2074	229.9102	229.6189	228.2509	227.9949	226.8033	226.8033	226.5827	227.2623	227.9949	228.5127	229.0541 (39)
Average = Sum(39)m / 12 =												228.2496 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1818	1.1803	1.1788	1.1718	1.1705	1.1643	1.1643	1.1632	1.1667	1.1705	1.1731	1.1759 (40)
HLP (average)												1.1718 (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												2.9951 (42)
Average daily hot water use (litres/day)												105.3345 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680 (44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071 (45)

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Energy content (annual)	Total = Sum(45)m = 1657.3222 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.5136	31.9351	32.9541	28.7302	27.5673	23.7885	22.0435	25.2953	25.5974	29.8313	32.5632	35.3615 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6351	28.9862	23.5732	17.8464	13.3404	11.2625	12.1696	15.8184	21.2315	26.9583	31.4643	33.5421	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.0666	369.8652	360.2928	339.9142	314.1900	290.0128	273.8610	270.0624	279.6348	300.0133	325.7376	349.9147	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	(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)	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)	49.0775	47.5224	44.2932	39.9031	37.0528	33.0396	29.6284	33.9990	35.5519	40.0958	45.2266	47.5289	(72)
Total internal gains	515.7062	514.3009	496.0862	465.5908	432.5103	402.2420	383.5860	387.8069	404.3453	434.9945	470.3555	498.9128	(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			
Southeast				18.5600	36.7938	0.6300	0.9000	0.7700	268.3300 (77)			
Southwest				3.1600	36.7938	0.6300	0.9000	0.7700	45.6855 (79)			
Northwest				20.8700	11.2829	0.6300	0.9000	0.7700	92.5254 (81)			
Horizontal				8.9900	26.0000	0.6300	0.9000	1.0000	119.2775 (82)			
Solar gains	525.8185	970.9531	1511.5873	2152.2102	2645.5911	2724.4655	2586.2830	2206.7442	1733.4885	1124.1071	643.9299	440.6323 (83)
Total gains	1041.5247	1485.2539	2007.6735	2617.8010	3078.1014	3126.7075	2969.8691	2594.5511	2137.8338	1559.1015	1114.2854	939.5452 (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	58.7604	58.8364	58.9110	59.2641	59.3306	59.6423	59.6423	59.7004	59.5219	59.3306	59.1962	59.0563	
alpha	4.9174	4.9224	4.9274	4.9509	4.9554	4.9762	4.9762	4.9800	4.9681	4.9554	4.9464	4.9371	
util living area	0.9988	0.9933	0.9654	0.8534	0.6509	0.4587	0.3350	0.3991	0.6838	0.9533	0.9963	0.9993	(86)
MIT	19.6558	19.9325	20.3328	20.7466	20.9439	20.9917	20.9986	20.9968	20.9489	20.5749	20.0080	19.6039	(87)
Th 2	19.9346	19.9358	19.9370	19.9426	19.9437	19.9486	19.9486	19.9495	19.9467	19.9437	19.9416	19.9393	(88)
util rest of house	0.9984	0.9910	0.9544	0.8158	0.5888	0.3858	0.2555	0.3094	0.5980	0.9324	0.9948	0.9990	(89)
MIT 2	18.7077	18.9840	19.3762	19.7578	19.9115	19.9454	19.9483	19.9488	19.9226	19.6187	19.0649	18.6597	(90)
Living area fraction	18.9705	19.2470	19.6414	20.0319	20.1977	20.2355	20.2395	20.2393	20.2071	19.8838	19.3264	18.9215	(91)
MIT	18.9705	19.2470	19.6414	20.0319	20.1977	20.2355	20.2395	20.2393	20.2071	19.8838	19.3264	18.9215	(92)
Temperature adjustment	18.9705	19.2470	19.6414	20.0319	20.1977	20.2355	20.2395	20.2393	20.2071	19.8838	19.3264	18.9215	(93)
adjusted MIT	18.9705	19.2470	19.6414	20.0319	20.1977	20.2355	20.2395	20.2393	20.2071	19.8838	19.3264	18.9215	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1039.3081	1469.0319	1908.5865	2144.7980	1860.1158	1269.2880	824.4264	867.4100	1326.3042	1451.3884	1107.1541	938.3111	(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	3377.2681	3298.5131	3017.5056	2540.8722	1937.4332	1278.1416	825.4462	869.9178	1387.9075	2116.6517	2793.8765	3372.0148	(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	1739.4423	1229.4113	825.0358	285.1735	57.5241	0.0000	0.0000	0.0000	0.0000	494.9559	1214.4401	1810.6756	(98)
Space heating												7656.6586	(98)
Space heating per m2												39.3072	(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													

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2131.9514	1678.3447	1722.0284	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9698	0.9858	0.9739	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2067.6250	1654.4493	1677.0561	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	3639.4539	3461.2110	3050.2024	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	1131.7169	1344.2307	1021.6209	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			3497.5684 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	282.9292	336.0577	255.4052	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												874.3921 (107)
Energy for space heating												4.4889 (108)
Energy for space cooling												39.3072 (99)
Total												4.4889 (108)
Dwelling Fabric Energy Efficiency (DFEE)												43.7961 (109)
												43.8 (109)

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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)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0787 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3287 (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) =	0.2794 (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	0.3562	0.3492	0.3422	0.3073	0.3003	0.2654	0.2654	0.2584	0.2794	0.3003	0.3143	0.3282 (22b)
Effective ac	0.5634	0.5610	0.5586	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Opening Type (Uw = 1.40)			38.5700	1.3258	51.1345		(27)
TER Room Window (Uw = 1.70)			8.1500	1.5918	12.9728		(27a)
Basement floor			54.0000	0.1300	7.0200		(28)
Lobby floor			4.4100	0.1300	0.5733		(28a)
External Wall 1	124.0500	40.5500	83.5000	0.1800	15.0300		(29a)
basement	56.7000		56.7000	0.1800	10.2060		(29a)
Basement roof	3.1500	2.4500	0.7000	0.1300	0.0910		(30)
Flat roof	56.8600	5.7000	51.1600	0.1300	6.6508		(30)
Total net area of external elements Aum(A, m ²)			299.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	105.6584		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 48.6111 (36)
Total fabric heat loss (33) + (36) = 154.2695 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 94.5515	Feb 94.1382	Mar 93.7330	Apr 91.8299	May 91.4739	Jun 89.8163	Jul 89.8163	Aug 89.5094	Sep 90.4548	Oct 91.4739	Nov 92.1942	Dec 92.9472 (38)
Heat transfer coeff	248.8211	248.4077	248.0025	246.0994	245.7434	244.0859	244.0859	243.7789	244.7243	245.7434	246.4637	247.2167 (39)
Average = Sum(39)m / 12 =												246.0977 (39)
HLP	Jan 1.2774	Feb 1.2753	Mar 1.2732	Apr 1.2634	May 1.2616	Jun 1.2531	Jul 1.2531	Aug 1.2515	Sep 1.2563	Oct 1.2616	Nov 1.2653	Dec 1.2691 (40)
HLP (average)												1.2634 (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												2.9951 (42)
Average daily hot water use (litres/day)												105.3345 (43)
Daily hot water use	Jan 115.8680	Feb 111.6546	Mar 107.4412	Apr 103.2278	May 99.0144	Jun 94.8011	Jul 94.8011	Aug 99.0144	Sep 103.2278	Oct 107.4412	Nov 111.6546	Dec 115.8680 (44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071 (45)
Energy content (annual)										Total = Sum(45)m =		1657.3222 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.5136	31.9351	32.9541	28.7302	27.5673	23.7885	22.0435	25.2953	25.5974	29.8313	32.5632	35.3615 (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	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569	149.7569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6351	28.9862	23.5732	17.8464	13.3404	11.2625	12.1696	15.8184	21.2315	26.9583	31.4643	33.5421 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.0666	369.8652	360.2928	339.9142	314.1900	290.0128	273.8610	270.0624	279.6348	300.0133	325.7376	349.9147 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757	37.9757 (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)	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055 (71)
Water heating gains (Table 5)	49.0775	47.5224	44.2932	39.9031	37.0528	33.0396	29.6284	33.9990	35.5519	40.0958	45.2266	47.5289 (72)
Total internal gains	515.7062	514.3009	496.0862	465.5908	432.5103	402.2420	383.5860	387.8069	404.3453	434.9945	470.3555	498.9128 (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	
Southeast					16.8000	36.7938	0.6300	0.7000	0.7700		188.9105 (77)	
Southwest					2.8600	36.7938	0.6300	0.7000	0.7700		32.1598 (79)	
Northwest					18.9100	11.2829	0.6300	0.7000	0.7700		65.2057 (81)	
Horizontal					8.1500	26.0000	0.6300	0.7000	1.0000		84.1031 (82)	
Solar gains	370.3791	683.9683	1064.9004	1516.3341	1864.0288	1919.6332	1822.2588	1554.7894	1221.2701	791.8808	453.5832	310.3698 (83)
Total gains	886.0853	1198.2692	1560.9865	1981.9249	2296.5391	2321.8752	2205.8449	1942.5964	1625.6154	1226.8752	923.9387	809.2826 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.3647	54.4552	54.5441	54.9659	55.0456	55.4194	55.4194	55.4891	55.2748	55.0456	54.8847	54.7175
alpha	4.6243	4.6303	4.6363	4.6644	4.6697	4.6946	4.6946	4.6993	4.6850	4.6697	4.6590	4.6478
util living area	0.9994	0.9974	0.9881	0.9444	0.8216	0.6345	0.4782	0.5580	0.8394	0.9828	0.9984	0.9996 (86)
MIT	19.4593	19.6781	20.0316	20.4775	20.8117	20.9580	20.9910	20.9823	20.8467	20.3621	19.8178	19.4218 (87)
Th 2	19.8586	19.8603	19.8619	19.8696	19.8711	19.8778	19.8778	19.8790	19.8752	19.8711	19.8681	19.8651 (88)
util rest of house	0.9992	0.9964	0.9836	0.9239	0.7642	0.5387	0.3607	0.4315	0.7620	0.9736	0.9977	0.9995 (89)
MIT 2	18.4516	18.6713	19.0233	19.4593	19.7516	19.8601	19.8757	19.8744	19.7926	19.3589	18.8174	18.4193 (90)
Living area fraction									fLA = Living area / (4) =			0.2772 (91)
MIT	18.7309	18.9504	19.3028	19.7416	20.0454	20.1644	20.1849	20.1815	20.0848	19.6370	19.0947	18.6972 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7309	18.9504	19.3028	19.7416	20.0454	20.1644	20.1849	20.1815	20.0848	19.6370	19.0947	18.6972 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9988	0.9953	0.9807	0.9211	0.7741	0.5644	0.3935	0.4669	0.7786	0.9710	0.9969	0.9992 (94)
Useful gains	885.0517	1192.6832	1530.9300	1825.5201	1777.6633	1310.4703	868.1055	907.0541	1265.6717	1191.2699	921.1187	808.6613 (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	3590.7201	3490.2296	3175.1316	2668.1079	2050.8369	1358.2000	875.0183	921.8516	1464.6304	2220.7851	2956.2647	3583.9500 (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	2013.0173	1543.9512	1223.2860	606.6632	203.2412	0.0000	0.0000	0.0000	0.0000	765.9593	1465.3051	2064.8148 (98)
Space heating												9886.2381 (98)
Space heating per m2										(98) / (4) =		50.7533 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
	0.0000	0.0000	0.0000	0.0000	0.0000	2294.4071	1806.2354	1852.7197	0.0000	0.0000	0.0000	0.0000 (100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8894	0.9377	0.9036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2040.5736	1693.7813	1674.1322	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2744.4219	2611.3643	2324.0369	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	506.7707	682.6817	483.5291	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1672.9816 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	126.6927	170.6704	120.8823	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												418.2454 (107)
Space cooling per m2												2.1472 (108)
Energy for space heating												50.7533 (99)
Energy for space cooling												2.1472 (108)
Total												52.9005 (109)
Target Fabric Energy Efficiency (TFEE)												60.8 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
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							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50							Yes	4.0000				
Infiltration rate								0.2000 (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) =		0.1700 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.5000	3.4000	3.4000	3.7000	3.6000	4.0000 (22)
Adj infilt rate	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8750	0.8500	0.8500	0.9250	0.9000	1.0000 (22a)
	0.1828	0.1743	0.1743	0.1615	0.1658	0.1445	0.1488	0.1445	0.1445	0.1573	0.1530	0.1700 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.2875	0.2790	0.2790	0.2663	0.2705	0.2493	0.2535	0.2493	0.2493	0.2620	0.2578	0.2748 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)					
Opening Type 3			1.9800	1.0000	1.9800		(26)					
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)					
Basement floor			54.0000	0.1000	5.4000		(28)					
Lobby floor			4.4100	0.1000	0.4410		(28a)					
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)					
basement	56.7000		56.7000	0.1600	9.0720		(29a)					
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)					
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)					
Total net area of external elements Aum(A, m2)			299.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.7729		(33)					
Party Wall 1			145.4400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)					
Total fabric heat loss						(33) + (36) =	138.6484 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.2463	Feb 46.8199	Mar 46.8199	Apr 44.6802	May 45.3934	Jun 41.8274	Jul 42.5406	Aug 41.8274	Sep 41.8274	Oct 43.9670	Nov 43.2538	Dec 46.1067 (38)
Heat transfer coeff	186.8946	185.4682	185.4682	183.3286	184.0418	180.4758	181.1890	180.4758	180.4758	182.6154	181.9022	184.7550 (39)
Average = Sum(39)m / 12 =												183.0909 (39)
HLP	Jan 0.9595	Feb 0.9521	Mar 0.9521	Apr 0.9412	May 0.9448	Jun 0.9265	Jul 0.9302	Aug 0.9265	Sep 0.9265	Oct 0.9375	Nov 0.9338	Dec 0.9485 (40)
HLP (average)												0.9399 (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	2.9951 (42)
Average daily hot water use (litres/day)	105.3345 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680	(44)
Energy content (annual)	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071	(45)
Distribution loss (46)m = 0.15 x (45)m													1657.3222 (45)
Total = Sum (45)m =													
Distribution loss (46)m = 0.15 x (45)m	25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.2150 (55)
Total storage loss													
37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage													
37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	227.3345	(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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(64)
Total per year (kWh/year) = Sum(64)m =													2374.6932 (64)
RHI water heating demand													2375 (64)
Heat gains from water heating, kWh/month													
105.8750	93.9939	100.3054	92.1239	91.8766	84.3916	83.2336	88.3216	87.2220	95.4191	98.1214	104.0723	104.0723	(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	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
81.5878	72.4655	58.9329	44.6160	33.3510	28.1563	30.4239	39.5461	53.0787	67.3956	78.6607	83.8553	83.8553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
546.3680	552.0376	537.7504	507.3347	468.9403	432.8550	408.7478	403.0782	417.3654	447.7811	486.1755	522.2608	522.2608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	(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)													
-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)													
142.3051	139.8719	134.8191	127.9499	123.4901	117.2105	111.8731	118.7118	121.1416	128.2515	136.2797	139.8821	139.8821	(72)
Total internal gains	889.1296	883.2438	850.3712	798.7693	744.6501	697.0906	669.9135	680.2049	710.4545	762.2969	819.9846	864.8669	(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
Southeast					18.5600	39.0225	0.6300	0.9000			0.7700			284.5831 (77)
Southwest					3.1600	39.0225	0.6300	0.9000			0.7700			48.4527 (79)
Northwest					20.8700	12.4885	0.6300	0.9000			0.7700			102.4116 (81)
Horizontal					8.9900	29.0000	0.6300	0.9000			1.0000			133.0403 (82)

Solar gains	568.4877	944.9984	1482.3124	2185.0358	2616.4136	2876.5981	2723.8771	2396.6645	1869.0112	1196.6545	719.4815			467.3606 (83)
Total gains	1457.6173	1828.2421	2332.6836	2983.8051	3361.0638	3573.6887	3393.7905	3076.8693	2579.4657	1958.9514	1539.4661	1332.2276	(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	72.3781	72.9348	72.9348	73.7860	73.5001	74.9523	74.6573	74.9523	74.9523	74.0742	74.3646	73.2163
alpha	5.8252	5.8623	5.8623	5.9191	5.9000	5.9968	5.9772	5.9968	5.9968	5.9383	5.9576	5.8811
util living area	0.9905	0.9681	0.8649	0.6219	0.4040	0.2222	0.1281	0.1525	0.3633	0.7534	0.9661	0.9938 (86)
MIT	20.4160	20.5809	20.8129	20.9349	20.9524	20.9546	20.9545	20.9546	20.9541	20.9117	20.6583	20.3827 (87)
Th 2	20.1172	20.1234	20.1234	20.1327	20.1296	20.1450	20.1419	20.1450	20.1450	20.1357	20.1388	20.1265 (88)
util rest of house												
	0.9874	0.9587	0.8344	0.5752	0.3570	0.1790	0.0823	0.1024	0.3038	0.6961	0.9541	0.9917 (89)
MIT 2	19.3499	19.5895	19.8996	20.0481	20.0611	20.0786	20.0753	20.0786	20.0784	20.0316	19.7146	19.3096 (90)
Living area fraction												
MIT	19.6455	19.8643	20.1528	20.2940	20.3082	20.3214	20.3190	20.3215	20.3211	20.2756	19.9762	19.6071 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4955	19.7143	20.0028	20.1440	20.1582	20.1714	20.1690	20.1715	20.1711	20.1256	19.8262	19.4571 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9845	0.9533	0.8297	0.5758	0.3586	0.1804	0.0838	0.1039	0.3057	0.6954	0.9487	0.9896	(94)
Useful gains	1435.0627	1742.9448	1935.4761	1718.1779	1205.1404	644.5402	284.2892	319.7043	788.4345	1362.1588	1460.4924	1318.3613	(95)
Ext temp.	5.6000	6.1000	8.1000	10.6000	13.6000	16.6000	18.6000	18.4000	15.8000	12.3000	8.5000	5.6000	(96)
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	2596.9890	2525.0243	2207.5923	1749.6837	1206.9798	644.5585	284.2893	319.7046	788.8844	1429.0672	2060.2573	2560.1674	(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	864.4731	525.5574	202.4544	22.6842	1.3685	0.0000	0.0000	0.0000	0.0000	49.7798	431.8307	923.9037	(98)
RHI space heating demand												3022.0519	(98)
												3022	(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)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
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							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50							Yes	4.0000				
Infiltration rate								0.2000 (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) =		0.1700 (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)
	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.3215	0.3173	0.3130	0.2918	0.2875	0.2663	0.2663	0.2620	0.2748	0.2875	0.2960	0.3045 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)					
Opening Type 3			1.9800	1.0000	1.9800		(26)					
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)					
Basement floor			54.0000	0.1000	5.4000		(28)					
Lobby floor			4.4100	0.1000	0.4410		(28a)					
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)					
basement	56.7000		56.7000	0.1600	9.0720		(29a)					
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)					
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)					
Total net area of external elements Aum(A, m2)			299.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.7729		(33)					
Party Wall 1			145.4400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)					
Total fabric heat loss						(33) + (36) =	138.6484 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.9519	Feb 53.2387	Mar 52.5255	Apr 48.9595	May 48.2463	Jun 44.6802	Jul 44.6802	Aug 43.9670	Sep 46.1067	Oct 48.2463	Nov 49.6727	Dec 51.0991 (38)
Heat transfer coeff	192.6003	191.8871	191.1739	187.6078	186.8946	183.3286	183.3286	182.6154	184.7550	186.8946	188.3211	189.7475 (39)
Average = Sum(39)m / 12 =												187.4295 (39)
HLP	Jan 0.9888	Feb 0.9851	Mar 0.9814	Apr 0.9631	May 0.9595	Jun 0.9412	Jul 0.9412	Aug 0.9375	Sep 0.9485	Oct 0.9595	Nov 0.9668	Dec 0.9741 (40)
HLP (average)												0.9622 (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	2.9951 (42)
Average daily hot water use (litres/day)	105.3345 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680	(44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071	(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													1657.3222
	25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:													
Store volume													300.0000
a) If manufacturer declared loss factor is known (kWh/day):													2.2500
Temperature factor from Table 2b													0.5400
Enter (49) or (54) in (55)													1.2150
Total storage loss													
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage													
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(64)
Heat gains from water heating, kWh/month	105.8750	93.9939	100.3054	92.1239	91.8766	84.3916	83.2336	88.3216	87.2220	95.4191	98.1214	104.0723	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.5878	72.4655	58.9329	44.6160	33.3510	28.1563	30.4239	39.5461	53.0787	67.3956	78.6607	83.8553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	546.3680	552.0376	537.7504	507.3347	468.9403	432.8550	408.7478	403.0782	417.3654	447.7811	486.1755	522.2608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	(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)													
	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)													
	142.3051	139.8719	134.8191	127.9499	123.4901	117.2105	111.8731	118.7118	121.1416	128.2515	136.2797	139.8821	(72)
Total internal gains	889.1296	883.2438	850.3712	798.7693	744.6501	697.0906	669.9135	680.2049	710.4545	762.2969	819.9846	864.8669	(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		
Southeast					18.5600	36.7938	0.6300	0.9000	0.7700	268.3300 (77)		
Southwest					3.1600	36.7938	0.6300	0.9000	0.7700	45.6855 (79)		
Northwest					20.8700	11.2829	0.6300	0.9000	0.7700	92.5254 (81)		
Horizontal					8.9900	26.0000	0.6300	0.9000	1.0000	119.2775 (82)		
Solar gains	525.8185	970.9531	1511.5873	2152.2102	2645.5911	2724.4655	2586.2830	2206.7442	1733.4885	1124.1071	643.9299	440.6323 (83)
Total gains	1414.9481	1854.1968	2361.9585	2950.9795	3390.2412	3421.5561	3256.1965	2886.9491	2443.9430	1886.4040	1463.9145	1305.4993 (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	70.2340	70.4950	70.7580	72.1030	72.3781	73.7860	73.7860	74.0742	73.2163	72.3781	71.8299	71.2899		
alpha	5.6823	5.6997	5.7172	5.8069	5.8252	5.9191	5.9191	5.9383	5.8811	5.8252	5.7887	5.7527		
util living area	0.9947	0.9775	0.9101	0.7228	0.5075	0.3425	0.2477	0.2908	0.5161	0.8659	0.9845	0.9965	(86)	
MIT	20.2782	20.4763	20.7203	20.9018	20.9468	20.9535	20.9540	20.9541	20.9487	20.8371	20.5129	20.2479	(87)	
Th 2	20.0927	20.0958	20.0988	20.1142	20.1172	20.1327	20.1327	20.1357	20.1265	20.1172	20.1111	20.1050	(88)	
util rest of house	0.9930	0.9710	0.8887	0.6811	0.4612	0.2963	0.1989	0.2363	0.4531	0.8273	0.9789	0.9954	(89)	
MIT 2	19.1297	19.4169	19.7557	19.9940	20.0436	20.0651	20.0653	20.0686	20.0555	19.9292	19.4850	19.0955	(90)	
Living area fraction														
MIT	19.4481	19.7106	20.0231	20.2457	20.2940	20.3114	20.3117	20.3141	20.3031	20.1809	19.7700	19.4150	(92)	
Temperature adjustment														
adjusted MIT	19.2981	19.5606	19.8731	20.0957	20.1440	20.1614	20.1617	20.1641	20.1531	20.0309	19.6200	19.2650	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9663	0.8826	0.6802	0.4626	0.2978	0.2005	0.2381	0.4551	0.8230	0.9750	0.9940	(94)
Useful gains	1402.3320	1791.6299	2084.7598	2007.1216	1568.2695	1019.0063	652.9227	687.2744	1112.2017	1552.5143	1427.3095	1297.6472	(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	2888.6327	2813.1735	2556.5805	2100.3986	1578.1317	1019.5591	652.9613	687.3787	1118.3418	1762.5818	2357.7721	2858.5407	(97)

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Month fraction	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	1105.8078	686.4773	351.0346	67.1594	7.3375	0.0000	0.0000	0.0000	0.0000	156.2902	669.9331	1161.3048 (98)
Space heating												4205.3447 (98)
Space heating per m2											(98) / (4) =	21.5891 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4497.6949 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1105.8078	686.4773	351.0346	67.1594	7.3375	0.0000	0.0000	0.0000	0.0000	156.2902	669.9331	1161.3048 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1182.6821	734.2003	375.4381	71.8283	7.8476	0.0000	0.0000	0.0000	0.0000	167.1553	716.5060	1242.0372 (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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345 (64)
Efficiency of water heater	88.4380	87.7899	86.1021	82.3007	80.1512	79.8000	79.8000	79.8000	79.8000	84.1482	87.6722	79.8000 (216)
Fuel for water heating, kWh/month	263.1857	233.8694	250.8715	235.9188	237.8703	214.1702	206.3430	225.5188	224.8374	239.2324	242.0386	256.7124 (219)
Water heating fuel used												2830.5686 (219)
Annual totals kWh/year												
Space heating fuel - main system												4497.6949 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)												
mechanical ventilation fans (SFP = 0.9000)												558.3600 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kWh/year												588.3600 (231)
Electricity for lighting (calculated in Appendix L)												576.3461 (232)
Total delivered energy for all uses												8492.9696 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4497.6949	3.4800	156.5198 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2830.5686	3.4800	98.5038 (247)
Mechanical ventilation fans	558.3600	13.1900	73.6477 (249)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Energy for lighting	576.3461	13.1900	76.0200 (250)
Additional standing charges			120.0000 (251)
Total energy cost			528.6483 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.9259 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	87.0831
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	4497.6949	0.2160	971.5021 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2830.5686	0.2160	611.4028 (264)
Space and water heating			1582.9049 (265)
Pumps and fans	558.3600	0.5190	305.3588 (267)
Energy for lighting	576.3461	0.5190	299.1236 (268)
Total kg/year			2187.3874 (272)
CO2 emissions per m2			11.2300 (273)
EI value			87.7764
EI rating			88 (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	$3.48 \times (1 + 0.29 \times 0.25) / 0.9050 = 4.124$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9050 = 0.2560$, stars = 4
Water heating energy efficiency	$3.48 / 0.8370 = 4.158$, stars = 4
Water heating environmental impact	$0.216 / 0.8370 = 0.2581$, 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)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
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							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50							Yes	4.0000				
Infiltration rate								0.2000 (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) =		0.1700 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.5000	3.4000	3.4000	3.7000	3.6000	4.0000 (22)
Adj infilt rate	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8750	0.8500	0.8500	0.9250	0.9000	1.0000 (22a)
	0.1828	0.1743	0.1743	0.1615	0.1658	0.1445	0.1488	0.1445	0.1445	0.1573	0.1530	0.1700 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.2875	0.2790	0.2790	0.2663	0.2705	0.2493	0.2535	0.2493	0.2493	0.2620	0.2578	0.2748 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)					
Opening Type 3			1.9800	1.0000	1.9800		(26)					
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)					
Basement floor			54.0000	0.1000	5.4000		(28)					
Lobby floor			4.4100	0.1000	0.4410		(28a)					
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)					
basement	56.7000		56.7000	0.1600	9.0720		(29a)					
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)					
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)					
Total net area of external elements Aum(A, m2)			299.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.7729		(33)					
Party Wall 1			145.4400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)					
Total fabric heat loss						(33) + (36) =	138.6484 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.2463	Feb 46.8199	Mar 46.8199	Apr 44.6802	May 45.3934	Jun 41.8274	Jul 42.5406	Aug 41.8274	Sep 41.8274	Oct 43.9670	Nov 43.2538	Dec 46.1067 (38)
Heat transfer coeff	186.8946	185.4682	185.4682	183.3286	184.0418	180.4758	181.1890	180.4758	180.4758	182.6154	181.9022	184.7550 (39)
Average = Sum(39)m / 12 =												183.0909 (39)
HLP	Jan 0.9595	Feb 0.9521	Mar 0.9521	Apr 0.9412	May 0.9448	Jun 0.9265	Jul 0.9302	Aug 0.9265	Sep 0.9265	Oct 0.9375	Nov 0.9338	Dec 0.9485 (40)
HLP (average)												0.9399 (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	2.9951 (42)
Average daily hot water use (litres/day)	105.3345 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680	(44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071	(45)
Energy content (annual)	Total = Sum (45)m =											1657.3222	(45)
Distribution loss (46)m = 0.15 x (45)m	25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2150	(55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345	(64)
Heat gains from water heating, kWh/month	105.8750	93.9939	100.3054	92.1239	91.8766	84.3916	83.2336	88.3216	87.2220	95.4191	98.1214	104.0723	(65)
Total per year (kWh/year) = Sum (64)m =													2374.6932 (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	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5878	72.4655	58.9329	44.6160	33.3510	28.1563	30.4239	39.5461	53.0787	67.3956	78.6607	83.8553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	546.3680	552.0376	537.7504	507.3347	468.9403	432.8550	408.7478	403.0782	417.3654	447.7811	486.1755	522.2608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	(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)	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)	142.3051	139.8719	134.8191	127.9499	123.4901	117.2105	111.8731	118.7118	121.1416	128.2515	136.2797	139.8821	(72)
Total internal gains	889.1296	883.2438	850.3712	798.7693	744.6501	697.0906	669.9135	680.2049	710.4545	762.2969	819.9846	864.8669	(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	
Southeast					18.5600	39.0225		0.6300	0.9000	0.7700		284.5831 (77)	
Southwest					3.1600	39.0225		0.6300	0.9000	0.7700		48.4527 (79)	
Northwest					20.8700	12.4885		0.6300	0.9000	0.7700		102.4116 (81)	
Horizontal					8.9900	29.0000		0.6300	0.9000	1.0000		133.0403 (82)	

Solar gains	568.4877	944.9984	1482.3124	2185.0358	2616.4136	2876.5981	2723.8771	2396.6645	1869.0112	1196.6545	719.4815	467.3606 (83)	
Total gains	1457.6173	1828.2421	2332.6836	2983.8051	3361.0638	3573.6887	3393.7905	3076.8693	2579.4657	1958.9514	1539.4661	1332.2276 (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	72.3781	72.9348	72.9348	73.7860	73.5001	74.9523	74.6573	74.9523	74.9523	74.0742	74.3646	73.2163	
alpha	5.8252	5.8623	5.8623	5.9191	5.9000	5.9968	5.9772	5.9968	5.9968	5.9383	5.9576	5.8811	
util living area	0.9905	0.9681	0.8649	0.6219	0.4040	0.2222	0.1281	0.1525	0.3633	0.7534	0.9661	0.9938	(86)
MIT	20.4160	20.5809	20.8129	20.9349	20.9524	20.9546	20.9545	20.9546	20.9541	20.9117	20.6583	20.3827	(87)
Th 2	20.1172	20.1234	20.1234	20.1327	20.1296	20.1450	20.1419	20.1450	20.1450	20.1357	20.1388	20.1265	(88)
util rest of house	0.9874	0.9587	0.8344	0.5752	0.3570	0.1790	0.0823	0.1024	0.3038	0.6961	0.9541	0.9917	(89)
MIT 2	19.3499	19.5895	19.8996	20.0481	20.0611	20.0786	20.0753	20.0786	20.0784	20.0316	19.7146	19.3096	(90)
Living area fraction	19.6455	19.8643	20.1528	20.2940	20.3082	20.3214	20.3190	20.3215	20.3211	20.2756	19.9762	19.6071	(91)
MIT	19.6455	19.8643	20.1528	20.2940	20.3082	20.3214	20.3190	20.3215	20.3211	20.2756	19.9762	19.6071	(92)
Temperature adjustment	19.4955	19.7143	20.0028	20.1440	20.1582	20.1714	20.1690	20.1715	20.1711	20.1256	19.8262	-0.1500	
adjusted MIT	19.4955	19.7143	20.0028	20.1440	20.1582	20.1714	20.1690	20.1715	20.1711	20.1256	19.8262	19.4571	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9845	0.9533	0.8297	0.5758	0.3586	0.1804	0.0838	0.1039	0.3057	0.6954	0.9487	0.9896	(94)
Useful gains	1435.0627	1742.9448	1935.4761	1718.1779	1205.1404	644.5402	284.2892	319.7043	788.4345	1362.1588	1460.4924	1318.3613	(95)
Ext temp.	5.6000	6.1000	8.1000	10.6000	13.6000	16.6000	18.6000	18.4000	15.8000	12.3000	8.5000	5.6000	(96)
Heat loss rate W	2596.9890	2525.0243	2207.5923	1749.6837	1206.9798	644.5585	284.2893	319.7046	788.8844	1429.0672	2060.2573	2560.1674	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Month fraction	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	864.4731	525.5574	202.4544	22.6842	1.3685	0.0000	0.0000	0.0000	0.0000	49.7798	431.8307	923.9037 (98)
Space heating												3022.0519 (98)
Space heating per m2										(98) / (4) =		15.5144 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3232.1410 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	864.4731	525.5574	202.4544	22.6842	1.3685	0.0000	0.0000	0.0000	0.0000	49.7798	431.8307	923.9037 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	924.5702	562.0935	216.5288	24.2612	1.4636	0.0000	0.0000	0.0000	0.0000	53.2405	461.8510	988.1323 (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	232.7563	205.3138	216.0056	194.1629	190.6559	170.9078	164.6617	179.9640	179.4203	201.3099	212.2005	227.3345 (64)
Efficiency of water heater (217)m	87.9970	87.2149	84.6416	80.7993	79.8673	79.8000	79.8000	79.8000	79.8000	81.7154	86.6709	79.8000 (216)
Fuel for water heating, kWh/month	264.5046	235.4114	255.2002	240.3026	238.7159	214.1702	206.3430	225.5188	224.8374	246.3549	244.8347	257.8495 (219)
Water heating fuel used												2854.0431 (219)
Annual totals kWh/year												
Space heating fuel - main system												3232.1410 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)												
mechanical ventilation fans (SFP = 0.9000)												558.3600 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kWh/year												588.3600 (231)
Electricity for lighting (calculated in Appendix L)												576.3461 (232)
Total delivered energy for all uses												7250.8902 (238)

10a. Fuel costs - using BEDF prices (457)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3232.1410	3.9700	128.3160 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2854.0431	3.9700	113.3055 (247)
Mechanical ventilation fans	558.3600	18.2700	102.0124 (249)
Pumps and fans for heating	30.0000	18.2700	5.4810 (249)
Energy for lighting	576.3461	18.2700	105.2984 (250)
Additional standing charges			90.0000 (251)
Total energy cost			544.4133 (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	3232.1410	0.2160	698.1425 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2854.0431	0.2160	616.4733 (264)
Space and water heating			1314.6158 (265)
Pumps and fans	558.3600	0.5190	305.3588 (267)
Energy for lighting	576.3461	0.5190	299.1236 (268)
Total kg/year			1919.0982 (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	3232.1410	1.2200	3943.2121 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2854.0431	1.2200	3481.9326 (264)
Space and water heating			7425.1446 (265)
Pumps and fans	558.3600	3.0700	1806.2652 (267)
Energy for lighting	576.3461	3.0700	1769.3825 (268)
Primary energy kWh/year			11000.7924 (272)
Primary energy kWh/m2/year			56.4751 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 46	-273 kg (14.2%)
U Solar photovoltaic panels	+ 5.6	-£ 327	-929 kg (56.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£46	1.40 kg/m²	B 88 B 89
Solar photovoltaic panels	£327	4.77 kg/m²	A 94 A 94
Total Savings	£373	6.17 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 457 TEST (30 Mar 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	£213	£222	-£9
Mains gas	£332	£277	£55
Space heating	£326	£327	-£1
Water heating	£113	£66	£47
Lighting	£105	£105	£0
Generated (PV)	-£0	-£327	£327
Total cost of fuels	£545	£172	£373
Total cost of uses	£544	£171	£373
Delivered energy	37 kWh/m²	21 kWh/m²	16 kWh/m²
Carbon dioxide emissions	1.9 tonnes	0.7 tonnes	1.2 tonnes
CO2 emissions per m²	10 kg/m²	4 kg/m²	6 kg/m²
Primary energy	56 kWh/m²	20 kWh/m²	36 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)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
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							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50								Yes				
Infiltration rate								4.0000				
Number of sides sheltered								0.2000 (18)				
								2 (19)				
Shelter factor						(20) = 1 - [0.075 x (19)] =		0.8500 (20)				
Infiltration rate adjusted to include shelter factor						(21) = (18) x (20) =		0.1700 (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)
	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.3215	0.3173	0.3130	0.2918	0.2875	0.2663	0.2663	0.2620	0.2748	0.2875	0.2960	0.3045 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)					
Opening Type 3			1.9800	1.0000	1.9800		(26)					
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)					
Basement floor			54.0000	0.1000	5.4000		(28)					
Lobby floor			4.4100	0.1000	0.4410		(28a)					
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)					
basement	56.7000		56.7000	0.1600	9.0720		(29a)					
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)					
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)					
Total net area of external elements Aum(A, m2)			299.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.7729		(33)					
Party Wall 1			145.4400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)					
Total fabric heat loss						(33) + (36) =	138.6484 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.9519	Feb 53.2387	Mar 52.5255	Apr 48.9595	May 48.2463	Jun 44.6802	Jul 44.6802	Aug 43.9670	Sep 46.1067	Oct 48.2463	Nov 49.6727	Dec 51.0991 (38)
Heat transfer coeff	192.6003	191.8871	191.1739	187.6078	186.8946	183.3286	183.3286	182.6154	184.7550	186.8946	188.3211	189.7475 (39)
Average = Sum(39)m / 12 =												187.4295 (39)
HLP	Jan 0.9888	Feb 0.9851	Mar 0.9814	Apr 0.9631	May 0.9595	Jun 0.9412	Jul 0.9412	Aug 0.9375	Sep 0.9485	Oct 0.9595	Nov 0.9668	Dec 0.9741 (40)
HLP (average)												0.9622 (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	2.9951 (42)
Average daily hot water use (litres/day)	105.3345 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680	(44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071	(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													1657.3222
	25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:													
Store volume													300.0000
a) If manufacturer declared loss factor is known (kWh/day):													2.2500
Temperature factor from Table 2b													0.5400
Enter (49) or (54) in (55)													1.2150
Total storage loss													
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage													
	28.2488	25.5150	28.2488	27.3375	28.2488	27.3375	28.2488	28.2488	27.3375	28.2488	27.3375	28.2488	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	223.3400	196.8088	205.1936	178.2968	168.4453	149.1886	142.2185	158.4513	164.9049	190.4979	203.0880	217.9182	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													3.0000
Collector heat loss coefficient													0.7000
Collector 2nd order heat loss coefficient													1.8000
Collector effective heat loss coefficient													0.0050
Collector performance ratio													1.8063
Annual solar radiation per m2													2.5804
Overshading factor													1079.5246
Solar energy available													0.8000
Adjustment factor for showers													1813.6014
Solar-to-load ratio													1.0000
Utilisation factor													1.0943
Collector performance factor													0.5990
Dedicated solar storage volume													0.8793
Effective solar volume													75.0000
Daily hot water demand													142.5000
Volume ratio Veff/V													105.3345
Solar storage volume factor													1.3528
Solar input													1.0000
Solar input	-27.7001	-46.2235	-78.7238	-105.5055	-130.3431	-128.1481	-126.4545	-110.4840	-86.5311	-59.0906	-32.8563	-955.2407	(H17)
Output from w/h													-23.1802
	195.6399	150.5854	126.4698	72.7914	38.1022	21.0406	15.7640	47.9673	78.3738	131.4074	170.2317	194.7380	(64)
Heat gains from water heating, kWh/month													
	98.3420	87.1899	91.6558	79.4310	74.1082	67.0162	65.2790	71.1114	75.6097	86.7695	90.8314	96.5393	(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	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.5878	72.4655	58.9329	44.6160	33.3510	28.1563	30.4239	39.5461	53.0787	67.3956	78.6607	83.8553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	546.3680	552.0376	537.7504	507.3347	468.9403	432.8550	408.7478	403.0782	417.3654	447.7811	486.1755	522.2608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	(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)													
	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)													
	132.1801	129.7469	123.1933	110.3209	99.6078	93.0781	87.7406	95.5799	105.0134	116.6257	126.1547	129.7571	(72)
Total internal gains													
	879.0046	873.1188	838.7454	781.1403	720.7678	672.9581	645.7810	657.0729	694.3263	750.6711	809.8596	854.7419	(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
Southeast				18.5600	36.7938		0.6300		0.9000		0.7700		268.3300 (77)
Southwest				3.1600	36.7938		0.6300		0.9000		0.7700		45.6855 (79)
Northwest				20.8700	11.2829		0.6300		0.9000		0.7700		92.5254 (81)
Horizontal				8.9900	26.0000		0.6300		0.9000		1.0000		119.2775 (82)

Solar gains	525.8185	970.9531	1511.5873	2152.2102	2645.5911	2724.4655	2586.2830	2206.7442	1733.4885	1124.1071	643.9299	440.6323	(83)
Total gains	1404.8231	1844.0718	2350.3327	2933.3505	3366.3589	3397.4236	3232.0640	2863.8171	2427.8148	1874.7782	1453.7895	1295.3743	(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	70.2340	70.4950	70.7580	72.1030	72.3781	73.7860	73.7860	74.0742	73.2163	72.3781	71.8299	71.2899		
alpha	5.6823	5.6997	5.7172	5.8069	5.8252	5.9191	5.9191	5.9383	5.8811	5.8252	5.7887	5.7527		
util living area														
	0.9949	0.9780	0.9116	0.7260	0.5110	0.3449	0.2495	0.2932	0.5194	0.8684	0.9849	0.9967	(86)	
MIT	20.2746	20.4729	20.7176	20.9006	20.9466	20.9535	20.9540	20.9541	20.9486	20.8351	20.5095	20.2442	(87)	
Th 2	20.0927	20.0958	20.0988	20.1142	20.1172	20.1327	20.1327	20.1357	20.1265	20.1172	20.1111	20.1050	(88)	
util rest of house														

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9933	0.9717	0.8905	0.6844	0.4643	0.2984	0.2004	0.2382	0.4561	0.8301	0.9796	0.9956 (89)
Living area fraction	19.1244	19.4122	19.7523	19.9928	20.0434	20.0651	20.0653	20.0686	20.0554	19.9268	19.4801	19.0901 (90)
MIT	19.4432	19.7063	20.0199	20.2444	20.2938	20.3114	20.3117	20.3141	fLA = Living area / (4) =			0.2772 (91)
Temperature adjustment									20.3030	20.1786	19.7655	19.4101 (92)
adjusted MIT	19.2932	19.5563	19.8699	20.0944	20.1438	20.1614	20.1617	20.1641	20.1530	20.0286	19.6155	-0.1500
												19.2601 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9670	0.8844	0.6834	0.4657	0.2999	0.2020	0.2400	0.4580	0.8258	0.9757	0.9942 (94)	
Useful gains	1392.7016	1783.1893	2078.5577	2004.6354	1567.8795	1018.9819	652.9208	687.2689	1111.9696	1548.1646	1418.4835	1287.8656 (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	2887.6992	2812.3466	2555.9727	2100.1639	1578.0942	1019.5565	652.9611	687.3780	1118.3183	1762.1619	2356.9228	2857.6066 (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	1112.2783	691.5937	355.1968	68.7806	7.5997	0.0000	0.0000	0.0000	0.0000	159.2140	675.6763	1167.8874 (98)	
Space heating												4238.2266 (98)	
Space heating per m2												(98) / (4) =	21.7579 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4532.8627 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1112.2783	691.5937	355.1968	68.7806	7.5997	0.0000	0.0000	0.0000	0.0000	159.2140	675.6763	1167.8874 (98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)	
Space heating fuel (main heating system)	1189.6024	739.6724	379.8896	73.5621	8.1280	0.0000	0.0000	0.0000	0.0000	170.2823	722.6484	1249.0774 (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	195.6399	150.5854	126.4698	72.7914	38.1022	21.0406	15.7640	47.9673	78.3738	131.4074	170.2317	194.7380 (64)	
Efficiency of water heater (217)m	88.7206	88.3811	87.4222	84.6632	81.4004	79.8000	79.8000	79.8000	79.8000	85.3268	88.1222	79.8000 (216)	
Fuel for water heating, kWh/month	220.5125	170.3819	144.6655	85.9776	46.8084	26.3666	19.7543	60.1095	98.2128	154.0048	193.1770	219.3035 (219)	
Water heating fuel used												1439.2744 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4532.8627 (211)	
Space heating fuel - secondary												0.0000 (215)	

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)		
mechanical ventilation fans (SFP = 0.9000)		558.3600 (230a)
central heating pump		30.0000 (230c)
pump for solar water heating		50.0000 (230g)
Total electricity for the above, kWh/year		638.3600 (231)
Electricity for lighting (calculated in Appendix L)		576.3461 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =	-1727.2394	-1727.2394 (233)
Total delivered energy for all uses		5459.6038 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4532.8627	3.4800	157.7436 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1439.2744	3.4800	50.0867 (247)	
Mechanical ventilation fans	558.3600	13.1900	73.6477 (249)	
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	576.3461	13.1900	76.0200 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			260.2272 (255)	

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):
 Energy cost factor (ECF) 0.4200 (256)
 SAP value 0.4558 (257)
 SAP rating (Section 12) 93.6416
 SAP band 94 (258)
A

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	4532.8627	0.2160	979.0983 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2744	0.2160	310.8833 (264)
Space and water heating			1289.9816 (265)
Pumps and fans	638.3600	0.5190	331.3088 (267)
Energy for lighting	576.3461	0.5190	299.1236 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			1023.9768 (272)
CO2 emissions per m2			5.2600 (273)
EI value			94.2778
EI rating			94 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	54.0000 (1a)	x	2.4000 (2a) = 129.6000 (1a) - (3a)
Ground floor	56.8600 (1b)	x	2.6600 (2b) = 151.2476 (1b) - (3b)
First floor	52.5500 (1c)	x	2.7800 (2c) = 146.0890 (1c) - (3c)
Second floor	31.3800 (1d)	x	2.6000 (2d) = 81.5880 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	194.7900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 508.5246 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
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							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50							Yes	4.0000				
Infiltration rate								0.2000 (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) =		0.1700 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.5000	3.4000	3.4000	3.7000	3.6000	4.0000 (22)
Adj infilt rate	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8750	0.8500	0.8500	0.9250	0.9000	1.0000 (22a)
	0.1828	0.1743	0.1743	0.1615	0.1658	0.1445	0.1488	0.1445	0.1445	0.1573	0.1530	0.1700 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.2875	0.2790	0.2790	0.2663	0.2705	0.2493	0.2535	0.2493	0.2493	0.2620	0.2578	0.2748 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.20)			42.5900	1.1450	48.7672		(27)					
Opening Type 3			1.9800	1.0000	1.9800		(26)					
Opening Type 2 (Uw = 1.20)			8.9900	1.1450	10.2939		(27a)					
Basement floor			54.0000	0.1000	5.4000		(28)					
Lobby floor			4.4100	0.1000	0.4410		(28a)					
External Wall 1	124.0500	44.5700	79.4800	0.1600	12.7168		(29a)					
basement	56.7000		56.7000	0.1600	9.0720		(29a)					
Basement roof	3.1500	2.7000	0.4500	0.1000	0.0450		(30)					
Flat roof	56.8600	6.2900	50.5700	0.1000	5.0570		(30)					
Total net area of external elements Aum(A, m2)			299.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7729		(33)					
Party Wall 1			145.4400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.150 * total exposed area)							44.8755 (36)					
Total fabric heat loss						(33) + (36) =	138.6484 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.2463	Feb 46.8199	Mar 46.8199	Apr 44.6802	May 45.3934	Jun 41.8274	Jul 42.5406	Aug 41.8274	Sep 41.8274	Oct 43.9670	Nov 43.2538	Dec 46.1067 (38)
Heat transfer coeff	186.8946	185.4682	185.4682	183.3286	184.0418	180.4758	181.1890	180.4758	180.4758	182.6154	181.9022	184.7550 (39)
Average = Sum(39)m / 12 =												183.0909 (39)
HLP	Jan 0.9595	Feb 0.9521	Mar 0.9521	Apr 0.9412	May 0.9448	Jun 0.9265	Jul 0.9302	Aug 0.9265	Sep 0.9265	Oct 0.9375	Nov 0.9338	Dec 0.9485 (40)
HLP (average)												0.9399 (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	2.9951 (42)
Average daily hot water use (litres/day)	105.3345 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.8680	111.6546	107.4412	103.2278	99.0144	94.8011	94.8011	99.0144	103.2278	107.4412	111.6546	115.8680	(44)
Energy conte	171.8289	150.2826	155.0782	135.2009	129.7285	111.9458	103.7343	119.0366	120.4583	140.3825	153.2385	166.4071	(45)
Energy content (annual)	Total = Sum (45)m =											1657.3222	(45)
Distribution loss (46)m = 0.15 x (45)m	25.7743	22.5424	23.2617	20.2801	19.4593	16.7919	15.5601	17.8555	18.0687	21.0574	22.9858	24.9611	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	28.2488	25.5150	28.2488	27.3375	28.2488	27.3375	28.2488	28.2488	27.3375	28.2488	27.3375	28.2488	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	223.3400	196.8088	205.1936	178.2968	168.4453	149.1886	142.2185	158.4513	164.9049	190.4979	203.0880	217.9182	(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													1118.1552 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1878.5008 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.1335 (H8)
Utilisation factor													0.5862 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													142.5000 (H13)
Daily hot water demand													105.3345 (H14)
Volume ratio Veff/V													1.3528 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-968.1795 (H17)
Solar input	-29.3278	-43.9763	-75.2558	-104.1975	-125.3393	-131.5875	-129.5082	-116.6852	-90.8543	-61.4259	-35.9334	-24.0882	(63)
Solar input (sum of months) = Sum(63)m =													-968.1795 (63)
Output from w/h	194.0122	152.8325	129.9378	74.0994	43.1060	17.6011	12.7103	41.7661	74.0506	129.0720	167.1545	193.8300	(64)
Heat gains from water heating, kWh/month	98.3420	87.1899	91.6558	79.4310	74.1082	67.0162	65.2790	71.1114	75.6097	86.7695	90.8314	96.5393	(65)
Total per year (kWh/year) = Sum(64)m =													1230.1725 (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	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	179.7083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5878	72.4655	58.9329	44.6160	33.3510	28.1563	30.4239	39.5461	53.0787	67.3956	78.6607	83.8553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	546.3680	552.0376	537.7504	507.3347	468.9403	432.8550	408.7478	403.0782	417.3654	447.7811	486.1755	522.2608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	55.9660	(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)	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	-119.8055	(71)
Water heating gains (Table 5)	132.1801	129.7469	123.1933	110.3209	99.6078	93.0781	87.7406	95.5799	105.0134	116.6257	126.1547	129.7571	(72)
Total internal gains	879.0046	873.1188	838.7454	781.1403	720.7678	672.9581	645.7810	657.0729	694.3263	750.6711	809.8596	854.7419	(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	
Southeast					18.5600	39.0225		0.6300	0.9000	0.7700		284.5831 (77)	
Southwest					3.1600	39.0225		0.6300	0.9000	0.7700		48.4527 (79)	
Northwest					20.8700	12.4885		0.6300	0.9000	0.7700		102.4116 (81)	
Horizontal					8.9900	29.0000		0.6300	0.9000	1.0000		133.0403 (82)	

Solar gains	568.4877	944.9984	1482.3124	2185.0358	2616.4136	2876.5981	2723.8771	2396.6645	1869.0112	1196.6545	719.4815	467.3606 (83)	
Total gains	1447.4923	1818.1171	2321.0578	2966.1761	3337.1814	3549.5562	3369.6581	3053.7374	2563.3375	1947.3256	1529.3411	1322.1026 (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	72.3781	72.9348	72.9348	73.7860	73.5001	74.9523	74.6573	74.9523	74.9523	74.0742	74.3646	73.2163	
alpha	5.8252	5.8623	5.8623	5.9191	5.9000	5.9968	5.9772	5.9968	5.9968	5.9383	5.9576	5.8811	
util living area	0.9908	0.9689	0.8669	0.6252	0.4069	0.2237	0.1290	0.1537	0.3656	0.7565	0.9671	0.9941	(86)
MIT	20.4124	20.5777	20.8109	20.9344	20.9524	20.9546	20.9545	20.9546	20.9541	20.9108	20.6552	20.3791	(87)
Th 2	20.1172	20.1234	20.1234	20.1327	20.1296	20.1450	20.1419	20.1450	20.1450	20.1357	20.1388	20.1265	(88)
util rest of house													

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MIT 2	0.9878	0.9597	0.8366	0.5783	0.3595	0.1802	0.0829	0.1031	0.3057	0.6994	0.9554	0.9921 (89)
Living area fraction	19.3448	19.5851	19.8972	20.0477	20.0610	20.0786	20.0753	20.0786	20.0783	20.0306	19.7103	19.3043 (90)
MIT	19.6407	19.8603	20.1505	20.2935	20.3081	20.3214	20.3190	20.3215	20.3211	20.2746	19.9722	19.6022 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4907	19.7103	20.0005	20.1435	20.1581	20.1714	20.1690	20.1715	20.1711	20.1246	19.8222	19.4522 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9850	0.9543	0.8319	0.5789	0.3611	0.1816	0.0844	0.1047	0.3076	0.6986	0.9500	0.9900 (94)
Useful gains	1425.7798	1735.0948	1930.9761	1717.2128	1205.0611	644.5394	284.2892	319.7042	788.4165	1360.3743	1452.8554	1308.8220 (95)
Ext temp.	5.6000	6.1000	8.1000	10.6000	13.6000	16.6000	18.6000	18.4000	15.8000	12.3000	8.5000	5.6000 (96)
Heat loss rate W	2596.1064	2524.2737	2207.1640	1749.5935	1206.9719	644.5584	284.2893	319.7046	788.8824	1428.8975	2059.5368	2559.2723 (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	870.7230	530.3282	205.4838	23.3141	1.4216	0.0000	0.0000	0.0000	0.0000	50.9812	436.8106	930.3350 (98)
Space heating												3049.3975 (98)
Space heating per m2										(98) / (4) =		15.6548 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3261.3877 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.7230	530.3282	205.4838	23.3141	1.4216	0.0000	0.0000	0.0000	0.0000	50.9812	436.8106	930.3350	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	931.2545	567.1960	219.7688	24.9349	1.5204	0.0000	0.0000	0.0000	0.0000	54.5254	467.1771	995.0107	(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	194.0122	152.8325	129.9378	74.0994	43.1060	17.6011	12.7103	41.7661	74.0506	129.0720	167.1545	193.8300	(64)
Efficiency of water heater (217)m	88.3416	87.8644	86.0313	82.1238	80.1024	79.8000	79.8000	79.8000	79.8000	82.5640	87.2617	79.8000	(216)
Fuel for water heating, kWh/month	219.6159	173.9414	151.0355	90.2288	53.8137	22.0565	15.9277	52.3385	92.7952	156.3296	191.5554	219.1284	(219)
Water heating fuel used												1438.7666	(219)
Annual totals kWh/year													
Space heating fuel - main system												3261.3877	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)	
mechanical ventilation fans (SFP = 0.9000)	558.3600 (230a)
central heating pump	30.0000 (230c)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	638.3600 (231)
Electricity for lighting (calculated in Appendix L)	576.3461 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.50 * 1118 * 0.80) =	-1789.0484	-1789.0484 (233)
Total delivered energy for all uses		4125.8121 (238)

10a. Fuel costs - using BEDF prices (457)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3261.3877	3.9700	129.4771 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1438.7666	3.9700	57.1190 (247)	
Mechanical ventilation fans	558.3600	18.2700	102.0124 (249)	
Pumps and fans for heating	30.0000	18.2700	5.4810 (249)	
Pump for solar water heating	50.0000	18.2700	9.1350 (249)	
Energy for lighting	576.3461	18.2700	105.2984 (250)	
Additional standing charges			90.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1789.0484	18.2700	-326.8591 (252)	
Total energy cost			171.6638 (255)	

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3261.3877	0.2160	704.4597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1438.7666	0.2160	310.7736 (264)
Space and water heating			1015.2333 (265)
Pumps and fans	638.3600	0.5190	331.3088 (267)
Energy for lighting	576.3461	0.5190	299.1236 (268)
Energy saving/generation technologies			
PV Unit	-1789.0484	0.5190	-928.5161 (269)
Total kg/year			717.1497 (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	3261.3877	1.2200	3978.8930 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1438.7666	1.2200	1755.2953 (264)
Space and water heating			5734.1883 (265)
Pumps and fans	638.3600	3.0700	1959.7652 (267)
Energy for lighting	576.3461	3.0700	1769.3825 (268)
Energy saving/generation technologies			
PV Unit	-1789.0484	3.0700	-5492.3784 (269)
Primary energy kWh/year			3970.9575 (272)
Primary energy kWh/m2/year			20.3858 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	4
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1342.50 (P1)
Transmission heat loss coefficient	138.65 (37)
Summer heat loss coefficient	1481.15 (P2)

Overhangs

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

Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)
Horizontal	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	18.5600	119.9223	0.6300	0.9000	0.9000	1022.2242
South West	3.1600	119.9223	0.6300	0.9000	0.9000	174.0425
North West	20.8700	98.8453	0.6300	0.9000	0.9000	947.4284
Horizontal	8.9900	203.0000	0.6300	0.9000	1.0000	931.2822

total: 3074.9774

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	3274	3075	2685	
Total summer gains	694	667	677	
	3968	3742	3362	(P5)

Summer gain/loss ratio	2.68	2.53	2.27	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.93	20.68	20.32	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight