



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 87 Highwood Avenue, North Stoneham Park
EASTLEIGH, SO50 9QY

Contact: Scott Spearing | BEAT Solutions
01489 565920
scott@beatsolutions.co.uk

Report Issue Date: 06/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 210			Issued on Date	06/03/2023
Assessment Reference	AB	Prop Type Ref	Type 6		
Property	87 Highwood Avenue, North Stoneham Park, EASTLEIGH, SO50 9QY				
SAP Rating	87 B	DER	14.27	TER	18.15
Environmental	88 B	% DER<TER	21.36		
CO ₂ Emissions (t/year)	1.13	DFEE	53.41	TFEE	58.80
General Requirements Compliance	Pass	% DFEE<TFEE	9.16		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD				

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)	18.15	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.27	kgCO ₂ /m ²	Pass
	-3.88 (-21.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.80	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	53.41	kWh/m ² /yr	
	-5.4 (-9.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.20 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing East

13.40 m², No overhang

Windows facing South

1.20 m², No overhang

Windows facing West

5.95 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.20 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Photovoltaic array

0.96

kW

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

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
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:	29.74 m	52.50 m ²	2.40 m
	1st Storey:	29.74 m	52.50 m ²	2.66 m

7.0 Living Area	18.20	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	82.89	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	150.48	127.78

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
		Double plasterboard on both sides, twin timber f rame with/without sheathing board		20.00	

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - GF	Plasterboard on timber frame		9.00	60.48
Internal Wall - FF	Plasterboard on timber frame		9.00	78.81

10.0 External Roofs					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	52.50

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	52.50

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.17	75.00	52.50

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	52.50

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Solid Doors	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] External Wall	West							2.15	
Front Elevation	Window	[1] External Wall	West	None	0.00					5.95	
Side Elevation	Window	[1] External Wall	South	None	0.00					1.20	
Rear Elevation	Window	[1] External Wall	East	None	0.00					13.40	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	15.77	0.300	Yes
Table K1 - Approved	E3 Sill	14.75	0.040	Yes
Table K1 - Approved	E4 Jamb	35.04	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	29.74	0.160	Yes
Table K1 - Approved	E6 Intermediate floor within a dwelling	29.74	0.070	Yes
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	17.28	0.060	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	12.46	0.240	No
Table K1 - Approved	E16 Corner (normal)	25.30	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	5.06	-0.090	No

Y-value 0.077 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	6.00	m ³ /(h.m ²) @ 50 Pa
As Built AP ₅₀	Yes	
	5.20	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

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

Description

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

Flow Temperature

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

SUMMARY FOR INPUT DATA

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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

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.96	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£81	B 88	

U-VALUE CALCULATOR REPORT

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Client	Highwood Construction Ltd, HIGHWOOD		

Building Elements

Roof Pitched Roof - 400mm Quilt

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool				
	Main construction	300	0.0400	7.5000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	100	0.0400	2.5000	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 10.046 m ² K/W	Lower limit = 9.832 m ² K/W	Average = 9.939 m ² K/W
	Total correction = 0.0005 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

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Building Elements

Wall External Wall - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.2900	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.0000	82.81
	Main construction	100	0.9407	0.0000	17.19
Layer 2	Standard cavity				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Low Emissivity (BR443)				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 6	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 8	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 9	Service Void				
	Main construction	25	0.0321	0.7800	89.63
	Main construction	25	0.1300	0.1923	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 11	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.477 m² K/W Lower limit = 4.778 m² K/W Average = 5.128 m² K/W
Total correction = 0.0041 m² K/W U-value (unrounded) = 0.2 W/m² K

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 52.50 m², Perimeter = 29.74 m, Wall thickness = 300.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 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	82.95
	Main construction	100	2.2000	0.0455	17.05
Layer 2	Jablite Jabfloor (HP)				
	Main construction	150	0.0320	4.6875	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 5.153 m² K/W Lower limit = 5.152 m² K/W Average = 5.152 m² K/W

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.17 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.17 W/m² K

Kappa: n/a

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 105 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) 18.15 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.27 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 53.4 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.20 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 13.40 m², No overhang
Windows facing South: 1.20 m², No overhang
Windows facing West: 5.95 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Photovoltaic array 0.96 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1129 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.3729 (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) =	0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4755	0.4662	0.4568	0.4102	0.4009	0.3543	0.3543	0.3450	0.3729	0.4009	0.4195	0.4382 (22b)
Effective ac	0.6130	0.6087	0.6044	0.5841	0.5804	0.5628	0.5628	0.5595	0.5695	0.5804	0.5880	0.5960 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			18.0000	945.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8703.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.8917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss							(33) + (36) = 89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.7422	53.3574	52.9802	51.2085	50.8770	49.3339	49.3339	49.0482	49.9283	50.8770	51.5476	52.2486 (38)
Heat transfer coeff	143.4895	143.1047	142.7275	140.9558	140.6243	139.0813	139.0813	138.7955	139.6756	140.6243	141.2949	141.9959 (39)
Average = Sum(39)m / 12 =												140.9542 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3666	1.3629	1.3593	1.3424	1.3393	1.3246	1.3246	1.3219	1.3302	1.3393	1.3457	1.3523 (40)
HLP (average)												1.3424 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)												Total = Sum(45)m = 1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1491	12.7686	14.1108	13.6162	14.0358	13.5435	13.9704	14.0128	13.5831	14.0772	13.6628	14.1367 (61)
Total heat required for water heating calculated for each month	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (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	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (64)
								Total per year (kWh/year) = Sum(64)m =				1743.0608 (64)
Heat gains from water heating, kWh/month	57.9150	50.7512	52.6044	46.1903	44.5634	38.8128	36.3208	41.1740	41.5165	47.9454	51.9102	56.1961 (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	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.7737	21.1156	17.1723	13.0006	9.7181	8.2044	8.8652	11.5233	15.4665	19.6383	22.9208	24.4344 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.1668	266.9081	260.0003	245.2944	226.7308	209.2837	197.6280	194.8868	201.7946	216.5004	235.0640	252.5111 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062 (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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497 (71)
Water heating gains (Table 5)	77.8427	75.5227	70.7049	64.1532	59.8971	53.9066	48.8183	55.3415	57.6619	64.4427	72.0975	75.5324 (72)
Total internal gains	433.5019	431.2649	415.5961	390.1668	364.0646	339.1134	323.0300	329.4701	342.6415	368.3001	397.8009	420.1965 (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
East			13.4000		19.6403		0.6300		0.7000		0.7700		80.4311 (76)
South			1.2000		46.7521		0.6300		0.7000		0.7700		17.1456 (78)
West			5.9500		19.6403		0.6300		0.7000		0.7700		35.7138 (80)
Solar gains	133.2905	255.2842	409.9418	586.1355	710.9137	725.1636	691.3997	598.3447	472.5434	299.8838	165.1425	110.3273	(83)
Total gains	566.7924	686.5491	825.5379	976.3023	1074.9783	1064.2770	1014.4297	927.8148	815.1850	668.1839	562.9434	530.5238	(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	16.8491	16.8945	16.9391	17.1520	17.1924	17.3832	17.3832	17.4190	17.3092	17.1924	17.1108	17.0264
alpha	2.1233	2.1263	2.1293	2.1435	2.1462	2.1589	2.1589	2.1613	2.1539	2.1462	2.1407	2.1351
util living area	0.9638	0.9453	0.9100	0.8436	0.7461	0.6206	0.5025	0.5501	0.7380	0.8895	0.9499	0.9683 (86)
MIT	17.7620	18.0995	18.6866	19.4429	20.1060	20.5920	20.8183	20.7722	20.3578	19.4656	18.4796	17.7071 (87)
Th 2	19.7891	19.7919	19.7947	19.8077	19.8102	19.8216	19.8216	19.8237	19.8172	19.8102	19.8052	19.8001 (88)
util rest of house	0.9585	0.9372	0.8963	0.8186	0.7021	0.5469	0.3960	0.4453	0.6759	0.8664	0.9411	0.9636 (89)
MIT 2	16.8499	17.1846	17.7633	18.5043	19.1284	19.5654	19.7392	19.7133	19.3782	18.5442	17.5738	16.8025 (90)
Living area fraction									fLA =	Living area / (4) =		0.1733 (91)
MIT	17.0080	17.3432	17.9234	18.6670	19.2978	19.7434	19.9263	19.8969	19.5480	18.7039	17.7308	16.9593 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0080	17.3432	17.9234	18.6670	19.2978	19.7434	19.9263	19.8969	19.5480	18.7039	17.7308	16.9593 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9408	0.9147	0.8685	0.7892	0.6801	0.5414	0.4063	0.4525	0.6591	0.8383	0.9198	0.9475 (94)
Useful gains	533.2429	627.9760	716.9458	770.5109	731.0598	576.2039	412.2026	419.8519	537.3182	560.1513	517.8153	502.6807 (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	1823.4606	1780.6822	1630.4260	1376.7098	1068.4404	715.3443	462.6218	485.3509	760.9492	1139.6049	1502.0800	1811.7697 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	959.9220	774.6185	679.6293	436.4632	251.0112	0.0000	0.0000	0.0000	0.0000	431.1135	708.6706	973.9622 (98)
Space heating												5215.3905 (98)
Space heating per m2										(98) / (4) =		49.6704 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5762.8624 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	959.9220	774.6185	679.6293	436.4632	251.0112	0.0000	0.0000	0.0000	0.0000	431.1135	708.6706	973.9622 (98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)	
Space heating fuel (main heating system)	1060.6873	855.9321	750.9716	482.2798	277.3605	0.0000	0.0000	0.0000	0.0000	476.3685	783.0614	1076.2013 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (64)	
Efficiency of water heater (217)m	89.9848	89.9479	89.8669	89.6917	89.3410	87.3000	87.3000	87.3000	87.3000	89.6614	89.8946	90.0036 (217)	
Fuel for water heating, kWh/month	197.4678	173.2152	179.9439	158.6510	153.9136	137.5607	129.0971	145.8288	146.8866	164.7191	177.4423	191.6795 (219)	
Water heating fuel used												1956.4058 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5762.8624 (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)												419.8508 (232)	
Energy saving/generation technologies (Appendices M,N and Q)													
PV Unit 0 (0.80 * 0.96 * 1068 * 1.00) =										-820.2781		-820.2781 (233)	
Total delivered energy for all uses												7393.8409 (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	5762.8624	0.2160	1244.7783 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1956.4058	0.2160	422.5836 (264)	
Space and water heating			1667.3619 (265)	
Pumps and fans	75.0000	0.5190	38.9250 (267)	
Energy for lighting	419.8508	0.5190	217.9026 (268)	
Energy saving/generation technologies				
PV Unit	-820.2781	0.5190	-425.7244 (269)	
Total CO2, kg/year			1498.4652 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			14.2700 (273)	

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

DER			14.2700 ZC1
Total Floor Area		TFA	105.0000
Assumed number of occupants		N	2.7812
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.9085 ZC2
CO2 emissions from cooking, equation (L16)			1.7690 ZC3
Total CO2 emissions			30.9476 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			30.9476 ZC8

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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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (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) = 0.1506 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4006 (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) =				0.4006 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5107	0.5007	0.4907	0.4406	0.4306	0.3805	0.3805	0.3705	0.4006	0.4306	0.4506	0.4707 (22b)
Effective ac	0.6304	0.6254	0.6204	0.5971	0.5927	0.5724	0.5724	0.5686	0.5802	0.5927	0.6015	0.6108 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1300	6.8250		(28a)
External Wall	150.4800	22.7000	127.7800	0.1800	23.0004		(29a)
External Roof	52.5000		52.5000	0.1300	6.8250		(30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.0447		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6424 (36)
Total fabric heat loss						(33) + (36) =	77.6871 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	55.2658	54.8218	54.3866	52.3425	51.9601	50.1798	50.1798
Heat transfer coeff	132.9529	132.5089	132.0737	130.0297	129.6472	127.8669	127.8669
Average = Sum(39)m / 12 =							127.5372
							128.5527
							129.6472
							130.4209
							131.2297 (39)
							130.0278 (39)
HLP	1.2662	1.2620	1.2578	1.2384	1.2347	1.2178	1.2178
HLP (average)							1.2146
Days in month	31	28	31	30	31	30	31
							1.2243
							1.2347
							1.2421
							1.2498 (40)
							1.2384 (40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)										Total = Sum(45)m =		1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.4518	48.0233	44.4965	45.9797	48.0233	48.4518	50.9589	49.3151	50.9589 (61)
Solar input	214.5009	189.0623	198.5581	177.1323	171.4953	151.0435	144.7112	161.3190	163.1006	184.5711	195.1632	209.3406 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	214.5009	189.0623	198.5581	177.1323	171.4953	151.0435	144.7112	161.3190	163.1006	184.5711	195.1632	209.3406 (64)
	67.1174	59.0659	61.8164	54.8992	53.0603	46.5510	44.3231	49.6767	50.2337	57.1658	60.8233	65.4016 (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	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.7737	21.1156	17.1723	13.0006	9.7181	8.2044	8.8652	11.5233	15.4665	19.6383	22.9208	24.4344	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.1668	266.9081	260.0003	245.2944	226.7308	209.2837	197.6280	194.8868	201.7946	216.5004	235.0640	252.5111	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	(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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	(71)
Water heating gains (Table 5)	90.2116	87.8957	83.0866	76.2489	71.3176	64.6542	59.5741	66.7697	69.7690	76.8357	84.4768	87.9054	(72)
Total internal gains	445.8708	443.6380	427.9779	402.2625	375.4851	349.8609	333.7859	340.8984	354.7487	380.6931	410.1802	432.5696	(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
East			13.4000		19.6403		0.6300		0.7000		0.7700		80.4311 (76)
South			1.2000		46.7521		0.6300		0.7000		0.7700		17.1456 (78)
West			5.9500		19.6403		0.6300		0.7000		0.7700		35.7138 (80)
Solar gains	133.2905	255.2842	409.9418	586.1355	710.9137	725.1636	691.3997	598.3447	472.5434	299.8838	165.1425	110.3273	(83)
Total gains	579.1613	698.9222	837.9197	988.3979	1086.3988	1075.0246	1025.1856	939.2431	827.2921	680.5769	575.3226	542.8969	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.8440	55.0277	55.2091	56.0769	56.2424	57.0254	57.0254	57.1728	56.7212	56.2424	55.9087	55.5641	
alpha	4.6563	4.6685	4.6806	4.7385	4.7495	4.8017	4.8017	4.8115	4.7814	4.7495	4.7272	4.7043	
util living area	0.9986	0.9963	0.9881	0.9559	0.8662	0.6995	0.5345	0.5986	0.8545	0.9804	0.9970	0.9990	(86)
MIT	19.5618	19.7403	20.0464	20.4467	20.7668	20.9414	20.9870	20.9784	20.8411	20.4000	19.9098	19.5397	(87)
Th 2	19.8674	19.8707	19.8740	19.8894	19.8923	19.9058	19.9058	19.9083	19.9006	19.8923	19.8865	19.8804	(88)
util rest of house	0.9981	0.9950	0.9837	0.9389	0.8166	0.6037	0.4089	0.4692	0.7815	0.9700	0.9957	0.9986	(89)
MIT 2	17.9537	18.2167	18.6636	19.2435	19.6666	19.8676	19.9012	19.8996	19.7724	19.1898	18.4759	17.9303	(90)
Living area fraction	18.2325	18.4808	18.9033	19.4521	19.8573	20.0538	20.0894	20.0866	19.9577	19.3995	18.7245	18.2093	(91)
MIT	18.2325	18.4808	18.9033	19.4521	19.8573	20.0538	20.0894	20.0866	19.9577	19.3995	18.7245	18.2093	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2325	18.4808	18.9033	19.4521	19.8573	20.0538	20.0894	20.0866	19.9577	19.3995	18.7245	18.2093	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	577.3851	693.7295	819.7629	919.4894	885.1764	663.9836	441.5029	461.6168	650.2343	655.6884	571.6491	541.6634	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1852.3630	1799.5799	1638.1535	1372.0824	1057.5717	697.3548	446.1810	470.1802	753.0175	1140.8352	1516.0759	1838.4352	(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	948.5836	743.1315	608.8826	325.8670	128.2620	0.0000	0.0000	0.0000	0.0000	360.9492	679.9873	964.7982	(98)
Space heating												4760.4615	(98)
Space heating per m2												45.3377	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5096.8539 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	948.5836	743.1315	608.8826	325.8670	128.2620	0.0000	0.0000	0.0000	0.0000	360.9492	679.9873	964.7982 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	1015.6141	795.6440	651.9086	348.8940	137.3255	0.0000	0.0000	0.0000	0.0000	386.4553	728.0378	1032.9745 (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	214.5009	189.0623	198.5581	177.1323	171.4953	151.0435	144.7112	161.3190	163.1006	184.5711	195.1632	209.3406 (64)
Efficiency of water heater (217)m	88.3506	88.1513	87.6878	86.5657	84.3315	80.3000	80.3000	80.3000	80.3000	86.7100	87.9335	80.3000 (216)
Fuel for water heating, kWh/month	242.7838	214.4747	226.4375	204.6217	203.3584	188.0990	180.2132	200.8955	203.1141	212.8603	221.9441	236.7645 (219)
Water heating fuel used												2535.5668 (219)
Annual totals kWh/year												
Space heating fuel - main system												5096.8539 (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)												419.8508 (232)
Total delivered energy for all uses												8127.2716 (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	5096.8539	0.2160	1100.9204 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2535.5668	0.2160	547.6824 (264)
Space and water heating			1648.6029 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	419.8508	0.5190	217.9026 (268)
Total CO2, kg/m2/year			1905.4305 (272)
Emissions per m2 for space and water heating			15.7010 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0753 (272b)
Emissions per m2 for pumps and fans			0.3707 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7010 * 1.00) + 2.0753 + 0.3707, rounded to 2 d.p.			18.1500 (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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1506 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.4106 (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) =				0.4106 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5235	0.5132	0.5030	0.4516	0.4414	0.3900	0.3900	0.3798	0.4106	0.4414	0.4619	0.4824 (22b)
Effective ac	0.6370	0.6317	0.6265	0.6020	0.5974	0.5761	0.5761	0.5721	0.5843	0.5974	0.6067	0.6164 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			9.0000	472.5000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8231.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.3917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss							(33) + (36) = 89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	55.8437	55.3773	54.9201	52.7728	52.3710	50.5007	50.5007	50.1543	51.2211	52.3710	53.1838	54.0335 (38)
Heat transfer coeff	145.5911	145.1246	144.6675	142.5201	142.1183	140.2480	140.2480	139.9017	140.9684	142.1183	142.9311	143.7808 (39)
Average = Sum(39)m / 12 =												142.5182 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3866	1.3821	1.3778	1.3573	1.3535	1.3357	1.3357	1.3324	1.3426	1.3535	1.3612	1.3693 (40)
HLP (average)												1.3573 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)												Total = Sum(45)m = 1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.7527	30.3949	31.3648	27.3446	26.2378	22.6412	20.9804	24.0754	24.3629	28.3926	30.9927	33.6561 (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	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.7737	21.1156	17.1723	13.0006	9.7181	8.2044	8.8652	11.5233	15.4665	19.6383	22.9208	24.4344	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.1668	266.9081	260.0003	245.2944	226.7308	209.2837	197.6280	194.8868	201.7946	216.5004	235.0640	252.5111	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	(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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	(71)
Water heating gains (Table 5)	46.7106	45.2305	42.1570	37.9786	35.2659	31.4462	28.1995	32.3593	33.8373	38.1621	43.0455	45.2367	(72)
Total internal gains	399.3697	397.9728	384.0483	360.9922	336.4334	313.6529	299.4113	303.4880	315.8170	339.0194	365.7489	386.9009	(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
East				13.4000	19.6403		0.6300		0.7000		0.7700		80.4311 (76)
South				1.2000	46.7521		0.6300		0.7000		0.7700		17.1456 (78)
West				5.9500	19.6403		0.6300		0.7000		0.7700		35.7138 (80)
Solar gains	133.2905	255.2842	409.9418	586.1355	710.9137	725.1636	691.3997	598.3447	472.5434	299.8838	165.1425	110.3273	(83)
Total gains	532.6603	653.2570	793.9901	947.1277	1047.3471	1038.8166	990.8110	901.8327	788.3604	638.9033	530.8913	497.2282	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.7044	15.7549	15.8047	16.0428	16.0882	16.3027	16.3027	16.3431	16.2194	16.0882	15.9967	15.9022	
alpha	2.0470	2.0503	2.0536	2.0695	2.0725	2.0868	2.0868	2.0895	2.0813	2.0725	2.0664	2.0601	
util living area	0.9648	0.9461	0.9109	0.8449	0.7491	0.6255	0.5090	0.5576	0.7432	0.8920	0.9512	0.9692	(86)
MIT	17.5731	17.9237	18.5356	19.3303	20.0282	20.5488	20.7946	20.7436	20.2975	19.3571	18.3270	17.5222	(87)
Th 2	19.7736	19.7771	19.7804	19.7962	19.7992	19.8130	19.8130	19.8155	19.8076	19.7992	19.7932	19.7869	(88)
util rest of house	0.9596	0.9383	0.8975	0.8204	0.7058	0.5525	0.4023	0.4530	0.6823	0.8696	0.9429	0.9647	(89)
MIT 2	16.6609	17.0093	17.6134	18.3946	19.0541	19.5267	19.7182	19.6891	19.3232	18.4392	17.4233	16.6188	(90)
Living area fraction									fLA = Living area / (4) =			0.1733	(91)
MIT	16.8190	17.1678	17.7732	18.5568	19.2230	19.7039	19.9048	19.8719	19.4921	18.5983	17.5800	16.7754	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.8190	17.1678	17.7732	18.5568	19.2230	19.7039	19.9048	19.8719	19.4921	18.5983	17.5800	16.7754	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	501.5367	597.7087	689.4721	747.4330	713.7252	566.0590	407.6039	413.5473	522.7316	536.7276	488.9644	471.5078	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1822.6550	1780.3637	1630.8684	1376.2818	1069.1510	715.8086	463.4925	485.7256	760.1175	1136.6994	1497.9149	1808.1018	(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	982.9120	794.7441	700.3988	452.7711	264.4368	0.0000	0.0000	0.0000	0.0000	446.3791	726.4443	994.4259	(98)
Space heating												5362.5121	(98)
Space heating per m2												51.0715	(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	1318.3312	1037.8352	1063.2526	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6770	0.7398	0.7057	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	892.4918	767.7627	750.3319	0.0000	0.0000	0.0000	0.0000	(102)

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1322.0084	1263.5526	1161.5008	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	309.2519	368.8677	305.9097	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												984.0292 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	77.3130	92.2169	76.4774	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												246.0073 (107)
Space cooling per m2												2.3429 (108)
Energy for space heating												51.0715 (99)
Energy for space cooling												2.3429 (108)
Total												53.4145 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.4 (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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (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) = 0.1506 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4006 (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) =	0.4006 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5107	0.5007	0.4907	0.4406	0.4306	0.3805	0.3805	0.3705	0.4006	0.4306	0.4506	0.4707 (22b)
Effective ac	0.6304	0.6254	0.6204	0.5971	0.5927	0.5724	0.5724	0.5686	0.5802	0.5927	0.6015	0.6108 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1300	6.8250		(28a)
External Wall	150.4800	22.7000	127.7800	0.1800	23.0004		(29a)
External Roof	52.5000		52.5000	0.1300	6.8250		(30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.0447		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6424 (36)
Total fabric heat loss						(33) + (36) =	77.6871 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	55.2658	54.8218	54.3866	52.3425	51.9601	50.1798	50.1798
Heat transfer coeff	132.9529	132.5089	132.0737	130.0297	129.6472	127.8669	127.8669
Average = Sum(39)m / 12 =							127.5372
							128.5527
							129.6472
							130.4209
							131.2297 (39)
							130.0278 (39)
HLP	1.2662	1.2620	1.2578	1.2384	1.2347	1.2178	1.2178
HLP (average)							1.2146
Days in month	31	28	31	30	31	30	31
							1.2243
							1.2347
							1.2421
							1.2498 (40)
							1.2384 (40)
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)										Total = Sum(45)m =		1577.3937 (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	(46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
If cylinder contains dedicated solar storage												

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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 (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 (59)
	34.7527	30.3949	31.3648	27.3446	26.2378	22.6412	20.9804	24.0754	24.3629	28.3926	30.9927	33.6561	(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	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	139.0621	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.7737	21.1156	17.1723	13.0006	9.7181	8.2044	8.8652	11.5233	15.4665	19.6383	22.9208	24.4344	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.1668	266.9081	260.0003	245.2944	226.7308	209.2837	197.6280	194.8868	201.7946	216.5004	235.0640	252.5111	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	36.9062	(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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	(71)
Water heating gains (Table 5)	46.7106	45.2305	42.1570	37.9786	35.2659	31.4462	28.1995	32.3593	33.8373	38.1621	43.0455	45.2367	(72)
Total internal gains	399.3697	397.9728	384.0483	360.9922	336.4334	313.6529	299.4113	303.4880	315.8170	339.0194	365.7489	386.9009	(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	
East				13.4000	19.6403	0.6300	0.7000		0.7700		80.4311 (76)	
South				1.2000	46.7521	0.6300	0.7000		0.7700		17.1456 (78)	
West				5.9500	19.6403	0.6300	0.7000		0.7700		35.7138 (80)	
Solar gains	133.2905	255.2842	409.9418	586.1355	710.9137	725.1636	691.3997	598.3447	472.5434	299.8838	165.1425	110.3273 (83)
Total gains	532.6603	653.2570	793.9901	947.1277	1047.3471	1038.8166	990.8110	901.8327	788.3604	638.9033	530.8913	497.2282 (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 (see Table 9a)														
tau	54.8440	55.0277	55.2091	56.0769	56.2424	57.0254	57.0254	57.1728	56.7212	56.2424	55.9087	55.5641		
alpha	4.6563	4.6685	4.6806	4.7385	4.7495	4.8017	4.8017	4.8115	4.7814	4.7495	4.7272	4.7043		
util living area	0.9990	0.9972	0.9904	0.9620	0.8787	0.7168	0.5510	0.6192	0.8719	0.9846	0.9979	0.9993	(86)	
MIT	19.5213	19.7010	20.0099	20.4171	20.7486	20.9349	20.9853	20.9751	20.8238	20.3665	19.8713	19.4998	(87)	
Th 2	19.8674	19.8707	19.8740	19.8894	19.8923	19.9058	19.9058	19.9083	19.9006	19.8923	19.8865	19.8804	(88)	
util rest of house	0.9987	0.9962	0.9868	0.9470	0.8318	0.6211	0.4225	0.4874	0.8032	0.9763	0.9969	0.9990	(89)	
MIT 2	18.5205	18.7023	19.0119	19.4211	19.7241	19.8764	19.9022	19.9013	19.8014	19.3806	18.8851	18.5091	(90)	
Living area fraction									fLA = Living area / (4) =			0.1733	(91)	
MIT	18.6939	18.8754	19.1849	19.5937	19.9017	20.0599	20.0899	20.0875	19.9786	19.5515	19.0560	18.6808	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6939	18.8754	19.1849	19.5937	19.9017	20.0599	20.0899	20.0875	19.9786	19.5515	19.0560	18.6808	(93)	

8. Space heating requirement

Utilisation	0.9981	0.9950	0.9838	0.9419	0.8323	0.6357	0.4450	0.5103	0.8091	0.9727	0.9959	0.9987	(94)	
Useful gains	531.6628	649.9858	781.1285	892.0946	871.6726	660.4182	440.8693	460.2481	637.8530	621.4755	528.7378	496.5585	(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	1913.7155	1851.8676	1675.3359	1390.4991	1063.3298	698.1406	446.2459	470.2882	755.7099	1160.5314	1559.3152	1900.3128	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	1028.2472	807.6646	665.2902	358.8512	142.5930	0.0000	0.0000	0.0000	0.0000	401.0576	742.0157	1044.3932	(98)	
Space heating												5190.1126	(98)	
Space heating per m2												49.4296	(99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b														
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	1201.9491	946.2152	969.2830	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8645	0.9230	0.8935	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1039.1255	873.3382	866.0275	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1322.0084	1263.5526	1161.5008	0.0000	0.0000	0.0000	0.0000	(103)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	203.6757	290.3195	219.8321	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												713.8273	(104)	

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.9189	72.5799	54.9580	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												178.4568 (107)
Space cooling per m2												1.6996 (108)
Energy for space heating												49.4296 (99)
Energy for space cooling												1.6996 (108)
Total												51.1292 (109)
Target Fabric Energy Efficiency (TFEE)												58.8 (109)

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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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1129 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.3729 (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) =	0.3729 (21)

Wind speed	Jan 4.4000	Feb 4.1000	Mar 4.1000	Apr 3.9000	May 3.9000	Jun 3.7000	Jul 3.7000	Aug 3.5000	Sep 3.5000	Oct 3.8000	Nov 3.7000	Dec 3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
Effective ac	0.4102	0.3823	0.3823	0.3636	0.3636	0.3450	0.3450	0.3263	0.3263	0.3543	0.3450	0.3636 (22b)
	0.5841	0.5731	0.5731	0.5661	0.5661	0.5595	0.5595	0.5532	0.5532	0.5628	0.5595	0.5661 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			18.0000	945.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8703.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.8917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss						(33) + (36) =	89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.2085	Feb 50.2369	Mar 50.2369	Apr 49.6273	May 49.6273	Jun 49.0482	Jul 49.0482	Aug 48.4996	Sep 48.4996	Oct 49.3339	Nov 49.0482	Dec 49.6273 (38)
Heat transfer coeff	140.9558	139.9842	139.9842	139.3746	139.3746	138.7955	138.7955	138.2469	138.2469	139.0813	138.7955	139.3746 (39)
Average = Sum(39)m / 12 =												139.2508 (39)

HLP	Jan 1.3424	Feb 1.3332	Mar 1.3332	Apr 1.3274	May 1.3274	Jun 1.3219	Jul 1.3219	Aug 1.3166	Sep 1.3166	Oct 1.3246	Nov 1.3219	Dec 1.3274 (40)
HLP (average)												1.3262 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)

Daily hot water use	Jan 110.2800	Feb 106.2698	Mar 102.2596	Apr 98.2494	May 94.2392	Jun 90.2291	Jul 90.2291	Aug 94.2392	Sep 98.2494	Oct 102.2596	Nov 106.2698	Dec 110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)										Total = Sum(45)m =		1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1491	12.7686	14.1108	13.6162	14.0358	13.5435	13.9704	14.0128	13.5831	14.0772	13.6628	14.1367 (61)
Total heat required for water heating calculated for each month	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (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	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (64)
								Total per year (kWh/year) = Sum(64)m =				1743.0608 (64)
RHI water heating demand												1743 (64)
Heat gains from water heating, kWh/month	57.9150	50.7512	52.6044	46.1903	44.5634	38.8128	36.3208	41.1740	41.5165	47.9454	51.9102	56.1961 (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	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.4342	52.7890	42.9309	32.5014	24.2952	20.5110	22.1629	28.8082	38.6663	49.0957	57.3019	61.0861 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.2789	398.3702	388.0601	366.1110	338.4042	312.3638	294.9671	290.8758	301.1859	323.1350	350.8418	376.8822 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687 (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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497 (71)
Water heating gains (Table 5)	77.8427	75.5227	70.7049	64.1532	59.8971	53.9066	48.8183	55.3415	57.6619	64.4427	72.0975	75.5324 (72)
Total internal gains	644.6493	639.7754	614.7894	575.8592	535.6900	499.8749	479.0418	488.1189	510.6076	549.7669	593.3348	626.5942 (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			
East				13.4000	25.1925	0.6300	0.7000	0.7700	103.1689 (76)			
South				1.2000	56.7559	0.6300	0.7000	0.7700	20.8144 (78)			
West				5.9500	25.1925	0.6300	0.7000	0.7700	45.8101 (80)			
Solar gains	169.7933	276.8109	447.4769	642.0059	734.9432	821.3954	755.7645	683.5062	540.2021	346.2775	209.7138	133.0091 (83)
Total gains	814.4426	916.5863	1062.2662	1217.8651	1270.6332	1321.2703	1234.8063	1171.6252	1050.8096	896.0444	803.0485	759.6033 (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	17.1520	17.2711	17.2711	17.3466	17.3466	17.4190	17.4190	17.4881	17.4881	17.3832	17.4190	17.3466
alpha	2.1435	2.1514	2.1514	2.1564	2.1564	2.1613	2.1613	2.1659	2.1659	2.1589	2.1613	2.1564
util living area	0.9216	0.8989	0.8469	0.7576	0.6331	0.4608	0.3423	0.3569	0.5817	0.7883	0.8900	0.9293 (86)
MIT	18.4431	18.7152	19.2708	19.9165	20.4735	20.8238	20.9372	20.9322	20.6851	20.0309	19.1607	18.4183 (87)
Th 2	19.8077	19.8149	19.8149	19.8195	19.8195	19.8237	19.8237	19.8278	19.8278	19.8216	19.8237	19.8195 (88)
util rest of house	0.9104	0.8947	0.8249	0.7221	0.5747	0.3742	0.2304	0.2415	0.4984	0.7468	0.8716	0.9190 (89)
MIT 2	17.5314	17.8009	18.3383	18.9510	19.4533	19.7345	19.8055	19.8079	19.6456	19.0777	18.2486	17.5160 (90)
Living area fraction									fLA = Living area / (4) =			0.1733 (91)
MIT	17.6894	17.9594	18.4999	19.1184	19.6301	19.9233	20.0017	20.0028	19.8258	19.2429	18.4067	17.6724 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6894	17.9594	18.4999	19.1184	19.6301	19.9233	20.0017	20.0028	19.8258	19.2429	18.4067	17.6724 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8841	0.8562	0.7952	0.6976	0.5643	0.3820	0.2482	0.2598	0.4982	0.7224	0.8432	0.8940 (94)
Useful gains	720.0380	784.7566	844.6919	849.6025	717.0332	504.7695	306.5344	304.3346	523.5472	647.3425	677.0947	679.0644 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1732.2682	1688.1277	1525.8209	1270.8717	910.1301	558.4152	319.4595	318.3516	625.6782	1007.3549	1388.8806	1696.5203 (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	753.0993	607.0654	506.7599	303.3138	143.6640	0.0000	0.0000	0.0000	0.0000	267.8492	512.4859	756.9872 (98)
Space heating												3851.2248 (98)
RHI space heating demand												3851 (98)

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Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1129 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.3729 (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) =	0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4755	0.4662	0.4568	0.4102	0.4009	0.3543	0.3543	0.3450	0.3729	0.4009	0.4195	0.4382 (22b)
Effective ac	0.6130	0.6087	0.6044	0.5841	0.5804	0.5628	0.5628	0.5595	0.5695	0.5804	0.5880	0.5960 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			18.0000	945.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8703.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.8917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss							(33) + (36) = 89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.7422	53.3574	52.9802	51.2085	50.8770	49.3339	49.3339	49.0482	49.9283	50.8770	51.5476	52.2486 (38)
Heat transfer coeff	143.4895	143.1047	142.7275	140.9558	140.6243	139.0813	139.0813	138.7955	139.6756	140.6243	141.2949	141.9959 (39)
Average = Sum(39)m / 12 =												140.9542 (39)
HLP	1.3666	1.3629	1.3593	1.3424	1.3393	1.3246	1.3246	1.3219	1.3302	1.3393	1.3457	1.3523 (40)
HLP (average)												1.3424 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)												Total = Sum(45)m = 1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1491	12.7686	14.1108	13.6162	14.0358	13.5435	13.9704	14.0128	13.5831	14.0772	13.6628	14.1367 (61)
Total heat required for water heating calculated for each month	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (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	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (64)
								Total per year (kWh/year) = Sum(64)m =				1743.0608 (64)
Heat gains from water heating, kWh/month	57.9150	50.7512	52.6044	46.1903	44.5634	38.8128	36.3208	41.1740	41.5165	47.9454	51.9102	56.1961 (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	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.4342	52.7890	42.9309	32.5014	24.2952	20.5110	22.1629	28.8082	38.6663	49.0957	57.3019	61.0861 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.2789	398.3702	388.0601	366.1110	338.4042	312.3638	294.9671	290.8758	301.1859	323.1350	350.8418	376.8822 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687 (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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497 (71)
Water heating gains (Table 5)	77.8427	75.5227	70.7049	64.1532	59.8971	53.9066	48.8183	55.3415	57.6619	64.4427	72.0975	75.5324 (72)
Total internal gains	644.6493	639.7754	614.7894	575.8592	535.6900	499.8749	479.0418	488.1189	510.6076	549.7669	593.3348	626.5942 (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
East			13.4000		19.6403		0.6300		0.7000		0.7700		80.4311 (76)
South			1.2000		46.7521		0.6300		0.7000		0.7700		17.1456 (78)
West			5.9500		19.6403		0.6300		0.7000		0.7700		35.7138 (80)
Solar gains	133.2905	255.2842	409.9418	586.1355	710.9137	725.1636	691.3997	598.3447	472.5434	299.8838	165.1425	110.3273	(83)
Total gains	777.9399	895.0596	1024.7312	1161.9947	1246.6037	1225.0386	1170.4415	1086.4636	983.1510	849.6507	758.4772	736.9215	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.8491	16.8945	16.9391	17.1520	17.1924	17.3832	17.3832	17.4190	17.3092	17.1924	17.1108	17.0264
alpha	2.1233	2.1263	2.1293	2.1435	2.1462	2.1589	2.1589	2.1613	2.1539	2.1462	2.1407	2.1351
util living area	0.9361	0.9136	0.8729	0.8002	0.6983	0.5697	0.4522	0.4933	0.6761	0.8405	0.9157	0.9423 (86)
MIT	18.0805	18.3952	18.9379	19.6304	20.2272	20.6585	20.8531	20.8176	20.4697	19.6772	18.7614	18.0249 (87)
Th 2	19.7891	19.7919	19.7947	19.8077	19.8102	19.8216	19.8216	19.8237	19.8172	19.8102	19.8052	19.8001 (88)
util rest of house	0.9273	0.9018	0.8550	0.7711	0.6513	0.4962	0.3516	0.3929	0.6097	0.8105	0.9021	0.9343 (89)
MIT 2	17.1616	17.4716	18.0024	18.6751	19.2295	19.6114	19.7567	19.7378	19.4641	18.7382	17.8462	17.1143 (90)
Living area fraction	0.9273	0.9018	0.8550	0.7711	0.6513	0.4962	0.3516	0.3929	0.6097	0.8105	0.9021	0.9343 (89)
MIT	17.3209	17.6317	18.1646	18.8407	19.4024	19.7929	19.9467	19.9250	19.6384	18.9009	18.0048	17.2722 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3209	17.6317	18.1646	18.8407	19.4024	19.7929	19.9467	19.9250	19.6384	18.9009	18.0048	17.2722 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9029	0.8741	0.8248	0.7430	0.6331	0.4943	0.3631	0.4023	0.5982	0.7822	0.8752	0.9112 (94)
Useful gains	702.3898	782.3900	845.2290	863.4189	789.2289	605.4993	424.9697	437.1158	588.1115	664.5828	663.7928	671.4873 (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	1868.3623	1821.9609	1664.8555	1401.1980	1083.1515	722.2314	465.4667	489.2547	773.5751	1167.3146	1540.7960	1856.1952 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	867.4835	698.5916	609.8021	387.2010	218.6784	0.0000	0.0000	0.0000	0.0000	374.0325	631.4423	881.4227 (98)
Space heating												4668.6541 (98)
Space heating per m2												44.4634 (99)

8c. Space cooling requirement

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Calculation Type: New Build (As Built)

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Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5158.7338 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	867.4835	698.5916	609.8021	387.2010	218.6784	0.0000	0.0000	0.0000	0.0000	374.0325	631.4423	881.4227	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	958.5453	771.9245	673.8145	427.8464	241.6336	0.0000	0.0000	0.0000	0.0000	413.2956	697.7263	973.9477	(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	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184	(64)
Efficiency of water heater (217)m	89.9395	89.8991	89.8100	89.6172	89.2372	87.3000	87.3000	87.3000	87.3000	89.5706	89.8359	89.9602	(216)
Fuel for water heating, kWh/month	197.5673	173.3092	180.0579	158.7829	154.0925	137.5607	129.0971	145.8288	146.8866	164.8861	177.5582	191.7718	(219)
Water heating fuel used												1957.3991	(219)
Annual totals kWh/year													
Space heating fuel - main system												5158.7338	(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)												419.8508	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.96 * 1068 * 1.00) =										-820.2781		-820.2781	(233)
Total delivered energy for all uses												6790.7057	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5158.7338	3.4800	179.5239 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1957.3991	3.4800	68.1175 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	419.8508	13.1900	55.3783 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-820.2781	13.1900	-108.1947 (252)
Total energy cost			324.7176 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9092 (257)
SAP value		87.3165
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5158.7338	0.2160	1114.2865 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1957.3991	0.2160	422.7982 (264)
Space and water heating			1537.0847 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	419.8508	0.5190	217.9026 (268)
Energy saving/generation technologies			
PV Unit	-820.2781	0.5190	-425.7244 (269)
Total kg/year			1368.1880 (272)
CO2 emissions per m2			13.0300 (273)
EI value			87.7775
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4

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Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8892 = 3.914$, stars = 4
Water heating environmental impact	$0.216 / 0.8892 = 0.2429$, 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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1129 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.3729 (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) =				0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4102	0.3823	0.3823	0.3636	0.3636	0.3450	0.3450	0.3263	0.3263	0.3543	0.3450	0.3636 (22b)
Effective ac	0.5841	0.5731	0.5731	0.5661	0.5661	0.5595	0.5595	0.5532	0.5532	0.5628	0.5595	0.5661 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			18.0000	945.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8703.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.8917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss							(33) + (36) = 89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.2085	50.2369	50.2369	49.6273	49.6273	49.0482	49.0482	48.4996	48.4996	49.3339	49.0482	49.6273 (38)
Heat transfer coeff	140.9558	139.9842	139.9842	139.3746	139.3746	138.7955	138.7955	138.2469	138.2469	139.0813	138.7955	139.3746 (39)
Average = Sum(39)m / 12 =												139.2508 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3424	1.3332	1.3332	1.3274	1.3274	1.3219	1.3219	1.3166	1.3166	1.3246	1.3219	1.3274 (40)
HLP (average)												1.3262 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)										Total = Sum(45)m =		1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1491	12.7686	14.1108	13.6162	14.0358	13.5435	13.9704	14.0128	13.5831	14.0772	13.6628	14.1367 (61)
Total heat required for water heating calculated for each month	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (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	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (64)
								Total per year (kWh/year) = Sum(64)m =				1743.0608 (64)
Heat gains from water heating, kWh/month	57.9150	50.7512	52.6044	46.1903	44.5634	38.8128	36.3208	41.1740	41.5165	47.9454	51.9102	56.1961 (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	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.4342	52.7890	42.9309	32.5014	24.2952	20.5110	22.1629	28.8082	38.6663	49.0957	57.3019	61.0861 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.2789	398.3702	388.0601	366.1110	338.4042	312.3638	294.9671	290.8758	301.1859	323.1350	350.8418	376.8822 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687 (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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497 (71)
Water heating gains (Table 5)	77.8427	75.5227	70.7049	64.1532	59.8971	53.9066	48.8183	55.3415	57.6619	64.4427	72.0975	75.5324 (72)
Total internal gains	644.6493	639.7754	614.7894	575.8592	535.6900	499.8749	479.0418	488.1189	510.6076	549.7669	593.3348	626.5942 (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	
East				13.4000	25.1925	0.6300	0.7000		0.7700		103.1689 (76)	
South				1.2000	56.7559	0.6300	0.7000		0.7700		20.8144 (78)	
West				5.9500	25.1925	0.6300	0.7000		0.7700		45.8101 (80)	
Solar gains	169.7933	276.8109	447.4769	642.0059	734.9432	821.3954	755.7645	683.5062	540.2021	346.2775	209.7138	133.0091 (83)
Total gains	814.4426	916.5863	1062.2662	1217.8651	1270.6332	1321.2703	1234.8063	1171.6252	1050.8096	896.0444	803.0485	759.6033 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	17.1520	17.2711	17.2711	17.3466	17.3466	17.4190	17.4190	17.4881	17.4881	17.3832	17.4190	17.3466
alpha	2.1435	2.1514	2.1514	2.1564	2.1564	2.1613	2.1613	2.1659	2.1659	2.1589	2.1613	2.1564
util living area	0.9216	0.8989	0.8469	0.7576	0.6331	0.4608	0.3423	0.3569	0.5817	0.7883	0.8900	0.9293 (86)
MIT	18.4431	18.7152	19.2708	19.9165	20.4735	20.8238	20.9372	20.9322	20.6851	20.0309	19.1607	18.4183 (87)
Th 2	19.8077	19.8149	19.8149	19.8195	19.8195	19.8237	19.8237	19.8278	19.8278	19.8216	19.8237	19.8195 (88)
util rest of house	0.9104	0.8847	0.8249	0.7221	0.5747	0.3742	0.2304	0.2415	0.4984	0.7468	0.8716	0.9190 (89)
MIT 2	17.5314	17.8009	18.3383	18.9510	19.4533	19.7345	19.8055	19.8079	19.6456	19.0777	18.2486	17.5160 (90)
Living area fraction									fLA =	Living area / (4) =		0.1733 (91)
MIT	17.6894	17.9594	18.4999	19.1184	19.6301	19.9233	20.0017	20.0028	19.8258	19.2429	18.4067	17.6724 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6894	17.9594	18.4999	19.1184	19.6301	19.9233	20.0017	20.0028	19.8258	19.2429	18.4067	17.6724 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8841	0.8562	0.7952	0.6976	0.5643	0.3820	0.2482	0.2598	0.4982	0.7224	0.8432	0.8940 (94)
Useful gains	720.0380	784.7566	844.6919	849.6025	717.0332	504.7695	306.5344	304.3346	523.5472	647.3425	677.0947	679.0644 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1732.2682	1688.1277	1525.8209	1270.8717	910.1301	558.4152	319.4595	318.3516	625.6782	1007.3549	1388.8806	1696.5203 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	753.0993	607.0654	506.7599	303.3138	143.6640	0.0000	0.0000	0.0000	0.0000	267.8492	512.4859	756.9872 (98)
Space heating												3851.2248 (98)
Space heating per m2										(98) / (4) =		36.6783 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4255.4970 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	753.0993	607.0654	506.7599	303.3138	143.6640	0.0000	0.0000	0.0000	0.0000	267.8492	512.4859	756.9872 (98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)	
Space heating fuel (main heating system)	832.1539	670.7905	559.9557	335.1534	158.7448	0.0000	0.0000	0.0000	0.0000	295.9660	566.2827	836.4500 (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	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (64)	
Efficiency of water heater (217)m	89.8711	89.8275	89.7046	89.4529	88.9062	87.3000	87.3000	87.3000	87.3000	89.3361	89.7194	89.8885 (217)	
Fuel for water heating, kWh/month	197.7176	173.4473	180.2695	159.0744	154.6662	137.5607	129.0971	145.8288	146.8866	165.3188	177.7888	191.9249 (219)	
Water heating fuel used												1959.5809 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4255.4970 (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)												419.8508 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.96 * 1179 * 1.00) =										-905.5311		-905.5311 (233)	
Total delivered energy for all uses												5804.3976 (238)	

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4255.4970	9.7400	414.4854 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1959.5809	9.7400	190.8632 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	419.8508	36.8500	154.7150 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-905.5311	36.8500	-333.6882 (252)
Total energy cost			558.0129 (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	4255.4970	0.2160	919.1874 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1959.5809	0.2160	423.2695 (264)
Space and water heating			1342.4568 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	419.8508	0.5190	217.9026 (268)
Energy saving/generation technologies			
PV Unit	-905.5311	0.5190	-469.9706 (269)
Total kg/year			1129.3138 (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	4255.4970	1.2200	5191.7063 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1959.5809	1.2200	2390.6887 (264)
Space and water heating			7582.3950 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	419.8508	3.0700	1288.9421 (268)
Energy saving/generation technologies			
PV Unit	-905.5311	3.0700	-2779.9805 (269)
Primary energy kWh/year			6321.6066 (272)
Primary energy kWh/m2/year			60.2058 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 81	-194 kg (17.2%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£81	1.85 kg/m²	B 88 B 89
Total Savings	£81	1.85 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£182	£201	-£18
Mains gas	£709	£610	£99
Space heating	£546	£546	£0
Water heating	£191	£110	£81
Lighting	£155	£155	£0
Generated (PV)	-£334	-£334	£0
Total cost of fuels	£557	£477	£81
Total cost of uses	£558	£477	£81
Delivered energy	55 kWh/m²	46 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	50 kWh/m²	10 kWh/m²

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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1129 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.3729 (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) =	0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4755	0.4662	0.4568	0.4102	0.4009	0.3543	0.3543	0.3450	0.3729	0.4009	0.4195	0.4382 (22b)
Effective ac	0.6130	0.6087	0.6044	0.5841	0.5804	0.5628	0.5628	0.5595	0.5695	0.5804	0.5880	0.5960 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			18.0000	945.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8703.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.8917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss							(33) + (36) = 89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.7422	53.3574	52.9802	51.2085	50.8770	49.3339	49.3339	49.0482	49.9283	50.8770	51.5476	52.2486 (38)
Heat transfer coeff	143.4895	143.1047	142.7275	140.9558	140.6243	139.0813	139.0813	138.7955	139.6756	140.6243	141.2949	141.9959 (39)
Average = Sum(39)m / 12 =												140.9542 (39)
HLP	1.3666	1.3629	1.3593	1.3424	1.3393	1.3246	1.3246	1.3219	1.3302	1.3393	1.3457	1.3523 (40)
HLP (average)												1.3424 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)												Total = Sum(45)m = 1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1491	12.7686	14.1108	13.6162	14.0358	13.5435	13.9704	14.0128	13.5831	14.0772	13.6628	14.1367 (61)
Total heat required for water heating calculated for each month	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1497 (H8)
Utilisation factor												0.5809 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.2545 (H14)
Volume ratio Veff/V												0.7481 (H15)
Solar storage volume factor												0.9420 (H16)
Solar input												-872.6546 (H17)
Solar input	-25.3052	-42.2272	-71.9177	-96.3839	-119.0742	-117.0689	-115.5218	-100.9320	-79.0500	-53.9818	-30.0157	-21.1762 (63)
								Solar input (sum of months) = Sum (63)m =				-872.6546 (63)
Output from w/h	152.3858	113.5763	89.7922	45.9128	18.4336	3.0216	0.0000	26.3766	49.1820	93.7076	129.4954	151.3422 (64)
								Total per year (kWh/year) = Sum (64)m =				873.2262 (64)
Heat gains from water heating, kWh/month	57.9150	50.7512	52.6044	46.1903	44.5634	38.8128	36.3208	41.1740	41.5165	47.9454	51.9102	56.1961 (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	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.4342	52.7890	42.9309	32.5014	24.2952	20.5110	22.1629	28.8082	38.6663	49.0957	57.3019	61.0861	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.2789	398.3702	388.0601	366.1110	338.4042	312.3638	294.9671	290.8758	301.1859	323.1350	350.8418	376.8822	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	(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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	(71)
Water heating gains (Table 5)	77.8427	75.5227	70.7049	64.1532	59.8971	53.9066	48.8183	55.3415	57.6619	64.4427	72.0975	75.5324	(72)
Total internal gains	644.6493	639.7754	614.7894	575.8592	535.6900	499.8749	479.0418	488.1189	510.6076	549.7669	593.3348	626.5942	(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
East				13.4000	19.6403		0.6300		0.7000		0.7700		80.4311 (76)
South				1.2000	46.7521		0.6300		0.7000		0.7700		17.1456 (78)
West				5.9500	19.6403		0.6300		0.7000		0.7700		35.7138 (80)
Solar gains	133.2905	255.2842	409.9418	586.1355	710.9137	725.1636	691.3997	598.3447	472.5434	299.8838	165.1425	110.3273	(83)
Total gains	777.9399	895.0596	1024.7312	1161.9947	1246.6037	1225.0386	1170.4415	1086.4636	983.1510	849.6507	758.4772	736.9215	(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	16.8491	16.8945	16.9391	17.1520	17.1924	17.3832	17.3832	17.4190	17.3092	17.1924	17.1108	17.0264	
alpha	2.1233	2.1263	2.1293	2.1435	2.1462	2.1589	2.1589	2.1613	2.1539	2.1462	2.1407	2.1351	
util living area	0.9361	0.9136	0.8729	0.8002	0.6983	0.5697	0.4522	0.4933	0.6761	0.8405	0.9157	0.9423	(86)
MIT	18.0805	18.3952	18.9379	19.6304	20.2272	20.6585	20.8531	20.8176	20.4697	19.6772	18.7614	18.0249	(87)
Th 2	19.7891	19.7919	19.7947	19.8077	19.8102	19.8216	19.8216	19.8237	19.8172	19.8102	19.8052	19.8001	(88)
util rest of house	0.9273	0.9018	0.8550	0.7711	0.6513	0.4962	0.3516	0.3929	0.6097	0.8105	0.9021	0.9343	(89)
MIT 2	17.1616	17.4716	18.0024	18.6751	19.2295	19.6114	19.7567	19.7378	19.4641	18.7382	17.8462	17.1143	(90)
Living area fraction									fLA = Living area / (4) =				0.1733 (91)
MIT	17.3209	17.6317	18.1646	18.8407	19.4024	19.7929	19.9467	19.9250	19.6384	18.9009	18.0048	17.2722	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3209	17.6317	18.1646	18.8407	19.4024	19.7929	19.9467	19.9250	19.6384	18.9009	18.0048	17.2722	(93)

8. Space heating requirement

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	5158.7338	0.2160	1114.2865 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	972.9122	0.2160	210.1490 (264)
Space and water heating			1324.4355 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	419.8508	0.5190	217.9026 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-820.2781	0.5190	-425.7244 (269)
CO2 emissions per m2			1181.4888 (272)
EI value			11.2500 (273)
EI rating			89.4454
EI band			89 (274)
			B

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	52.5000 (1b)	x 2.4000 (2b)	= 126.0000 (1b) - (3b)
First floor	52.5000 (1c)	x 2.6600 (2c)	= 139.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1129 (8)
Pressure test					Yes
Measured/design AP50					5.2000
Infiltration rate					0.3729 (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) =	0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4102	0.3823	0.3823	0.3636	0.3636	0.3450	0.3450	0.3263	0.3263	0.3543	0.3450	0.3636 (22b)
Effective ac	0.5841	0.5731	0.5731	0.5661	0.5661	0.5595	0.5595	0.5532	0.5532	0.5628	0.5595	0.5661 (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
Solid Doors			2.1500	1.4000	3.0100		(26)
Windows (Uw = 1.40)			20.5500	1.3258	27.2443		(27)
Heat Loss Floor			52.5000	0.1700	8.9250	75.0000	3937.5000 (28a)
External Wall	150.4800	22.7000	127.7800	0.2000	25.5560	9.0000	1150.0200 (29a)
External Roof	52.5000		52.5000	0.1000	5.2500	9.0000	472.5000 (30)
Total net area of external elements Aum(A, m ²)			255.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.9853		(33)
Internal Wall - GF			60.4800			9.0000	544.3200 (32c)
Internal Wall - FF			78.8100			9.0000	709.2900 (32c)
Internal Floor			52.5000			18.0000	945.0000 (32d)
Internal Ceiling			52.5000			18.0000	945.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8703.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.8917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7620 (36)
Total fabric heat loss						(33) + (36) =	89.7473 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2085	50.2369	50.2369	49.6273	49.6273	49.0482	49.0482	48.4996	48.4996	49.3339	49.0482	49.6273 (38)
Heat transfer coeff	140.9558	139.9842	139.9842	139.3746	139.3746	138.7955	138.7955	138.2469	138.2469	139.0813	138.7955	139.3746 (39)
Average = Sum(39)m / 12 =												139.2508 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3424	1.3332	1.3332	1.3274	1.3274	1.3219	1.3219	1.3166	1.3166	1.3246	1.3219	1.3274 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7812 (42)
Average daily hot water use (litres/day)												100.2545 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.2800	106.2698	102.2596	98.2494	94.2392	90.2291	90.2291	94.2392	98.2494	102.2596	106.2698	110.2800 (44)
Energy conte	163.5420	143.0349	147.5992	128.6805	123.4720	106.5470	98.7314	113.2958	114.6489	133.6122	145.8482	158.3817 (45)
Energy content (annual)										Total = Sum(45)m =		1577.3937 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	24.5313	21.4552	22.1399	19.3021	18.5208	15.9820	14.8097	16.9944	17.1973	20.0418	21.8772	23.7573 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1491	12.7686	14.1108	13.6162	14.0358	13.5435	13.9704	14.0128	13.5831	14.0772	13.6628	14.1367 (61)
Total heat required for water heating calculated for each month	177.6910	155.8034	161.7100	142.2968	137.5079	120.0905	112.7018	127.3086	128.2320	147.6894	159.5110	172.5184 (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												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2787 (H8)
Utilisation factor												0.5425 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.2545 (H14)
Volume ratio Veff/V												0.7481 (H15)
Solar storage volume factor												0.9420 (H16)
Solar input												-906.3489 (H17)
Solar input	-29.7534	-42.3075	-72.7164	-98.1113	-114.6671	-123.6318	-117.6878	-107.2648	-83.8168	-57.6415	-35.1905	-23.5598 (63)
												-906.3489 (63)
Output from w/h	147.9376	113.4959	88.9935	44.1855	22.8407	0.0000	0.0000	20.0438	44.4152	90.0479	124.3205	148.9585 (64)
												845.2392 (64)
Heat gains from water heating, kWh/month	57.9150	50.7512	52.6044	46.1903	44.5634	38.8128	36.3208	41.1740	41.5165	47.9454	51.9102	56.1961 (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	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	166.8745	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.4342	52.7890	42.9309	32.5014	24.2952	20.5110	22.1629	28.8082	38.6663	49.0957	57.3019	61.0861	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.2789	398.3702	388.0601	366.1110	338.4042	312.3638	294.9671	290.8758	301.1859	323.1350	350.8418	376.8822	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	54.4687	(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)	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	-111.2497	(71)
Water heating gains (Table 5)	77.8427	75.5227	70.7049	64.1532	59.8971	53.9066	48.8183	55.3415	57.6619	64.4427	72.0975	75.5324	(72)
Total internal gains	644.6493	639.7754	614.7894	575.8592	535.6900	499.8749	479.0418	488.1189	510.6076	549.7669	593.3348	626.5942	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.4000	25.1925	0.6300	0.7000	0.7700	103.1689	(76)
South	1.2000	56.7559	0.6300	0.7000	0.7700	20.8144	(78)
West	5.9500	25.1925	0.6300	0.7000	0.7700	45.8101	(80)

Solar gains	169.7933	276.8109	447.4769	642.0059	734.9432	821.3954	755.7645	683.5062	540.2021	346.2775	209.7138	133.0091	(83)
Total gains	814.4426	916.5863	1062.2662	1217.8651	1270.6332	1321.2703	1234.8063	1171.6252	1050.8096	896.0444	803.0485	759.6033	(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	17.1520	17.2711	17.2711	17.3466	17.3466	17.4190	17.4190	17.4881	17.4881	17.3832	17.4190	17.3466	
alpha	2.1435	2.1514	2.1514	2.1564	2.1564	2.1613	2.1613	2.1659	2.1659	2.1589	2.1613	2.1564	
util living area	0.9216	0.8989	0.8469	0.7576	0.6331	0.4608	0.3423	0.3569	0.5817	0.7883	0.8900	0.9293	(86)
MIT	18.4431	18.7152	19.2708	19.9165	20.4735	20.8238	20.9372	20.9322	20.6851	20.0309	19.1607	18.4183	(87)
Th 2	19.8077	19.8149	19.8149	19.8195	19.8195	19.8237	19.8237	19.8278	19.8278	19.8216	19.8237	19.8195	(88)
util rest of house	0.9104	0.8847	0.8249	0.7221	0.5747	0.3742	0.2304	0.2415	0.4984	0.7468	0.8716	0.9190	(89)
MIT 2	17.5314	17.8009	18.3383	18.9510	19.4533	19.7345	19.8055	19.8079	19.6456	19.0777	18.2486	17.5160	(90)
Living area fraction									fLA = Living area / (4) =			0.1733	(91)
MIT	17.6894	17.9594	18.4999	19.1184	19.6301	19.9233	20.0017	20.0028	19.8258	19.2429	18.4067	17.6724	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6894	17.9594	18.4999	19.1184	19.6301	19.9233	20.0017	20.0028	19.8258	19.2429	18.4067	17.6724	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8841	0.8562	0.7952	0.6976	0.5643	0.3820	0.2482	0.2598	0.4982	0.7224	0.8432	0.8940	(94)
Useful gains	720.0380	784.7566	844.6919	849.6025	717.0332	504.7695	306.5344	304.3346	523.5472	647.3425	677.0947	679.0644	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1732.2682	1688.1277	1525.8209	1270.8717	910.1301	558.4152	319.4595	318.3516	625.6782	1007.3549	1388.8806	1696.5203	(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	753.0993	607.0654	506.7599	303.3138	143.6640	0.0000	0.0000	0.0000	0.0000	267.8492	512.4859	756.9872	(98)
Space heating												3851.2248	(98)
Space heating per m2											(98) / (4) =	36.6783	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4255.4970	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	753.0993	607.0654	506.7599	303.3138	143.6640	0.0000	0.0000	0.0000	0.0000	267.8492	512.4859	756.9872	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	832.1539	670.7905	559.9557	335.1534	158.7448	0.0000	0.0000	0.0000	0.0000	295.9660	566.2827	836.4500	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	147.9376	113.4959	88.9935	44.1855	22.8407	0.0000	0.0000	20.0438	44.4152	90.0479	124.3205	148.9585	(64)	
Efficiency of water heater	89.9586	89.9805	90.0072	90.0802	90.0472	87.3000	87.3000	87.3000	87.3000	89.6730	89.8570	89.9578	(216)	
Fuel for water heating, kWh/month	164.4508	126.1339	98.8738	49.0513	25.3653	0.0000	0.0000	22.9597	50.8765	100.4181	138.3538	165.5871	(219)	
Water heating fuel used												942.0702	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4255.4970	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													419.8508	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.96 * 1179 * 1.00) =										-905.5311			-905.5311	(233)
Total delivered energy for all uses													4836.8870	(238)

10a. Fuel costs - using BEDF prices (£13)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4255.4970	9.7400	414.4854	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.0702	9.7400	91.7576	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	419.8508	36.8500	154.7150	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-905.5311	36.8500	-333.6882	(252)
Total energy cost			477.3324	(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	4255.4970	0.2160	919.1874	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0702	0.2160	203.4872	(264)
Space and water heating			1122.6745	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	419.8508	0.5190	217.9026	(268)
Energy saving/generation technologies				
PV Unit	-905.5311	0.5190	-469.9706	(269)
Total kg/year			935.4815	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	4255.4970	1.2200	5191.7063 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	942.0702	1.2200	1149.3257 (264)
Space and water heating			6341.0320 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	419.8508	3.0700	1288.9421 (268)
Energy saving/generation technologies			
PV Unit	-905.5311	3.0700	-2779.9805 (269)
Primary energy kWh/year			5233.7436 (272)
Primary energy kWh/m2/year			49.8452 (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	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	82.9 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	701.32 (P1)
Transmission heat loss coefficient	89.75 (37)
Summer heat loss coefficient	791.06 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	13.4000	125.2818	0.6300	0.7000	0.9000	599.6755
South	1.2000	118.5567	0.6300	0.7000	0.9000	50.8196
West	5.9500	125.2818	0.6300	0.7000	0.9000	266.2738

total: 916.7689

Solar gains	Jun 985	Jul 917	Aug 812	(P3)
Internal gains	497	476	485	
Total summer gains	1482	1393	1297	(P5)

Summer gain/loss ratio	1.87	1.76	1.64	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 82.9)	1.42	1.42	1.42	
Threshold temperature	18.69	20.48	20.36	(P7)

Likelihood of high internal temperature Not significant Not significant Not significant

Assessment of likelihood of high internal temperature: Not significant