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energy



SAP Report Submission for Building Regulations Compliance

Client: Urgent Developments

Project: Summer Cottage, Edgebridge
Mere, WARMINSTER, Wiltshire, BA12 6DB

Contact: Richard Harris
Peninsula Energy Compliance
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Report Issue Date: 16/04/2019

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)



Property Reference	1753 Mill Lane		Issued on Date	16/04/2019	
Assessment Reference	As Built SAP	Prop Type Ref	Detached House		
Property	Summer Cottage, Edgebridge, Mere, WARMINSTER, Wiltshire, BA12 6DB				
SAP Rating	85 B	DER	14.71	TER	15.51
Environmental	85 B	% DER<TER	5.17		
CO ₂ Emissions (t/year)	2.38	DFEE	48.86	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	16.10		
Assessor Details	Mr. Richard Harris, Peninsula Energy Compliance, Tel: 01392683664, richard@pecairsap.com			Assessor ID	J794-0001
Client	Urgent Developments, 1753				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

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)	15.51	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.71	kgCO ₂ /m ²	Pass
	-0.80 (-5.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.24	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.86	kWh/m ² /yr	
	-9.3 (-16.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.13 (max. 0.30)	0.13 (max. 0.70)	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.15 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	1.80 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	2.64 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

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Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar 18i System ErP Efficiency: 89.7% SEDBUK2009 Minimum: 88.0%	Pass
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Secondary heating system	Room heaters - Wood Logs Closed room heater Efficiency: 65% Minimum: 65%	Pass
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5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.80 kWh/day Permitted by DBSCG 2.30	Pass
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Primary pipework insulated	Yes	Pass
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6 Controls

Space heating controls	Time and temperature zone control	Pass
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Hot water controls	Cylinderstat	Pass
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Independent timer for DHW	Yes	Pass
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Boiler interlock	Yes	Pass
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7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
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Minimum	75	%	Pass
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8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Severn Valley)	Not significant	Pass
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Based on:

Overshading	Average
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Windows facing North	8.08 m ² , No overhang
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Windows facing East	4.40 m ² , No overhang
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Windows facing South	13.37 m ² , No overhang
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Windows facing West	12.88 m ² , Overhang width less than twice window, ratio 2.25
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Air change rate	8.00 ach
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Blinds/curtains	None
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Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	2.64 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)



10 Key features

External wall U-value	0.13	W/m ² K
Air permeability	2.6	m ³ /m ² h
Secondary heating (wood logs)	N/A	
Secondary heating fuel:	wood logs	

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THERMAL BRIDGING

Calculation Type: New Build (As Built)



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CO ₂ Emissions (t/year)	2.38	DFEE	48.86	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	16.10		
Assessor Details	Mr. Richard Harris, Peninsula Energy Compliance, Tel: 01392683664, richard@pecairsap.com			Assessor ID	J794-0001
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	30.70	9.21	
External wall	E3 Sill	Table K1 - Approved	0.040	16.35	0.65	
External wall	E4 Jamb	Table K1 - Approved	0.050	36.18	1.81	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	51.52	8.24	
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	13.20	4.22	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	2.40	0.77	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	44.01	3.08	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	12.25	0.49	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	10.03	0.40	
External wall	E14 Flat roof	Table K1 - Default	0.080	35.09	2.81	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	27.71	2.49	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	6.70	-0.60	
External roof	R1 Head of roof window	Table K1 - Default	0.080	2.92	0.23	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	2.92	0.18	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	5.60	0.45	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	8.07	0.65	
External roof	R5 Ridge (inverted)	Table K1 - Default	0.040	13.06	0.52	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	12.90	0.77	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.040	2.00	0.08	

Total: **36.46** W/mK
 Y-Value: **0.087** W/m²K

SUMMARY FOR INPUT DATA

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Client	Urgent Developments, 1753				

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

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Rural
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2018
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	51.52 m	95.17 m ²	2.25 m
1st Storey:	44.01 m	81.94 m ²	2.31 m

7.0 Living Area m²

8.0 Thermal Mass Parameter
 Thermal Mass
 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Timber Frame	Timber framed wall (one layer of plasterboard)	0.13	189.53	150.80

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof Flat	External Flat Roof	Other	0.15	89.01	88.22
External Roof Slope	External Slope Roof	Plasterboard, insulated slope	0.13	32.54	31.26

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Heat Loss Floor 1	Ground Floor - Solid	Suspended concrete floor, carpeted	0.16	95.17
Exposed Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.15	13.22

12.0 Opening Types

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)



Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft	0.05		0.63		0.70	1.40
Patio Doors	Manufacturer	Window	Double Low-E Soft	0.05		0.63		0.70	1.40
R/ Winds Flat (corrected)	Manufacturer	Roof Window	Double Low-E Soft	0.05		0.63		0.70	1.80
R Wind Slope (corrected)	Manufacturer	Roof Window	Double Low-E Soft	0.05		0.63		0.70	1.60

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
North Windows	Window	[1] External Wall 1	North	None	0.00					4.16	
North Patio Doors	Window	[1] External Wall 1	North	None	0.00					3.92	
South Windows	Window	[1] External Wall 1	South	None	0.00					3.15	
Roof Windows Flat	Roof Window	[1] External Roof Flat	Horizontal	None						0.79	
South R/Wind	Roof Window	[2] External Roof Slope	South	None						0.64	
South Patio Doors	Window	[1] External Wall 1	South	None	0.00					10.22	
East Windows	Window	[1] External Wall 1	East	None	0.00					4.40	
East R/Wind	Roof Window	[2] External Roof Slope	East	None						0.64	
West Windows	Window	[1] External Wall 1	West	None	2.25	No				2.16	
West Patio Doors	Window	[1] External Wall 1	West	None	0.00					10.72	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	30.70	0.300	No
Table K1 - Approved	E3 Sill	16.35	0.040	No
Table K1 - Approved	E4 Jamb	36.18	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	51.52	0.160	No
Table K1 - Default	E20 Exposed floor (normal)	13.20	0.320	No
Table K1 - Default	E21 Exposed floor (inverted)	2.40	0.320	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	44.01	0.070	No
Table K1 - Approved	E11 Eaves (insulation at rafter level)	12.25	0.040	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	10.03	0.040	No
Table K1 - Default	E14 Flat roof	35.09	0.080	No
Table K1 - Approved	E16 Corner (normal)	27.71	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	6.70	-0.090	No
Table K1 - Default	R1 Head of roof window	2.92	0.080	No
Table K1 - Default	R2 Sill of roof window	2.92	0.060	No
Table K1 - Default	R3 Jamb of roof window	5.60	0.080	No
Table K1 - Default	R4 Ridge (vaulted ceiling)	8.07	0.080	No
Table K1 - Default	R5 Ridge (inverted)	13.06	0.040	No
Table K1 - Default	R6 Flat ceiling	12.90	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.00	0.040	No

Y-value	<input type="text" value="0.087"/>	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	<input type="text" value="5.00"/>	m ³ /(h.m ²) @ 50 Pa
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SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)



Property Tested ?
 As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather
 Cross ventilation possible
 Night Ventilation
 Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0	0	0	0
Number of open flues	0	0	0	0
Number of intermittent fans				5
Number of passive vents				1
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %
 Database Ref. No.
 Fuel Type
 Main Heating
 SAP Code
 In Winter
 In Summer
 Controls
 PCDF Controls
 Delayed Start Stat
 Sap Code
 Flue Type
 Fan Assisted Flue
 Is MHS Pumped
 Heat Emitter
 Underfloor Heating
 Flow Temperature

25.0 Main Heating 2

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)



Community Heating	None	
27.0 Secondary Heating	RWM	
Secondary Heating	SAP table	
Description	Wood Logs RWM Closed room heater	
SHS efficiency	65.00	%
SAP Code	633	
HETAS Approved System	Yes	
Smoke Control Area	Unknown	
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	210.00	L
Loss	1.80	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement
Solar water heating	£4,000 - £6,000	£45	SAP rating B 86 Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£331	Ratings after improvement SAP rating A 92 Environmental Impact
Wind turbine	£15,000 - £25,000	£628	Ratings after improvement SAP rating A 104 Environmental Impact

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 177 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) 15.51 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.71 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.13 (max. 0.30)	0.13 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 2.64 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Worcester Greenstar 18i System ErP
Boiler system with radiators or underfloor - Mains gas
Data from database

Efficiency: 89.7% SEDBUK2009
Minimum: 88.0%

OK

Secondary heating system:

Room heaters - Wood Logs

Closed room heater

Efficiency: 65%
Minimum: 65%

OK

5 Cylinder insulation

Hot water storage Permitted by DBSCG 2.30
Measured cylinder loss: 1.80 kWh/day
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

Not applicable

9 Summertime temperature

Overheating risk (Severn Valley): Not significant OK

Based on:

Overshading: Average
Windows facing North: 9.08 m², No overhang
Windows facing East: 4.40 m², No overhang
Windows facing South: 13.37 m², No overhang
Windows facing West: 12.88 m², Overhang width less than twice window, ratio 2.25
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.13 W/m²K
Air permeability 2.6 m³/m²h
Secondary heating (wood logs)
Secondary heating fuel: wood logs

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					5 * 10 = 50.0000 (7a)							
Number of passive vents					1 * 10 = 10.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) = 0.1487 (8)							
Pressure test					Yes							
Measured/design AP50					2.6400							
Infiltration rate					0.2807 (18)							
Number of sides sheltered					0 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2807 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3579	0.3509	0.3439	0.3088	0.3018	0.2667	0.2667	0.2597	0.2807	0.3018	0.3158	0.3299 (22b)
	0.5641	0.5616	0.5591	0.5477	0.5455	0.5356	0.5356	0.5337	0.5394	0.5455	0.5499	0.5544 (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					
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)					
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)					
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)					
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)					
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)					
Exposed Floor			13.2200	0.1500	1.9830		(28b)					
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)					
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)					
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)					
Total net area of external elements Aum(A, m ²)			419.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)					
Total fabric heat loss						(33) + (36) =	145.1659 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 75.0910	Feb 74.7599	Mar 74.4353	Apr 72.9108	May 72.6255	Jun 71.2977	Jul 71.2977	Aug 71.0518	Sep 71.8091	Oct 72.6255	Nov 73.2025	Dec 73.8058 (38)
Heat transfer coeff	220.2569	219.9258	219.6012	218.0766	217.7914	216.4636	216.4636	216.2177	216.9750	217.7914	218.3684	218.9717 (39)
Average = Sum(39)m / 12 =												218.0753 (39)
HLP	Jan 1.2436	Feb 1.2417	Mar 1.2399	Apr 1.2313	May 1.2297	Jun 1.2222	Jul 1.2222	Aug 1.2208	Sep 1.2251	Oct 1.2297	Nov 1.2330	Dec 1.2364 (40)
HLP (average)												1.2313 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	1511.8654	1176.4757	991.8885	603.4780	316.4979	0.0000	0.0000	0.0000	0.0000	613.4597	1096.6132	1551.0803 (98)
Space heating												7861.3588 (98)
Space heating per m2												(98) / (4) = 44.3869 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												7800.6868 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1511.8654	1176.4757	991.8885	603.4780	316.4979	0.0000	0.0000	0.0000	0.0000	613.4597	1096.6132	1551.0803	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1500.1972	1167.3960	984.2334	598.8205	314.0553	0.0000	0.0000	0.0000	0.0000	608.7252	1088.1498	1539.1095	(211)
Water heating requirement	232.5947	180.9963	152.5982	92.8428	48.6920	0.0000	0.0000	0.0000	0.0000	94.3784	168.7097	238.6277	(215)
Water heating requirement	224.3273	197.7262	207.6640	186.1680	182.4465	163.0341	156.5878	171.8103	171.5022	193.0449	204.1115	218.9338	(64)
Efficiency of water heater (217)m	89.0150	88.8304	88.4669	87.7055	86.1987	80.0000	80.0000	80.0000	80.0000	87.6625	88.6677	89.0847	(217)
Fuel for water heating, kWh/month	252.0107	222.5883	234.7362	212.2648	211.6581	203.7927	195.7347	214.7629	214.3777	220.2138	230.1982	245.7592	(219)
Water heating fuel used												2658.0974 (219)	
Annual totals kWh/year													
Space heating fuel - main system												7800.6868 (211)	
Space heating fuel - secondary												1209.4398 (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)												549.0559 (232)
Total delivered energy for all uses												12292.2799 (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	7800.6868	0.2160	1684.9483	(261)
Space heating - secondary	1209.4398	0.0190	22.9794	(263)
Water heating (other fuel)	2658.0974	0.2160	574.1490	(264)
Space and water heating			2282.0767	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	549.0559	0.5190	284.9600	(268)
Total CO2, kg/year			2605.9617	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7100	(273)

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

DER		14.7100	ZC1
Total Floor Area	TFA	177.1100	
Assumed number of occupants	N	2.9720	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.6680	ZC2
CO2 emissions from cooking, equation (L16)		1.0746	ZC3
Total CO2 emissions		27.4526	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4526	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				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) =	0.0992 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3492 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4452	0.4364	0.4277	0.3841	0.3753	0.3317	0.3317	0.3230	0.3492	0.3753	0.3928	0.4103 (22b)
	0.5991	0.5952	0.5915	0.5738	0.5704	0.5550	0.5550	0.5522	0.5610	0.5704	0.5771	0.5842 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.40)			38.7300	1.3258	51.3466		(27)
TER Room Window (Uw = 1.70)			2.0700	1.5918	3.2949		(27a)
Heat Loss Floor 1			95.1700	0.1300	12.3721		(28a)
Exposed Floor			13.2200	0.1300	1.7186		(28b)
External Wall 1	189.5300	38.7300	150.8000	0.1800	27.1440		(29a)
External Roof Flat	89.0100	0.7900	88.2200	0.1300	11.4686		(30)
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)
Total net area of external elements Aum(A, m ²)			419.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	111.4086		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.2660 (36)
 Total fabric heat loss (33) + (36) = 137.6746 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	79.7546	79.2424	78.7403	76.3820	75.9408	73.8867	73.8867	73.5064	74.6779	75.9408	76.8334	77.7665 (38)
Heat transfer coeff	217.4293	216.9170	216.4149	214.0566	213.6154	211.5614	211.5614	211.1810	212.3525	213.6154	214.5080	215.4412 (39)
Average = Sum(39)m / 12 =												214.0545 (39)
HLP	1.2277	1.2248	1.2219	1.2086	1.2061	1.1945	1.1945	1.1924	1.1990	1.2061	1.2112	1.2164 (40)
HLP (average)												1.2086 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)
Store volume												210.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):																					1.7016 (48)	
Temperature factor from Table 2b																						0.5400 (49)
Enter (49) or (54) in (55)																						0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842	27.5653	28.4842 (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	22.5120	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	222.6795	196.2378	206.0162	184.5733	180.7987	161.4395	154.9400	170.1625	169.9075	191.3971	202.5168	217.2860	217.2860 (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	222.6795	196.2378	206.0162	184.5733	180.7987	161.4395	154.9400	170.1625	169.9075	191.3971	202.5168	217.2860 (64)										
Heat gains from water heating, kWh/month	98.2325	87.0995	92.6919	84.7818	84.3071	77.0898	75.7091	80.7706	79.9054	87.8311	90.7480	96.4391 (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	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0898	27.6137	22.4570	17.0014	12.7087	10.7292	11.5933	15.0694	20.2262	25.6818	29.9744	31.9539 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.7332	352.3519	343.2328	323.8192	299.3130	276.2806	260.8936	257.2748	266.3940	285.8076	310.3138	333.3461 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601 (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)	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805 (71)	
Water heating gains (Table 5)	132.0329	129.6124	124.5859	117.7525	113.3160	107.0691	101.7595	108.5626	110.9797	118.0525	126.0389	129.6225 (72)	
Total internal gains	582.4360	580.1582	560.8558	529.1532	495.9179	464.6592	444.8266	451.4870	468.1801	500.1220	536.9072	565.5027 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	8.0800	10.6334	0.6300	0.7000	0.7700	26.2576 (74)						
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102 (76)						
South	13.3700	46.7521	0.6300	0.7000	0.7700	191.0311 (78)						
West	12.8800	19.6403	0.6300	0.7000	0.7700	77.3099 (80)						
East	0.6400	25.9287	0.6300	0.7000	1.0000	6.5863 (82)						
South	0.6400	47.0123	0.6300	0.7000	1.0000	11.9419 (82)						
Horizontal	0.7900	26.0000	0.6300	0.7000	1.0000	8.1523 (82)						
Solar gains	347.6893	617.3586	901.6655	1196.7815	1401.6084	1415.2787	1354.7994	1200.3844	1004.6859	698.6139	421.2615	294.3094 (83)
Total gains	930.1253	1197.5167	1462.5213	1725.9347	1897.5263	1879.9378	1799.6260	1651.8714	1472.8659	1198.7360	958.1687	859.8121 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)																						21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec										
tau	56.5669	56.7005	56.8321	57.4582	57.5769	58.1359	58.1359	58.2406	57.9193	57.5769	57.3373	57.0889										
alpha	4.7711	4.7800	4.7888	4.8305	4.8385	4.8757	4.8757	4.8827	4.8613	4.8385	4.8225	4.8059										
util living area	0.9989	0.9961	0.9860	0.9482	0.8472	0.6726	0.5070	0.5691	0.8272	0.9761	0.9972	0.9992 (86)										
MIT	19.5872	19.7970	20.1123	20.4997	20.8010	20.9529	20.9903	20.9835	20.8703	20.4480	19.9374	19.5538 (87)										
Th 2	19.8979	19.9002	19.9025	19.9131	19.9151	19.9244	19.9244	19.9261	19.9208	19.9151	19.9111	19.9069 (88)										
util rest of house	0.9985	0.9947	0.9810	0.9291	0.7948	0.5784	0.3884	0.4457	0.7496	0.9639	0.9959	0.9990 (89)										
MIT 2	18.0119	18.3198	18.7788	19.3338	19.7254	19.8943	19.9210	19.9196	19.8192	19.2736	18.5333	17.9693 (90)										
Living area fraction									FLA = Living area / (4) =			0.3905 (91)										
MIT	18.6271	18.8967	19.2996	19.7891	20.1455	20.3077	20.3386	20.3351	20.2297	19.7323	19.0816	18.5881 (92)										
Temperature adjustment												0.0000										
adjusted MIT	18.6271	18.8967	19.2996	19.7891	20.1455	20.3077	20.3386	20.3351	20.2297	19.7323	19.0816	18.5881 (93)										

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9978	0.9929	0.9773	0.9265	0.8071	0.6137	0.4350	0.4942	0.7744	0.9612	0.9946	0.9985 (94)	
Useful gains	928.0818	1188.9828	1429.2830	1599.0020	1531.5797	1153.6408	782.8280	816.3393	1140.6336	1152.2260	952.9960	858.5029 (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	3115.1399	3036.1213	2770.0244	2330.8897	1804.0886	1207.5352	790.9449	831.0209	1301.6535	1950.7979	2570.1588	3099.7929 (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	1627.1713	1241.2771	997.5116	526.9592	202.7466	0.0000	0.0000	0.0000	0.0000	594.1375	1164.3572	1667.5198 (98)	
Space heating												8021.6802 (98)	
Space heating per m2												(98) / (4) = 45.2921 (99)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													8579.3371 (211)
Space heating requirement	1627.1713	1241.2771	997.5116	526.9592	202.7466	0.0000	0.0000	0.0000	0.0000	594.1375	1164.3572	1667.5198	(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)	1740.2901	1327.5691	1066.8573	563.5927	216.8413	0.0000	0.0000	0.0000	0.0000	635.4412	1245.3018	1783.4436	(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	222.6795	196.2378	206.0162	184.5733	180.7987	161.4395	154.9400	170.1625	169.9075	191.3971	202.5168	217.2860	(64)
Efficiency of water heater (217)m	89.0625	88.8732	88.4694	87.4580	85.1199	79.8000	79.8000	79.8000	79.8000	87.6369	88.7371	79.8000	(216)
Fuel for water heating, kWh/month	250.0262	220.8064	232.8671	211.0421	212.4047	202.3051	194.1604	213.2362	212.9167	218.3979	228.2210	243.8063	(219)
Water heating fuel used												2640.1901	(219)
Annual totals kWh/year													
Space heating fuel - main system													8579.3371 (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)													549.0559 (232)
Total delivered energy for all uses													11843.5831 (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	8579.3371	0.2160	1853.1368	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2640.1901	0.2160	570.2811	(264)
Space and water heating			2423.4179	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	549.0559	0.5190	284.9600	(268)
Total CO2, kg/m2/year			2747.3029	(272)
Emissions per m2 for space and water heating			13.6831	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.6089	(272b)
Emissions per m2 for pumps and fans			0.2198	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6831 * 1.00) + 1.6089 + 0.2198, rounded to 2 d.p.			15.5100	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				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) =	0.0992 (8)
Pressure test					Yes
Measured/design AP50					2.6400
Infiltration rate					0.2312 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2312 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.2947	0.2889	0.2832	0.2543	0.2485	0.2196	0.2196	0.2138	0.2312	0.2485	0.2600	0.2716 (22b)
	0.5434	0.5417	0.5401	0.5323	0.5309	0.5241	0.5241	0.5229	0.5267	0.5309	0.5338	0.5369 (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
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)
Exposed Floor			13.2200	0.1500	1.9830		(28b)
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)
Total net area of external elements Aum(A, m ²)			419.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)
Total fabric heat loss						(33) + (36) =	145.1659 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	72.3450	72.1205	71.9004	70.8668	70.6734	69.7731	69.7731	69.6064	70.1199	70.6734	71.0646	71.4736 (38)
Heat transfer coeff	217.5109	217.2864	217.0663	216.0327	215.8393	214.9390	214.9390	214.7723	215.2858	215.8393	216.2305	216.6395 (39)
Average = Sum(39)m / 12 =												216.0318 (39)
HLP	1.2281	1.2268	1.2256	1.2198	1.2187	1.2136	1.2136	1.2126	1.2155	1.2187	1.2209	1.2232 (40)
HLP (average)												1.2198 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	36.3232	31.7685	32.7823	28.5804	27.4236	23.6645	21.9286	25.1634	25.4639	29.6757	32.3934	35.1771	(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	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0898	27.6137	22.4570	17.0014	12.7087	10.7292	11.5933	15.0694	20.2262	25.6818	29.9744	31.9539	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.7332	352.3519	343.2328	323.8192	299.3130	276.2806	260.8936	257.2748	266.3940	285.8076	310.3138	333.3461	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	(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)	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	(71)
Water heating gains (Table 5)	48.8216	47.2746	44.0622	39.6950	36.8596	32.8673	29.4739	33.8217	35.3665	39.8867	44.9908	47.2811	(72)
Total internal gains	496.2247	494.8204	477.3321	448.0957	416.4615	387.4573	369.5410	373.7462	389.5669	418.9563	452.8592	480.1613	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF	Access factor Table 6d	Gains W
North	4.1600	10.6334	0.6300	0.7000	0.7700	13.5188	(74)
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(76)
South	3.1500	46.7521	0.6300	0.7000	0.7700	45.0073	(78)
West	2.1600	19.6403	0.6300	0.7000	0.7700	12.9650	(80)
North	3.9200	10.6334	0.6300	0.7000	0.7700	12.7388	(74)
South	10.2200	46.7521	0.6300	0.7000	0.7700	146.0238	(78)
West	10.7200	19.6403	0.6300	0.7000	0.7700	64.3449	(80)
Horizontal	0.7900	26.0000	0.6300	0.7000	1.0000	8.1523	(82)
East	0.6400	25.9287	0.6300	0.7000	1.0000	6.5863	(82)
South	0.6400	47.0123	0.6300	0.7000	1.0000	11.9419	(82)

Solar gains	347.6893	617.3586	901.6655	1196.7815	1401.6084	1415.2787	1354.7994	1200.3844	1004.6859	698.6139	421.2615	294.3094	(83)
Total gains	843.9140	1112.1790	1378.9976	1644.8772	1818.0699	1802.7360	1724.3404	1574.1306	1394.2527	1117.5702	874.1206	774.4707	(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	22.6183	22.6416	22.6646	22.7730	22.7934	22.8889	22.8889	22.9067	22.8521	22.7934	22.7522	22.7093		
alpha	2.5079	2.5094	2.5110	2.5182	2.5196	2.5259	2.5259	2.5271	2.5235	2.5196	2.5168	2.5140		
util living area	0.9801	0.9608	0.9251	0.8564	0.7504	0.6145	0.4867	0.5383	0.7385	0.9052	0.9679	0.9838	(86)	
MIT	18.2448	18.6127	19.1601	19.8128	20.3664	20.7356	20.8949	20.8612	20.5504	19.7851	18.8738	18.1691	(87)	
Th 2	19.8976	19.8986	19.8996	19.9042	19.9051	19.9091	19.9091	19.9099	19.9076	19.9051	19.9033	19.9015	(88)	
util rest of house	0.9769	0.9546	0.9129	0.8322	0.7064	0.5416	0.3854	0.4369	0.6762	0.8840	0.9617	0.9812	(89)	
MIT 2	17.3752	17.7396	18.2780	18.9110	19.4256	19.7465	19.8631	19.8447	19.6043	18.8996	18.0053	17.3027	(90)	
Living area fraction									fLA = Living area / (4) =			0.3905	(91)	
MIT	17.7148	18.0805	18.6225	19.2632	19.7930	20.1328	20.2661	20.2417	19.9738	19.2454	18.3445	17.6410	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.7148	18.0805	18.6225	19.2632	19.7930	20.1328	20.2661	20.2417	19.9738	19.2454	18.3445	17.6410	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9679	0.9409	0.8952	0.8156	0.7014	0.5576	0.4203	0.4698	0.6804	0.8681	0.9498	0.9735	(94)	
Useful gains	816.8434	1046.4391	1234.4824	1341.5710	1275.2259	1005.2752	724.7946	739.5947	948.6872	970.1147	830.2719	753.9147	(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	2917.8652	2863.9538	2631.3856	2238.7929	1746.7881	1189.2132	787.9780	825.0927	1264.5416	1866.0210	2431.4043	2911.8578	(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	1563.1602	1221.3699	1039.2960	645.9998	350.8423	0.0000	0.0000	0.0000	0.0000	666.5543	1152.8153	1605.5097	(98)	
Space heating												8245.5474	(98)	
Space heating per m2												(98) / (4) =	46.5561	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2020.4269	1590.5488	1632.2696	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7486	0.8105	0.7773	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1512.4014	1289.1251	1268.8400	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	2215.4009	2121.8097	1952.5907	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh						1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	506.1596	619.5173	508.7105	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction													1634.3874 (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	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	126.5399	154.8793	127.1776	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2													408.5969 (107)
Energy for space heating													2.3070 (108)
Energy for space cooling													46.5561 (99)
Total													2.3070 (108)
Dwelling Fabric Energy Efficiency (DFEE)													48.8631 (109)
													48.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 403.4139 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4452	0.4364	0.4277	0.3841	0.3753	0.3317	0.3317	0.3230	0.3492	0.3753	0.3928	0.4103 (22b)
	0.5991	0.5952	0.5915	0.5738	0.5704	0.5550	0.5550	0.5522	0.5610	0.5704	0.5771	0.5842 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.40)			38.7300	1.3258	51.3466		(27)
TER Room Window (Uw = 1.70)			2.0700	1.5918	3.2949		(27a)
Heat Loss Floor 1			95.1700	0.1300	12.3721		(28a)
Exposed Floor			13.2200	0.1300	1.7186		(28b)
External Wall 1	189.5300	38.7300	150.8000	0.1800	27.1440		(29a)
External Roof Flat	89.0100	0.7900	88.2200	0.1300	11.4686		(30)
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)
Total net area of external elements Aum(A, m ²)			419.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	111.4086		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.2660 (36)
 Total fabric heat loss (33) + (36) = 137.6746 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	79.7546	79.2424	78.7403	76.3820	75.9408	73.8867	73.8867	73.5064	74.6779	75.9408	76.8334	77.7665 (38)
Heat transfer coeff	217.4293	216.9170	216.4149	214.0566	213.6154	211.5614	211.5614	211.1810	212.3525	213.6154	214.5080	215.4412 (39)
Average = Sum(39)m / 12 =												214.0545 (39)
HLP	1.2277	1.2248	1.2219	1.2086	1.2061	1.1945	1.1945	1.1924	1.1990	1.2061	1.2112	1.2164 (40)
HLP (average)												1.2086 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)		
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
	36.3232	31.7685	32.7823	28.5804	27.4236	23.6645	21.9286	25.1634	25.4639	29.6757	32.3934	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	35.1771	(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	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	148.6006	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0898	27.6137	22.4570	17.0014	12.7087	10.7292	11.5933	15.0694	20.2262	25.6818	29.9744	31.9539	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.7332	352.3519	343.2328	323.8192	299.3130	276.2806	260.8936	257.2748	266.3940	285.8076	310.3138	333.3461	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	37.8601	(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)	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	(71)
Water heating gains (Table 5)	48.8216	47.2746	44.0622	39.6950	36.8596	32.8673	29.4739	33.8217	35.3665	39.8867	44.9908	47.2811	(72)
Total internal gains	496.2247	494.8204	477.3321	448.0957	416.4615	387.4573	369.5410	373.7462	389.5669	418.9563	452.8592	480.1613	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	8.0800	10.6334	0.6300	0.7000	0.7700	26.2576 (74)							
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102 (76)							
South	13.3700	46.7521	0.6300	0.7000	0.7700	191.0311 (78)							
West	12.8800	19.6403	0.6300	0.7000	0.7700	77.3099 (80)							
East	0.6400	25.9287	0.6300	0.7000	1.0000	6.5863 (82)							
South	0.6400	47.0123	0.6300	0.7000	1.0000	11.9419 (82)							
Horizontal	0.7900	26.0000	0.6300	0.7000	1.0000	8.1523 (82)							
Solar gains	347.6893	617.3586	901.6655	1196.7815	1401.6084	1415.2787	1354.7994	1200.3844	1004.6859	698.6139	421.2615	294.3094	(83)
Total gains	843.9140	1112.1790	1378.9976	1644.8772	1818.0699	1802.7360	1724.3404	1574.1306	1394.2527	1117.5702	874.1206	774.4707	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9993	0.9971	0.9890	0.9562	0.8633	0.6942	0.5272	0.5934	0.8493	0.9818	0.9981	0.9995	(86)
MIT	19.5423	19.7531	20.0714	20.4663	20.7810	20.9461	20.9885	20.9803	20.8523	20.4098	19.8939	19.5093	(87)
Th 2	19.8979	19.9002	19.9025	19.9131	19.9151	19.9244	19.9244	19.9261	19.9208	19.9151	19.9111	19.9069	(88)
util rest of house	0.9990	0.9961	0.9849	0.9394	0.8137	0.5996	0.4048	0.4665	0.7759	0.9722	0.9973	0.9994	(89)
MIT 2	18.5655	18.7776	19.0952	19.4870	19.7705	19.9004	19.9216	19.9207	19.8397	19.4409	18.9271	18.5395	(90)
Living area fraction	18.9470	19.1586	19.4764	19.8695	20.1652	20.3088	20.3383	20.3345	20.2352	19.8193	19.3047	18.9182	(92)
Temperature adjustment	18.9470	19.1586	19.4764	19.8695	20.1652	20.3088	20.3383	20.3345	20.2352	19.8193	19.3047	18.9182	(93)
adjusted MIT	18.9470	19.1586	19.4764	19.8695	20.1652	20.3088	20.3383	20.3345	20.2352	19.8193	19.3047	18.9182	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	842.8151	1106.8019	1355.3267	1543.9411	1502.5986	1145.2753	781.2061	813.1577	1115.5289	1085.2147	871.1801	773.8017	(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	3184.6834	3092.9313	2808.2965	2348.0839	1808.2937	1207.7610	790.8792	830.8979	1302.8215	1969.3863	2617.9970	3170.9084	(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	1742.3500	1334.6789	1081.0095	578.9828	227.4372	0.0000	0.0000	0.0000	0.0000	657.8237	1257.7082	1783.4473	(98)
Space heating												8663.4376	(98)
Space heating per m2												48.9156	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1988.6769	1565.5542	1604.9756	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8713	0.9285	0.9001	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1732.7304	1453.5840	1444.6823	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2215.4009	2121.8097	1952.5907	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	347.5227	497.1599	377.8839	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												1222.5665	(104)
Intermittency factor (Table 10b)												FC = cooled area / (4) =	1.0000
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	86.8807	124.2900	94.4710	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2												305.6416	(107)
Energy for space heating												1.7257	(108)
Energy for space cooling												48.9156	(99)
Total												1.7257	(108)
Target Fabric Energy Efficiency (TFEE)												50.6413	(109)
												58.2	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					5 * 10 = 50.0000 (7a)							
Number of passive vents					1 * 10 = 10.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					60.0000 / (5) = 0.1487 (8)							
Pressure test					Yes							
Measured/design AP50					2.6400							
Infiltration rate					0.2807 (18)							
Number of sides sheltered					0 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2807 (21)							
Wind speed	Jan 5.0000	Feb 4.8000	Mar 4.7000	Apr 4.3000	May 4.2000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 3.9000	Oct 4.3000	Nov 4.3000	Dec 4.6000 (22)
Wind factor	1.2500	1.2000	1.1750	1.0750	1.0500	0.9500	0.9500	0.9250	0.9750	1.0750	1.0750	1.1500 (22a)
Adj infilt rate												
Effective ac	0.3509	0.3369	0.3299	0.3018	0.2948	0.2667	0.2667	0.2597	0.2737	0.3018	0.3018	0.3228 (22b)
	0.5616	0.5567	0.5544	0.5455	0.5434	0.5356	0.5356	0.5337	0.5375	0.5455	0.5455	0.5521 (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					
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)					
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)					
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)					
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)					
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)					
Exposed Floor			13.2200	0.1500	1.9830		(28b)					
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)					
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)					
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)					
Total net area of external elements Aum(A, m ²)			419.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)					
Total fabric heat loss						(33) + (36) =	145.1659 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 74.7599	Feb 74.1173	Mar 73.8058	Apr 72.6255	May 72.3468	Jun 71.2977	Jul 71.2977	Aug 71.0518	Sep 71.5501	Oct 72.6255	Nov 72.6255	Dec 73.5009 (38)
Heat transfer coeff	219.9258	219.2832	218.9717	217.7914	217.5127	216.4636	216.4636	216.2177	216.7160	217.7914	217.7914	218.6668 (39)
Average = Sum(39)m / 12 =												217.7996 (39)
HLP	Jan 1.2417	Feb 1.2381	Mar 1.2364	Apr 1.2297	May 1.2281	Jun 1.2222	Jul 1.2222	Aug 1.2208	Sep 1.2236	Oct 1.2297	Nov 1.2297	Dec 1.2346 (40)
HLP (average)												1.2297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9720	(55)
Total storage loss													
	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage													
	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(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													
	224.3273	197.7262	207.6640	186.1680	182.4465	163.0341	156.5878	171.8103	171.5022	193.0449	204.1115	218.9338	(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													
	224.3273	197.7262	207.6640	186.1680	182.4465	163.0341	156.5878	171.8103	171.5022	193.0449	204.1115	218.9338	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
	99.5507	88.2902	94.0102	86.0575	85.6253	78.3655	77.0273	82.0888	81.1811	89.1493	92.0237	97.7574	(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	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.7245	69.0342	56.1424	42.5034	31.7718	26.8231	28.9833	37.6736	50.5654	64.2044	74.9360	79.8847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	520.4973	525.8984	512.2877	483.3122	446.7358	412.3591	389.3934	383.9923	397.6030	426.5785	463.1549	497.5316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	(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)	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	(71)
Water heating gains (Table 5)	133.8047	131.3842	126.3577	119.5243	115.0878	108.8410	103.5313	110.3344	112.7516	119.8243	127.8107	131.3943	(72)
Total internal gains	850.2708	844.5612	813.0322	763.5842	711.8397	666.2675	640.1524	650.2446	679.1643	728.8516	784.1460	827.0549	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	4.1600	13.1177	0.6300	0.7000	0.7700	16.6771 (74)							
East	4.4000	24.4891	0.6300	0.7000	0.7700	32.9304 (76)							
South	3.1500	55.4171	0.6300	0.7000	0.7700	53.3490 (78)							
West	2.1600	24.4891	0.6300	0.7000	0.7700	16.1658 (80)							
North	3.9200	13.1177	0.6300	0.7000	0.7700	15.7150 (74)							
South	10.2200	55.4171	0.6300	0.7000	0.7700	173.0879 (78)							
West	10.7200	24.4891	0.6300	0.7000	0.7700	80.2305 (80)							
Horizontal	0.7900	33.0000	0.6300	0.7000	1.0000	10.3472 (82)							
East	0.6400	32.5353	0.6300	0.7000	1.0000	8.2645 (82)							
South	0.6400	57.0591	0.6300	0.7000	1.0000	14.4939 (82)							
Solar gains	421.2615	656.6404	959.9669	1290.5854	1420.3296	1563.2299	1454.0253	1308.6699	1108.0004	751.5228	499.9215	347.6893	(83)
Total gains	1271.5323	1501.2016	1772.9991	2054.1697	2132.1693	2229.4975	2094.1776	1958.9145	1787.1647	1480.3743	1284.0675	1174.7442	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	22.3699	22.4355	22.4674	22.5891	22.6181	22.7277	22.7277	22.7536	22.7012	22.5891	22.5891	22.4987	
alpha	2.4913	2.4957	2.4978	2.5059	2.5079	2.5152	2.5152	2.5169	2.5134	2.5059	2.5059	2.4999	
util living area	0.9517	0.9284	0.8801	0.7997	0.6919	0.5278	0.4340	0.4577	0.6547	0.8435	0.9263	0.9589	(86)
MIT	19.1029	19.3240	19.7227	20.1463	20.5058	20.7554	20.8294	20.8212	20.6374	20.1609	19.5881	19.0529	(87)
Th 2	19.8867	19.8896	19.8910	19.8963	19.8976	19.9023	19.9023	19.9034	19.9011	19.8963	19.8963	19.8924	(88)
util rest of house	0.9444	0.9179	0.8624	0.7702	0.6439	0.4558	0.3436	0.3642	0.5887	0.8128	0.9134	0.9526	(89)
MIT 2	17.3611	17.6797	18.2477	18.8398	19.3221	19.6274	19.7045	19.6998	19.4999	18.8776	18.0697	17.2932	(90)
Living area fraction									fLA = Living area / (4) =				0.3905 (91)
MIT	18.0414	18.3219	18.8238	19.3501	19.7844	20.0679	20.1438	20.1378	19.9442	19.3788	18.6627	17.9805	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8914	18.1719	18.6738	19.2001	19.6344	19.9179	19.9938	19.9878	19.7942	19.2288	18.5127	17.8305	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9270	0.8970	0.8387	0.7488	0.6312	0.4569	0.3515	0.3718	0.5815	0.7905	0.8925	0.9367	(94)
Useful gains	1178.7136	1346.6270	1487.0468	1538.1029	1345.8344	1018.5773	736.1353	728.4016	1039.2705	1170.1936	1145.9746	1100.4005	(95)
Ext temp.	4.4000	4.9000	6.6000	8.8000	11.8000	14.7000	16.4000	16.4000	14.0000	10.7000	7.4000	4.4000	(96)
Heat loss rate W	2967.1015	2910.2960	2643.8205	2265.0431	1704.0782	1129.4957	777.9309	775.7434	1255.6898	1857.4967	2420.2590	2936.7947	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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													
Space heating	1330.5606	1050.7856	860.6397	523.3970	266.5334	0.0000	0.0000	0.0000	0.0000	511.3535	917.4848	1366.2773	(98)
RHI space heating demand												6827.0319	(98)
												6827	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				5 * 10 =	50.0000 (7a)							
Number of passive vents				1 * 10 =	10.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				60.0000 / (5) =	0.1487 (8)							
Pressure test				Yes								
Measured/design AP50					2.6400							
Infiltration rate					0.2807 (18)							
Number of sides sheltered					0 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2807 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3579	0.3509	0.3439	0.3088	0.3018	0.2667	0.2667	0.2597	0.2807	0.3018	0.3158	0.3299 (22b)
	0.5641	0.5616	0.5591	0.5477	0.5455	0.5356	0.5356	0.5337	0.5394	0.5455	0.5499	0.5544 (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					
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)					
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)					
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)					
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)					
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)					
Exposed Floor			13.2200	0.1500	1.9830		(28b)					
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)					
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)					
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)					
Total net area of external elements Aum(A, m ²)			419.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)					
Total fabric heat loss						(33) + (36) =	145.1659 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 75.0910	Feb 74.7599	Mar 74.4353	Apr 72.9108	May 72.6255	Jun 71.2977	Jul 71.2977	Aug 71.0518	Sep 71.8091	Oct 72.6255	Nov 73.2025	Dec 73.8058 (38)
Heat transfer coeff	220.2569	219.9258	219.6012	218.0766	217.7914	216.4636	216.4636	216.2177	216.9750	217.7914	218.3684	218.9717 (39)
Average = Sum(39)m / 12 =												218.0753 (39)
HLP	Jan 1.2436	Feb 1.2417	Mar 1.2399	Apr 1.2313	May 1.2297	Jun 1.2222	Jul 1.2222	Aug 1.2208	Sep 1.2251	Oct 1.2297	Nov 1.2330	Dec 1.2364 (40)
HLP (average)												1.2313 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	1380.0797	1070.2396	896.6343	539.2646	277.9775	0.0000	0.0000	0.0000	0.0000	537.7395	987.8875	1419.3058 (98)
Space heating												7109.1286 (98)
Space heating per m2												(98) / (4) = 40.1396 (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)												0.1000 (201)	
Fraction of space heat from main system(s)												0.9000 (202)	
Efficiency of main space heating system 1 (in %)												90.7000 (206)	
Efficiency of secondary/supplementary heating system, %												65.0000 (208)	
Space heating requirement												7054.2622 (211)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1380.0797	1070.2396	896.6343	539.2646	277.9775	0.0000	0.0000	0.0000	0.0000	537.7395	987.8875	1419.3058 (98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)	
Space heating fuel (main heating system)	1369.4286	1061.9797	889.7143	535.1027	275.8322	0.0000	0.0000	0.0000	0.0000	533.5894	980.2632	1408.3520 (211)	
Water heating requirement	212.3200	164.6522	137.9437	82.9638	42.7658	0.0000	0.0000	0.0000	0.0000	82.7292	151.9827	218.3547 (215)	
Water heating requirement	224.3273	197.7262	207.6640	186.1680	182.4465	163.0341	156.5878	171.8103	171.5022	193.0449	204.1115	218.9338 (64)	
Efficiency of water heater (217)m	88.8814	88.6799	88.2833	87.4570	85.8572	80.0000	80.0000	80.0000	80.0000	87.3680	88.4902	88.9591 (217)	
Fuel for water heating, kWh/month	252.3894	222.9662	235.2245	212.8679	212.4998	203.7927	195.7347	214.7629	214.3777	220.9562	230.6599	246.1061 (219)	
Water heating fuel used												2662.3381 (219)	
Annual totals kWh/year													
Space heating fuel - main system													7054.2622 (211)
Space heating fuel - secondary													1093.7121 (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)													549.0559 (232)
Total delivered energy for all uses													11434.3682 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7054.2622	3.4800	245.4883 (240)
Space heating - secondary	1093.7121	4.2300	46.2640 (242)
Water heating (other fuel)	2662.3381	3.4800	92.6494 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	549.0559	13.1900	72.4205 (250)
Additional standing charges			120.0000 (251)
Total energy cost			586.7147 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1095 (257)
SAP value		84.5232
SAP rating (Section 12)		85 (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	7054.2622	0.2160	1523.7206 (261)
Space heating - secondary	1093.7121	0.0190	20.7805 (263)
Water heating (other fuel)	2662.3381	0.2160	575.0650 (264)
Space and water heating			2119.5662 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	549.0559	0.5190	284.9600 (268)
Total kg/year			2443.4512 (272)
CO2 emissions per m2			13.8000 (273)
EI value			85.2585
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9070 = 4.115$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9070 = 0.2554$, stars = 4
Water heating energy efficiency	$3.48 / 0.8533 = 4.078$, stars = 4
Water heating environmental impact	$0.216 / 0.8533 = 0.2531$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					5 * 10 = 50.0000 (7a)							
Number of passive vents					1 * 10 = 10.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) = 0.1487 (8)							
Pressure test					Yes							
Measured/design AP50					2.6400							
Infiltration rate					0.2807 (18)							
Number of sides sheltered					0 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2807 (21)							
Wind speed	Jan 5.0000	Feb 4.8000	Mar 4.7000	Apr 4.3000	May 4.2000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 3.9000	Oct 4.3000	Nov 4.3000	Dec 4.6000 (22)
Wind factor	1.2500	1.2000	1.1750	1.0750	1.0500	0.9500	0.9500	0.9250	0.9750	1.0750	1.0750	1.1500 (22a)
Adj infilt rate												
Effective ac	0.3509	0.3369	0.3299	0.3018	0.2948	0.2667	0.2667	0.2597	0.2737	0.3018	0.3018	0.3228 (22b)
	0.5616	0.5567	0.5544	0.5455	0.5434	0.5356	0.5356	0.5337	0.5375	0.5455	0.5455	0.5521 (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					
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)					
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)					
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)					
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)					
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)					
Exposed Floor			13.2200	0.1500	1.9830		(28b)					
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)					
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)					
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)					
Total net area of external elements Aum(A, m ²)			419.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)					
Total fabric heat loss						(33) + (36) =	145.1659 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 74.7599	Feb 74.1173	Mar 73.8058	Apr 72.6255	May 72.3468	Jun 71.2977	Jul 71.2977	Aug 71.0518	Sep 71.5501	Oct 72.6255	Nov 72.6255	Dec 73.5009 (38)
Heat transfer coeff	219.9258	219.2832	218.9717	217.7914	217.5127	216.4636	216.4636	216.2177	216.7160	217.7914	217.7914	218.6668 (39)
Average = Sum(39)m / 12 =												217.7996 (39)
HLP	Jan 1.2417	Feb 1.2381	Mar 1.2364	Apr 1.2297	May 1.2281	Jun 1.2222	Jul 1.2222	Aug 1.2208	Sep 1.2236	Oct 1.2297	Nov 1.2297	Dec 1.2346 (40)
HLP (average)												1.2297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Space heating kWh	1330.5606	1050.7856	860.6397	523.3970	266.5334	0.0000	0.0000	0.0000	0.0000	511.3535	917.4848	1366.2773 (98)
Space heating												6827.0319 (98)
Space heating per m2												(98) / (4) = 38.5468 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												6774.3425 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1330.5606	1050.7856	860.6397	523.3970	266.5334	0.0000	0.0000	0.0000	0.0000	511.3535	917.4848	1366.2773	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1320.2917	1042.6759	853.9975	519.3575	264.4764	0.0000	0.0000	0.0000	0.0000	507.4070	910.4039	1355.7327	(211)
Water heating requirement	204.7016	161.6593	132.4061	80.5226	41.0051	0.0000	0.0000	0.0000	0.0000	78.6698	141.1515	210.1965	(215)
Water heating requirement	224.3273	197.7262	207.6640	186.1680	182.4465	163.0341	156.5878	171.8103	171.5022	193.0449	204.1115	218.9338	(64)
Efficiency of water heater (217)m	88.8256	88.6497	88.2058	87.3891	85.7456	80.0000	80.0000	80.0000	80.0000	87.2514	88.3578	88.9029	(216)
Fuel for water heating, kWh/month	252.5481	223.0422	235.4312	213.0333	212.7765	203.7927	195.7347	214.7629	214.3777	221.2512	231.0057	246.2618	(219)
Water heating fuel used												2664.0180	(219)
Annual totals kWh/year													
Space heating fuel - main system													6774.3425 (211)
Space heating fuel - secondary													1050.3126 (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)													549.0559 (232)
Total delivered energy for all uses													11112.7290 (238)

10a. Fuel costs - using BEDF prices (444)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6774.3425	3.9300	266.2317	(240)
Space heating - secondary	1050.3126	4.6500	48.8395	(242)
Water heating (other fuel)	2664.0180	3.9300	104.6959	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Energy for lighting	549.0559	17.5600	96.4142	(250)
Additional standing charges			88.0000	(251)
Total energy cost			617.3513	(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	6774.3425	0.2160	1463.2580	(261)
Space heating - secondary	1050.3126	0.0190	19.9559	(263)
Water heating (other fuel)	2664.0180	0.2160	575.4279	(264)
Space and water heating			2058.6418	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	549.0559	0.5190	284.9600	(268)
Total kg/year			2382.5268	(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	6774.3425	1.2200	8264.6979	(261)
Space heating - secondary	1050.3126	1.0400	1092.3251	(263)
Water heating (other fuel)	2664.0180	1.2200	3250.1020	(264)
Space and water heating			12607.1250	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	549.0559	3.0700	1685.6015	(268)
Primary energy kWh/year			14522.9765	(272)
Primary energy kWh/m2/year			81.9998	(273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Current energy efficiency rating: B 85
 Current environmental impact rating: B 85

(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	Recommended
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 45	-271 kg (11.4%)
U Solar photovoltaic panels	+ 6.0	-£ 331	-978 kg (46.3%)
V2 Wind turbine	+ 12.4	-£ 628	-1856 kg (163.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£45	1.53 kg/m ²	B 86 B 87
Solar photovoltaic panels	£331	5.52 kg/m ²	A 92 A 92
Wind turbine	£628	10.48 kg/m ²	A 104 A 103
Total Savings	£1004	17.53 kg/m²	

Potential energy efficiency rating: A 104
 Potential environmental impact rating: A 103

Fuel prices for cost data on this page from database revision number 444 TEST (27 Jun 2019)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Severn Valley):

	Current	Potential	Saving
Electricity	£110	£118	-£9
Mains gas	£459	£405	£54
Wood	£49	£49	-£0
Space heating	£416	£418	-£2
Water heating	£105	£58	£47
Lighting	£96	£96	£0
Generated (PV)	-£0	-£331	£331
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£618	-£387	£1004
Total cost of uses	£617	-£387	£1004
Delivered energy	63 kWh/m ²	24 kWh/m ²	38 kWh/m ²
Carbon dioxide emissions	2.4 tonnes	-0.7 tonnes	3.1 tonnes
CO2 emissions per m ²	13 kg/m ²	-4 kg/m ²	18 kg/m ²
Primary energy	82 kWh/m ²	-21 kWh/m ²	103 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				5 * 10 =	50.0000 (7a)							
Number of passive vents				1 * 10 =	10.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				60.0000 / (5) =	0.1487 (8)							
Pressure test				Yes								
Measured/design AP50					2.6400							
Infiltration rate					0.2807 (18)							
Number of sides sheltered					0 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2807 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3579	0.3509	0.3439	0.3088	0.3018	0.2667	0.2667	0.2597	0.2807	0.3018	0.3158	0.3299 (22b)
	0.5641	0.5616	0.5591	0.5477	0.5455	0.5356	0.5356	0.5337	0.5394	0.5455	0.5499	0.5544 (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					
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)					
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)					
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)					
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)					
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)					
Exposed Floor			13.2200	0.1500	1.9830		(28b)					
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)					
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)					
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)					
Total net area of external elements Aum(A, m ²)			419.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)					
Total fabric heat loss						(33) + (36) =	145.1659 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 75.0910	Feb 74.7599	Mar 74.4353	Apr 72.9108	May 72.6255	Jun 71.2977	Jul 71.2977	Aug 71.0518	Sep 71.8091	Oct 72.6255	Nov 73.2025	Dec 73.8058 (38)
Heat transfer coeff	220.2569	219.9258	219.6012	218.0766	217.7914	216.4636	216.4636	216.2177	216.9750	217.7914	218.3684	218.9717 (39)
Average = Sum(39)m / 12 =												218.0753 (39)
HLP	Jan 1.2436	Feb 1.2417	Mar 1.2399	Apr 1.2313	May 1.2297	Jun 1.2222	Jul 1.2222	Aug 1.2208	Sep 1.2251	Oct 1.2297	Nov 1.2330	Dec 1.2364 (40)
HLP (average)												1.2313 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water storage loss:														
Store volume														210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														1.8000 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														0.9720 (55)
Total storage loss														
	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320		(56)
If cylinder contains dedicated solar storage														
	19.3706	17.4960	19.3706	18.7457	19.3706	18.7457	19.3706	19.3706	18.7457	19.3706	18.7457	19.3706		(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	21.8667	22.5120				(59)
Total heat required for water heating calculated for each month														
	213.5659	188.0062	195.5068	169.0001	158.8907	140.0131	132.7994	148.9524	155.6850	180.8877	193.6972	208.1723		(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 m ²														1079.5246 (H5)
Overshading factor														0.8000 (H6)
Solar energy available														1813.6014 (H7)
Adjustment factor for showers														1.0000 (H7a)
Solar-to-load ratio														1.1000 (H8)
Utilisation factor														0.5971 (H9)
Collector performance factor														0.8793 (H10)
Dedicated solar storage volume														75.0000 (H11)
Effective solar volume														115.5000 (H13)
Daily hot water demand														104.7853 (H14)
Volume ratio Veff/V														1.1023 (H15)
Solar storage volume factor														1.0000 (H16)
Solar input														-952.1865 (H17)
Solar input	-27.6115	-46.0757	-78.4721	-105.1681	-129.9264	-127.7383	-126.0502	-110.1307	-86.2544	-58.9016	-32.7512			-23.1061 (63)
														Solar input (sum of months) = Sum (63)m = -952.1865 (63)
Output from w/h														
	185.9543	141.9305	117.0347	63.8319	28.9643	12.2748	6.7492	38.8217	69.4306	121.9861	160.9459	185.0662		(64)
														Total per year (kWh/year) = Sum (64)m = 1132.9904 (64)
Heat gains from water heating, kWh/month														
	90.9416	80.5142	84.2844	72.3232	66.7807	59.9487	57.9966	63.8025	68.5274	79.4236	83.6923	89.1482		(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.7245	69.0342	56.1424	42.5034	31.7718	26.8231	28.9833	37.6736	50.5654	64.2044	74.9360	79.8847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	520.4973	525.8984	512.2877	483.3122	446.7358	412.3591	389.3934	383.9923	397.6030	426.5785	463.1549	497.5316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	(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)													
	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	(71)
Water heating gains (Table 5)													
	122.2333	119.8128	113.2855	100.4489	89.7591	83.2621	77.9524	85.7561	95.1769	106.7521	116.2393	119.8229	(72)
Total internal gains													
	838.6994	832.9897	799.9600	744.5088	686.5110	640.6886	614.5735	625.6663	661.5896	715.7793	772.5745	815.4835	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m ²	Table 6a	Specific data	Specific data	factor	W							
		W/m ²	or Table 6b	or Table 6c	Table 6d								
North	4.1600	10.6334	0.6300	0.7000	0.7700	13.5188 (74)							
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102 (76)							
South	3.1500	46.7521	0.6300	0.7000	0.7700	45.0073 (78)							
West	2.1600	19.6403	0.6300	0.7000	0.7700	12.9650 (80)							
North	3.9200	10.6334	0.6300	0.7000	0.7700	12.7388 (74)							
South	10.2200	46.7521	0.6300	0.7000	0.7700	146.0238 (78)							
West	10.7200	19.6403	0.6300	0.7000	0.7700	64.3449 (80)							
Horizontal	0.7900	26.0000	0.6300	0.7000	1.0000	8.1523 (82)							
East	0.6400	25.9287	0.6300	0.7000	1.0000	6.5863 (82)							
South	0.6400	47.0123	0.6300	0.7000	1.0000	11.9419 (82)							
Solar gains	347.6893	617.3586	901.6655	1196.7815	1401.6084	1415.2787	1354.7994	1200.3844	1004.6859	698.6139	421.2615	294.3094	(83)
Total gains	1186.3887	1450.3483	1701.6254	1941.2903	2088.1194	2055.9673	1969.3729	1826.0507	1666.2755	1414.3933	1193.8360	1109.7929	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	22.3363	22.3699	22.4030	22.5596	22.5891	22.7277	22.7277	22.7536	22.6741	22.5891	22.5295	22.4674	
alpha	2.4891	2.4913	2.4935	2.5040	2.5059	2.5152	2.5152	2.5169	2.5116	2.5059	2.5020	2.4978	
util living area													
	0.9587	0.9331	0.8901	0.8140	0.7038	0.5653	0.4401	0.4837	0.6760	0.8572	0.9389	0.9645	(86)
MIT	19.0305	19.2886	19.6676	20.1141	20.4839	20.7288	20.8302	20.8114	20.6200	20.1182	19.4851	18.9767	(87)
Th 2	19.8853	19.8867	19.8882	19.8950	19.8963	19.9023	19.9023	19.9034	19.9000	19.8963	19.8937	19.8910	(88)
util rest of house													
	0.9523	0.9232	0.8736	0.7854	0.6568	0.4929	0.3444	0.3871	0.6095	0.8286	0.9281	0.9590	(89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.2560	17.6276	18.1688	18.7975	19.2938	19.6011	19.7067	19.6927	19.4816	18.8202	17.9212	17.1824 (90)
Living area fraction									fLA = Living area / (4) =			0.3905 (91)
MIT	17.9490	18.2763	18.7542	19.3117	19.7586	20.0415	20.1455	20.1296	19.9262	19.3271	18.5319	17.8831 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7990	18.1263	18.6042	19.1617	19.6086	19.8915	19.9955	19.9796	19.7762	19.1771	18.3819	17.7331 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9364	0.9029	0.8501	0.7634	0.6432	0.4922	0.3530	0.3943	0.6012	0.8058	0.9086	0.9444	(94)
Useful gains	1110.8968	1309.5161	1446.5860	1481.9667	1343.0882	1011.8476	695.1265	719.9244	1001.6846	1139.7865	1084.7677	1048.0976	(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													
	2973.2538	2908.7974	2658.0920	2237.8399	1722.4250	1145.4184	734.9919	773.9671	1231.5882	1868.0278	2463.6185	2963.3758	(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	1385.5936	1074.7170	901.3604	544.2288	282.2266	0.0000	0.0000	0.0000	0.0000	541.8115	992.7726	1424.9670	(98)
Space heating												7147.6775	(98)
Space heating per m2												40.3573	(99)
												(98) / (4) =	

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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													7092.5135 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1385.5936	1074.7170	901.3604	544.2288	282.2266	0.0000	0.0000	0.0000	0.0000	541.8115	992.7726	1424.9670	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1374.8999	1066.4226	894.4040	540.0285	280.0485	0.0000	0.0000	0.0000	0.0000	537.6300	985.1106	1413.9695	(211)
Water heating requirement	213.1682	165.3411	138.6708	83.7275	43.4195	0.0000	0.0000	0.0000	0.0000	83.3556	152.7342	219.2257	(215)
Water heating requirement	185.9543	141.9305	117.0347	63.8319	28.9643	12.2748	6.7492	38.8217	69.4306	121.9861	160.9459	185.0662	(64)
Efficiency of water heater (217)m	89.1526	89.1738	89.1959	89.3226	89.4750	80.0000	80.0000	80.0000	80.0000	88.3358	88.8854	89.1956	(217)
Fuel for water heating, kWh/month	208.5797	159.1617	131.2108	71.4623	32.3714	15.3435	8.4365	48.5272	86.7882	138.0936	181.0713	207.4837	(219)
Water heating fuel used												1288.5299	(219)
Annual totals kWh/year													
Space heating fuel - main system													7092.5135 (211)
Space heating fuel - secondary													1099.6427 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													549.0559 (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)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													4851.9619 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7092.5135	3.4800	246.8195	(240)
Space heating - secondary	1099.6427	4.2300	46.5149	(242)
Water heating (other fuel)	1288.5299	3.4800	44.8408	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	549.0559	13.1900	72.4205	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Wind Turbine	-3575.5408	13.1900	-471.6138	(252)
Total energy cost			-152.3535	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = -0.2881 (257)
 SAP value 104.0189
 SAP rating (Section 12) 104 (258)
 SAP band 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	7092.5135	0.2160	1531.9829 (261)
Space heating - secondary	1099.6427	0.0190	20.8932 (263)
Water heating (other fuel)	1288.5299	0.2160	278.3225 (264)
Space and water heating			1831.1986 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	549.0559	0.5190	284.9600 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-571.1093 (272)
CO2 emissions per m2			-3.2200 (273)
EI value			103.4455
EI rating			103 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	95.1700 (1b)	x 2.2500 (2b)	= 214.1325 (1b) - (3b)
First floor	81.9400 (1c)	x 2.3100 (2c)	= 189.2814 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 403.4139 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					5 * 10 = 50.0000 (7a)							
Number of passive vents					1 * 10 = 10.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					60.0000 / (5) = 0.1487 (8)							
Pressure test					Yes							
Measured/design AP50					2.6400							
Infiltration rate					0.2807 (18)							
Number of sides sheltered					0 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2807 (21)							
Wind speed	Jan 5.0000	Feb 4.8000	Mar 4.7000	Apr 4.3000	May 4.2000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 3.9000	Oct 4.3000	Nov 4.3000	Dec 4.6000 (22)
Wind factor	1.2500	1.2000	1.1750	1.0750	1.0500	0.9500	0.9500	0.9250	0.9750	1.0750	1.0750	1.1500 (22a)
Adj infilt rate												
Effective ac	0.3509	0.3369	0.3299	0.3018	0.2948	0.2667	0.2667	0.2597	0.2737	0.3018	0.3018	0.3228 (22b)
	0.5616	0.5567	0.5544	0.5455	0.5434	0.5356	0.5356	0.5337	0.5375	0.5455	0.5455	0.5521 (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					
Windows (Uw = 1.40)			13.8700	1.3258	18.3883		(27)					
Patio Doors (Uw = 1.40)			24.8600	1.3258	32.9583		(27)					
R/ Winds Flat (corrected) (Uw = 1.80)			0.7900	1.6791	1.3265		(27a)					
R Wind Slope (corrected) (Uw = 1.60)			1.2800	1.5038	1.9248		(27a)					
Heat Loss Floor 1			95.1700	0.1600	15.2272		(28a)					
Exposed Floor			13.2200	0.1500	1.9830		(28b)					
External Wall 1	189.5300	38.7300	150.8000	0.1300	19.6040		(29a)					
External Roof Flat	89.0100	0.7900	88.2200	0.1500	13.2330		(30)					
External Roof Slope	32.5400	1.2800	31.2600	0.1300	4.0638		(30)					
Total net area of external elements Aum(A, m ²)			419.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	108.7089		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							36.4570 (36)					
Total fabric heat loss						(33) + (36) =	145.1659 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 74.7599	Feb 74.1173	Mar 73.8058	Apr 72.6255	May 72.3468	Jun 71.2977	Jul 71.2977	Aug 71.0518	Sep 71.5501	Oct 72.6255	Nov 72.6255	Dec 73.5009 (38)
Heat transfer coeff	219.9258	219.2832	218.9717	217.7914	217.5127	216.4636	216.4636	216.2177	216.7160	217.7914	217.7914	218.6668 (39)
Average = Sum(39)m / 12 =												217.7996 (39)
HLP	Jan 1.2417	Feb 1.2381	Mar 1.2364	Apr 1.2297	May 1.2281	Jun 1.2222	Jul 1.2222	Aug 1.2208	Sep 1.2236	Oct 1.2297	Nov 1.2297	Dec 1.2346 (40)
HLP (average)												1.2297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9720 (42)
Average daily hot water use (litres/day)												104.7853 (43)
Daily hot water use	115.2638	111.0724	106.8810	102.6896	98.4982	94.3067	94.3067	98.4982	102.6896	106.8810	111.0724	115.2638 (44)
Energy conte	170.9329	149.4990	154.2696	134.4960	129.0521	111.3621	103.1934	118.4159	119.8302	139.6505	152.4395	165.5394 (45)
Energy content (annual)												Total = Sum(45)m = 1648.6804 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6399	22.4248	23.1404	20.1744	19.3578	16.7043	15.4790	17.7624	17.9745	20.9476	22.8659	24.8309 (46)

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

Water storage loss:													210.0000	(47)	
Store volume													1.8000	(48)	
a) If manufacturer declared loss factor is known (kWh/day):													0.5400	(49)	
Temperature factor from Table 2b													0.9720	(55)	
Enter (49) or (54) in (55)													0.9720	(55)	
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage													19.3706	(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	23.2624	(59)	
Total heat required for water heating calculated for each month	213.5659	188.0062	195.5068	169.0001	158.8907	140.0131	132.7994	148.9524	155.6850	180.8877	193.6972	208.1723	(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													1177.6465	(H5)	
Overshading factor													0.8000	(H6)	
Solar energy available													1978.4461	(H7)	
Adjustment factor for showers													1.0000	(H7a)	
Solar-to-load ratio													1.2000	(H8)	
Utilisation factor													0.5654	(H9)	
Collector performance factor													0.8793	(H10)	
Dedicated solar storage volume													75.0000	(H11)	
Effective solar volume													115.5000	(H13)	
Daily hot water demand													104.7853	(H14)	
Volume ratio Veff/V													1.1023	(H15)	
Solar storage volume factor													1.0000	(H16)	
Solar input													-983.5831	(H17)	
Solar input	-32.0461	-46.9368	-79.8792	-108.0725	-125.1134	-133.9208	-128.4685	-114.2709	-90.8382	-60.6591	-37.2320	-26.1455	(63)		
Solar input (sum of months) = Sum(63)m =													-983.5831	(63)	
Output from w/h	181.5198	141.0694	115.6275	60.9275	33.7773	6.0923	4.3309	34.6816	64.8468	120.2286	156.4651	182.0269	(64)		
Total per year (kWh/year) = Sum(64)m =													1101.5937	(64)	
Heat gains from water heating, kWh/month	90.9416	80.5142	84.2844	72.3232	66.7807	59.9487	57.9966	63.8025	68.5274	79.4236	83.6923	89.1482	(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	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	178.3207	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.7245	69.0342	56.1424	42.5034	31.7718	26.8231	28.9833	37.6736	50.5654	64.2044	74.9360	79.8847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	520.4973	525.8984	512.2877	483.3122	446.7358	412.3591	389.3934	383.9923	397.6030	426.5785	463.1549	497.5316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	55.8041	(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)	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	-118.8805	(71)
Water heating gains (Table 5)	122.2333	119.8128	113.2855	100.4489	89.7591	83.2621	77.9524	85.7561	95.1769	106.7521	116.2393	119.8229	(72)
Total internal gains	838.6994	832.9897	799.9600	744.5088	686.5110	640.6886	614.5735	625.6663	661.5896	715.7793	772.5745	815.4835	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	4.1600	13.1177	0.6300	0.7000	0.7700	16.6771 (74)
East	4.4000	24.4891	0.6300	0.7000	0.7700	32.9304 (76)
South	3.1500	55.4171	0.6300	0.7000	0.7700	53.3490 (78)
West	2.1600	24.4891	0.6300	0.7000	0.7700	16.1658 (80)
North	3.9200	13.1177	0.6300	0.7000	0.7700	15.7150 (74)
South	10.2200	55.4171	0.6300	0.7000	0.7700	173.0879 (78)
West	10.7200	24.4891	0.6300	0.7000	0.7700	80.2305 (80)
Horizontal	0.7900	33.0000	0.6300	0.7000	1.0000	10.3472 (82)
East	0.6400	32.5353	0.6300	0.7000	1.0000	8.2645 (82)
South	0.6400	57.0591	0.6300	0.7000	1.0000	14.4939 (82)

Solar gains	421.2615	656.6404	959.9669	1290.5854	1420.3296	1563.2299	1454.0253	1308.6699	1108.0004	751.5228	499.9215	347.6893	(83)
Total gains	1259.9609	1489.6301	1759.9269	2035.0943	2106.8405	2203.9186	2068.5987	1934.3361	1769.5900	1467.3021	1272.4960	1163.1728	(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	(85)	
tau	22.3699	22.4355	22.4674	22.5891	22.6181	22.7277	22.7277	22.7536	22.7012	22.5891	22.5891	22.4987	(85)	
alpha	2.4913	2.4957	2.4978	2.5059	2.5079	2.5152	2.5152	2.5169	2.5134	2.5059	2.5059	2.4999	(85)	
util living area	0.9526	0.9294	0.8816	0.8025	0.6963	0.5322	0.4384	0.4624	0.6584	0.8458	0.9276	0.9597	(86)	
MIT	19.0957	19.3173	19.7163	20.1392	20.4997	20.7527	20.8279	20.8195	20.6338	20.1553	19.5815	19.0454	(87)	
Th 2	19.8867	19.8896	19.8910	19.8963	19.8976	19.9023	19.9023	19.9034	19.9011	19.8963	19.8963	19.8924	(88)	
util rest of house	0.9454	0.9190	0.8641	0.7732	0.6485	0.4600	0.3473	0.3682	0.5925	0.8154	0.9148	0.9535	(89)	

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MIT 2	17.3508	17.6702	18.2389	18.8306	19.3149	19.6248	19.7034	19.6986	19.4961	18.8701	18.0603	17.2826 (90)
Living area fraction									fLA = Living area / (4) =			0.3905 (91)
MIT	18.0322	18.3134	18.8159	19.3417	19.7776	20.0653	20.1426	20.1364	19.9405	19.3720	18.6544	17.9711 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8822	18.1634	18.6659	19.1917	19.6276	19.9153	19.9926	19.9864	19.7905	19.2220	18.5044	17.8211 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9282	0.8984	0.8405	0.7516	0.6355	0.4609	0.3552	0.3758	0.5851	0.7929	0.8941	0.9379 (94)
Useful gains	1169.4810	1338.2134	1479.1538	1529.6622	1338.8395	1015.7927	734.8555	726.9441	1035.4276	1163.4834	1137.6830	1090.8923 (95)
Ext temp.	4.4000	4.9000	6.6000	8.8000	11.8000	14.7000	16.4000	16.4000	14.0000	10.7000	7.4000	4.4000 (96)
Heat loss rate W												
	2965.0900	2908.4510	2642.0832	2263.2133	1702.6043	1128.9285	777.6637	775.4384	1254.8833	1856.0239	2418.4446	2934.7381 (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	1335.9332	1055.1996	865.2194	528.1568	270.6410	0.0000	0.0000	0.0000	0.0000	515.2501	922.1483	1371.8213 (98)
Space heating												6864.3699 (98)
Space heating per m2												(98) / (4) = 36.7577 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												6811.3924 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1335.9332	1055.1996	865.2194	528.1568	270.6410	0.0000	0.0000	0.0000	0.0000	515.2501	922.1483	1371.8213 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	1325.6228	1047.0559	858.5419	524.0806	268.5523	0.0000	0.0000	0.0000	0.0000	511.2736	915.0314	1361.2339 (211)
Water heating requirement	205.5282	162.3384	133.1107	81.2549	41.6371	0.0000	0.0000	0.0000	0.0000	79.2693	141.8690	211.0494 (215)
Water heating requirement	181.5198	141.0694	115.6275	60.9275	33.7773	6.0923	4.3309	34.6816	64.8468	120.2286	156.4651	182.0269 (64)
Efficiency of water heater (217)m	89.1362	89.1577	89.1582	89.3424	89.2463	80.0000	80.0000	80.0000	80.0000	88.2693	88.8157	89.1676 (217)
Fuel for water heating, kWh/month	203.6432	158.2246	129.6880	68.1956	37.8473	7.6154	5.4136	43.3519	81.0585	136.2066	176.1683	204.1401 (219)
Water heating fuel used												1251.5530 (219)
Annual totals kWh/year												
Space heating fuel - main system												6811.3924 (211)
Space heating fuel - secondary												1056.0569 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												549.0559 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1178 * 0.80) =										-1884.2344		-1884.2344 (233)
Wind generation												-3575.5408 (234)
Total delivered energy for all uses												4333.2831 (238)

10a. Fuel costs - using BEDF prices (444)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6811.3924	3.9300	267.6877 (240)
Space heating - secondary	1056.0569	4.6500	49.1066 (242)
Water heating (other fuel)	1251.5530	3.9300	49.1860 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Pump for solar water heating	50.0000	17.5600	8.7800 (249)
Energy for lighting	549.0559	17.5600	96.4142 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1884.2344	17.5600	-330.8716 (252)
Wind Turbine	-3575.5408	17.5600	-627.8650 (252)
Total energy cost			-386.3919 (255)

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

Energy Emission factor Emissions

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	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	6811.3924	0.2160	1471.2608 (261)
Space heating - secondary	1056.0569	0.0190	20.0651 (263)
Water heating (other fuel)	1251.5530	0.2160	270.3355 (264)
Space and water heating			1761.6613 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	549.0559	0.5190	284.9600 (268)
Energy saving/generation technologies			
PV Unit	-1884.2344	0.5190	-977.9176 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-722.1270 (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	6811.3924	1.2200	8309.8987 (261)
Space heating - secondary	1056.0569	1.0400	1098.2992 (263)
Water heating (other fuel)	1251.5530	1.2200	1526.8947 (264)
Space and water heating			10935.0926 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	549.0559	3.0700	1685.6015 (268)
Energy saving/generation technologies			
PV Unit	-1884.2344	3.0700	-5784.5995 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-3757.0655 (272)
Primary energy kWh/m2/year			-21.2132 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1065.01 (P1)
Transmission heat loss coefficient	145.17 (37)
Summer heat loss coefficient	1210.18 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	2.250	0.570	Normal overhang
West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
East	1.000	1.00	1.000	1.000 (P8)
South	1.000	0.90	1.000	0.900 (P8)
South	1.000	1.00	1.000	1.000 (P8)
West	1.000	0.90	0.570	0.470 (P8)
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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.1600	82.4373	0.6300	0.7000	0.9000	122.5013
East	4.4000	119.1985	0.6300	0.7000	0.9000	187.3471
South	3.1500	113.6726	0.6300	0.7000	0.9000	127.9057
West	2.1600	119.1985	0.6300	0.7000	0.4700	48.0290
North	3.9200	82.4373	0.6300	0.7000	0.9000	115.4340
South	10.2200	113.6726	0.6300	0.7000	0.9000	414.9831
West	10.7200	119.1985	0.6300	0.7000	0.9000	456.4457
Horizontal	0.7900	206.0000	0.6300	0.7000	1.0000	64.5915
East	0.6400	179.1999	0.6300	0.7000	1.0000	45.5197
South	0.6400	193.5489	0.6300	0.7000	1.0000	49.1645

total: 1631.9217

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	Jun	Jul	Aug	
Solar gains	1769	1632	1472	(P3)
Internal gains	663	637	647	
Total summer gains	2433	2269	2119	(P5)
Summer gain/loss ratio	2.01	1.87	1.75	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	18.31	19.87	19.75	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature:	Not significant			

U-VALUE CALCULATOR REPORT



Property Reference	1753 Mill Lane	Issued on Date	16/04/2019
Assessment Reference	As Built SAP	Prop Type Ref	Detached House
Project	Summer Cottage, Edgebridge, Mere, WARMINSTER, Wiltshire, BA12 6DB		
Calculation Type	New Build (As Built)		

SAP Rating	85 B	DER	14.71	TER	15.51
Environmental	85 B	% DER<TER	5.17		
CO ₂ Emissions (t/year)	2.38	DFEE	48.86	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	16.10		

Assessor Details	Mr. Richard Harris, Peninsula Energy Compliance, Tel: 01392683664, richard@pecairsap.com	Assessor ID	J794-0001
Client	Urgent Developments, 1753		

Building Elements

Wall Generic Heatloss Wall

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Limestone Main construction	100	1.7000	0.0588	100.00
Layer 2	Standard cavity Main construction Corrections - Cavity Unventilated, Emissivity: Normal	50	0.2778	0.1800	100.00
Layer 3	Ecotherm Full Fill Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	100	0.0220	4.5455	100.00
Layer 4	Breather membrane Main construction	2	0.0000	0.0000	100.00
Layer 5	Orientated Strand Board Main construction	18	0.1300	0.1385	100.00
Layer 6	Mineral wool Main construction Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	150 150	0.0400 0.1300	3.7500 1.1538	85.00 15.00
Layer 7	Plasterboard, standard Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance: Upper limit = 8.384 m² K/W Lower limit = 7.956 m² K/W Average = 8.170 m² K/W
 Total correction = 0.0043 m² K/W U-value (unrounded) = 0.13 W/m² K

Unheated space: None

Total thickness: 433 mm

U-value: 0.13 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT



Property Reference	1753 Mill Lane	Issued on Date	16/04/2019
Assessment Reference	As Built SAP	Prop Type Ref	Detached House
Project	Summer Cottage, Edgebridge, Mere, WARMINSTER, Wiltshire, BA12 6DB		
Calculation Type	New Build (As Built)		

SAP Rating	85 B	DER	14.71	TER	15.51
Environmental	85 B	% DER<TER	5.17		
CO ₂ Emissions (t/year)	2.38	DFEE	48.86	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	16.10		

Assessor Details	Mr. Richard Harris, Peninsula Energy Compliance, Tel: 01392683664, richard@pecairsap.com	Assessor ID	J794-0001
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Client	Urgent Developments, 1753
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Building Elements

Floor 000001 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 95.17 m², Perimeter = 51.52 m, Wall thickness = 300.00 mm, Soil: Clay

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.000 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Blockwork, dense				
	Main construction	100	1.5900	0.0629	86.00
	Main construction	100	0.8800	0.1136	14.00
Layer 2	Celotex FF4000				
	Main construction	100	0.0220	4.5455	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance: Upper limit = 5.125 m² K/W Lower limit = 5.122 m² K/W Average = 5.123 m² K/W

Total correction = 0.0079 m² K/W

U-value (unrounded) = 0.16 W/m² K

Unheated space: None

Total thickness: 222 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT



Property Reference	1753 Mill Lane	Issued on Date	16/04/2019
Assessment Reference	As Built SAP	Prop Type Ref	Detached House
Project	Summer Cottage, Edgebridge, Mere, WARMINSTER, Wiltshire, BA12 6DB		
Calculation Type	New Build (As Built)		

SAP Rating	85 B	DER	14.71	TER	15.51
Environmental	85 B	% DER<TER	5.17		
CO ₂ Emissions (t/year)	2.38	DFEE	48.86	TFEE	58.24
General Requirements Compliance	Pass	% DFEE<TFEE	16.10		

Assessor Details	Mr. Richard Harris, Peninsula Energy Compliance, Tel: 01392683664, richard@pecairsap.com	Assessor ID	J794-0001
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Client	Urgent Developments, 1753
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Building Elements

Floor 000002

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Asbestos cement				
	Main construction	20	0.6000	0.0333	100.00
Layer 2	TLX Silver				
	Main construction	30	0.0330	0.9100	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Celotex XR4000				
	Main construction	150	0.0220	6.8182	85.00
	Main construction	150	0.1300	1.1538	15.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	TLX Gold				
	Main construction	33	0.0388	0.8500	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance: Upper limit = 7.162 m² K/W Lower limit = 6.099 m² K/W Average = 6.630 m² K/W
 Total correction = 0.0039 m² K/W U-value (unrounded) = 0.15 W/m² K

Unheated space: None

Total thickness: 255 mm

U-value: 0.15 W/m² K

Kappa: n/a