

ASSESSMENT NOTES

Calculation Type: New Build (As Designed)

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

SAP Rating	87 B	DER	14.83	TER	18.54
Environmental	89 B	% DER<TER	20.00		
CO ₂ Emissions (t/year)	0.92	DFEE	48.33	TFEE	52.75
General Requirements Compliance	Pass	% DFEE<TFEE	8.38		

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

Cavity walls to have 125mm Dritherm 32
IG Hi therm or Catnic thermally broken lintels (alternatively independent lintels) to be used
Celcon Accredited Construction Details to be used to limit thermal bridging. Sap Assessor will need written confirmation that this has been done along with signed ACD sheets on completion
100% low energy light fittings
Space heating and hot water provided by mains gas combi boiler with time and temperature zone control of space heating. Delayed start thermostat to control space heating.
External doors, glazed doors and windows to have U value no worse than 1.4W/m2.K, If possible windows and doors should have BFRC/WER datasheet
Air tightness to achieve 5.0m3/hr/m2
U values of walls, floor and roof as per U value calculation sheets.
A minimum 0.66Kw solar PV to South elevation roof

BASIC COMPLIANCE REPORT

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		TFEE	52.75
		% DFEE<TFEE	8.38
Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com		Assessor ID 7358-0001
Client	Greg Farrell, 052		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.54	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.83	kgCO ₂ /m ²	Pass
	-3.71 (-20.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.75	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.33	kWh/m ² /yr	
	-4.5 (-8.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

7.37 m², No overhang

Windows facing South

3.31 m², No overhang

Windows facing West

1.26 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Photovoltaic array

0.66

kW

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

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Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com			Assessor ID	7358-0001
Client	Greg Farrell, 052				

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

Orientation	South							
Property Tenure	Unknown							
Transaction Type	New dwelling							
Terrain Type	Suburban							
1.0 Property Type	House, End-Terrace							
2.0 Number of Storeys	2							
3.0 Date Built	2020							
4.0 Sheltered Sides	2							
5.0 Sunlight/Shade	Average or unknown							
6.0 Measurements								
		Heat Loss Perimeter		Internal Floor Area		Average Storey Height		
Ground Floor:		18.26 m		41.66 m²		2.40 m		
1st Storey:		18.26 m		41.66 m²		2.65 m		
7.0 Living Area	20.91			m²				
8.0 Thermal Mass Parameter		Precise calculation						
Thermal Mass		261.24			kJ/m²K			
9.0 External Walls								
Description		Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall 1		Cavity Wall	Other		0.22	67.84	92.21	78.31
9.1 Party Walls								
Description		Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	
Party Wall 1		Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill		0.00	140.00	47.28	
9.2 Internal Walls								
Description		Construction				Kappa (kJ/m²K)	Area (m²)	
Internal Wall 1		Other				75.00	56.45	
Internal Wall 2		Plasterboard on timber frame				9.00	96.06	
10.0 External Roofs								
Description		Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1		External Plane Roof	Other		0.14	12.17	41.66	41.66

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

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

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Other	0.13	65.52	41.66

11.2 Internal Floors

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

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Half Glazed Door	[1] External Wall 1	South							1.96	
Opening 2	Window	[1] External Wall 1	North	None	0.00					4.20	
Opening 3	Window	[1] External Wall 1	North	None	0.00					3.17	
Opening 4	Window	[1] External Wall 1	South	None	0.00					3.31	
Opening 5	Window	[1] External Wall 1	West	None	0.00					1.26	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

Yes

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	10.30	0.050	No	IG hi therm or independent lin
Independently assessed	E3 Sill	9.37	0.034	No	CD0027
Independently assessed	E4 Jamb	23.10	0.040	No	CD0028
Independently assessed	E5 Ground floor (normal)	18.26	0.060	Yes	CD0022
Independently assessed	E6 Intermediate floor within a dwelling	18.26	0.000	Yes	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	8.90	0.105	No	CD0033
Independently assessed	E12 Gable (insulation at ceiling level)	9.36	0.069	No	CD0031
Independently assessed	E16 Corner (normal)	10.10	0.058	Yes	CD0035
Independently assessed	E18 Party wall between dwellings	10.10	0.067	Yes	CD0037
Table K1 - Default	P1 Party wall - Ground floor	9.36	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.36	0.000	No	
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	9.36	0.240	No	

Y-value 0.054 W/m²K

18.0 Pressure Testing

Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
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
 Light and motion sensor

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

SUMMARY FOR INPUT DATA

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Combi keep hot type	Gas/Oil, time clock			
25.0 Main Heating 2	None			
Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.66	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£30	B 88	

THERMAL BRIDGING

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CO ₂ Emissions (t/year)	0.92	DFEE	48.33	TFEE	52.75	
General Requirements Compliance	Pass	% DFEE<TFEE	8.38			
Assessor Details	Mr. James Turner, J E Turner, Tel: 01437710954, jim.thinkinggreen@gmail.com				Assessor ID	7358-0001
Client	Greg Farrell, 052					

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	10.30	0.52	IG hi therm or independent lin
External wall	E3 Sill	Independently assessed	0.034	9.37	0.32	CD0027
External wall	E4 Jamb	Independently assessed	0.040	23.10	0.92	CD0028
External wall	E5 Ground floor (normal)	Independently assessed	0.060	18.26	1.10	CD0022
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.26	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.105	8.90	0.93	CD0033
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.069	9.36	0.65	CD0031
External wall	E16 Corner (normal)	Independently assessed	0.058	10.10	0.59	CD0035
External wall	E18 Party wall between dwellings	Independently assessed	0.067	10.10	0.68	CD0037
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	9.36	1.50	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	9.36	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.240	9.36	2.25	

Total: **9.44** W/mK:
Y-Value: **0.054** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	20.00			
CO ₂ Emissions (t/year)	0.92	DFEE	48.33	TFEE	52.75	
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 83 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.54 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.83 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.3 kWh/m²/yr OK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 7.37 m², No overhang
Windows facing South: 3.31 m², No overhang
Windows facing West: 1.26 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21766.3658 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 261.2382 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4400 (36)
Total fabric heat loss (33) + (36) = 56.1084 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	97.1058	96.8617	96.6225	95.4991	95.2889	94.3104	94.3104	94.1292	94.6873	95.2889	95.7141	96.1587 (39)
Average = Sum(39)m / 12 =												95.4981 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1655	1.1625	1.1597	1.1462	1.1436	1.1319	1.1319	1.1297	1.1364	1.1436	1.1488	1.1541 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum (45)m = 1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518 (61)
Total heat required for water heating calculated for each month												
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)
Heat gains from water heating, kWh/month												
57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
21.5291	19.1219	15.5510	11.7731	8.8005	7.4298	8.0281	10.4353	14.0062	17.7841	20.7567	22.1274	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)												
77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	388.7800	386.5437	372.5343	350.0152	327.1532	305.2218	291.0643	297.2421	308.9044	331.6385	357.6931	377.2286 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North						3.1700	10.6334	0.6300	0.7000	0.7700		10.3016 (74)
South						3.3100	46.7521	0.6300	0.7000	0.7700		47.2934 (78)
West						1.2600	19.6403	0.6300	0.7000	0.7700		7.5629 (80)
North						4.2000	10.6334	0.6300	0.7000	0.7700		13.6488 (74)
Solar gains	78.8066	138.0194	200.8028	271.9717	328.0373	336.5644	319.9037	276.0107	224.9131	155.5805	95.0347	67.0514 (83)
Total gains	467.5866	524.5631	573.3371	621.9869	655.1905	641.7862	610.9680	573.2528	533.8176	487.2190	452.7278	444.2800 (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	62.2642	62.4211	62.5756	63.3117	63.4514	64.1097	64.1097	64.2331	63.8545	63.4514	63.1695	62.8775
alpha	5.1509	5.1614	5.1717	5.2208	5.2301	5.2740	5.2740	5.2822	5.2570	5.2301	5.2113	5.1918
util living area	0.9988	0.9976	0.9942	0.9814	0.9366	0.8137	0.6481	0.7047	0.9119	0.9874	0.9976	0.9991 (86)
MIT	19.7466	19.8746	20.0970	20.4062	20.7030	20.9112	20.9793	20.9683	20.8182	20.4444	20.0432	19.7257 (87)
Th 2	19.9477	19.9501	19.9524	19.9633	19.9653	19.9749	19.9749	19.9766	19.9712	19.9653	19.9612	19.9569 (88)
util rest of house	0.9984	0.9967	0.9918	0.9731	0.9059	0.7279	0.5128	0.5722	0.8567	0.9804	0.9965	0.9988 (89)
MIT 2	18.8050	18.9347	19.1579	19.4718	19.7539	19.9315	19.9694	19.9672	19.8636	19.5134	19.1122	18.7915 (90)
Living area fraction												
MIT	19.0413	19.1706	19.3936	19.7063	19.9921	20.1773	20.2229	20.2184	20.1032	19.7470	19.3458	19.0259 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8913	19.0206	19.2436	19.5563	19.8421	20.0273	20.0729	20.0684	19.9532	19.5970	19.1958	18.8759 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9978	0.9956	0.9896	0.9688	0.9013	0.7329	0.5266	0.5852	0.8555	0.9768	0.9954	0.9983 (94)
Useful gains	466.5483	522.2580	567.4031	602.5787	590.5458	470.3966	321.7400	335.4591	456.6854	475.9370	450.6545	443.5252 (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	1416.9030	1367.7414	1231.3167	1017.6663	775.8501	511.8540	327.5266	345.3039	554.2230	857.3164	1157.7430	1411.2193 (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	707.0639	568.1649	493.9517	298.8631	137.8664	0.0000	0.0000	0.0000	0.0000	283.7463	509.1037	719.9644 (98)
Space heating												3718.7245 (98)
Space heating per m2												(98) / (4) = 44.6318 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.1000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3994.3335 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	707.0639	568.1649	493.9517	298.8631	137.8664	0.0000	0.0000	0.0000	0.0000	283.7463	509.1037	719.9644 (98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000 (210)
Space heating fuel (main heating system)	759.4672	610.2737	530.5604	321.0130	148.0842	0.0000	0.0000	0.0000	0.0000	304.7758	546.8354	773.3237 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (64)
Efficiency of water heater (217)m	89.9705	89.9176	89.8016	89.5241	88.8941	87.2000	87.2000	87.2000	87.2000	89.4538	89.8315	87.2000 (216)
Fuel for water heating, kWh/month	198.9429	174.9016	182.6162	162.3983	158.9491	142.8518	135.3603	151.0669	151.5993	168.6264	179.8256	193.4946 (219)
Water heating fuel used												2000.6331 (219)
Annual totals kWh/year												
Space heating fuel - main system												3994.3335 (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)												380.2101 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =												-569.9890
Total delivered energy for all uses												-569.9890 (233)
												5880.1877 (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	3994.3335	0.2160	862.7760 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2000.6331	0.2160	432.1368 (264)
Space and water heating			1294.9128 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	380.2101	0.5190	197.3291 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total CO2, kg/year			1235.3426 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8300 (273)

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

DER		14.8300 ZC1
Total Floor Area	TFA	83.3200
Assumed number of occupants	N	2.5228
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.0903 ZC2
CO2 emissions from cooking, equation (L16)		2.1549 ZC3
Total CO2 emissions		33.0752 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		33.0752 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9600	1.2000	2.3520		(26a)
TER Opening Type (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158		(28a)
External Wall 1	92.2100	13.9000	78.3100	0.1800	14.0958		(29a)
External Roof 1	41.6600		41.6600	0.1300	5.4158		(30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1089		(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)							9.5427 (36)
Total fabric heat loss						(33) + (36) =	52.6516 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	93.6490	93.4050	93.1658	92.0423	91.8321	90.8536	90.8536	90.6724	91.2305	91.8321	92.2573	92.7019 (39)
Average = Sum(39)m / 12 =												92.0413 (39)
HLP	1.1240	1.1210	1.1182	1.1047	1.1022	1.0904	1.0904	1.0882	1.0949	1.1022	1.1073	1.1126 (40)
HLP (average)												1.1047 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	45.9190	48.9205	45.4858	45.0836	41.7727	43.1651	45.0836	45.4858	48.9205	49.1990	50.9589 (61)
Solar input	204.4898	180.1982	187.4845	166.2893	160.9974	141.7975	135.8528	151.4441	153.1166	174.3538	186.1192	199.6454 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	204.4898	180.1982	187.4845	166.2893	160.9974	141.7975	135.8528	151.4441	153.1166	174.3538	186.1192	199.6454 (64)
	63.7888	56.1276	58.3027	51.5386	49.8122	43.7014	41.6099	46.6358	47.1587	53.9367	57.8257	62.1780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5291	19.1219	15.5510	11.7731	8.8005	7.4298	8.0281	10.4353	14.0062	17.7841	20.7567	22.1274	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	85.7376	83.5232	78.3638	71.5814	66.9519	60.6964	55.9273	62.6825	65.4982	72.4956	80.3135	83.5726	(72)
Total internal gains	397.3485	395.0746	380.4282	357.2735	333.7731	311.2047	297.0517	303.8664	316.1690	339.5388	366.2276	385.7995	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				7.3700	10.6334	0.6300	0.7000	0.7700		23.9503 (74)		
South				3.3100	46.7521	0.6300	0.7000	0.7700		47.2934 (78)		
West				1.2600	19.6403	0.6300	0.7000	0.7700		7.5629 (80)		
Solar gains	78.8066	138.0194	200.8028	271.9717	328.0373	336.5644	319.9037	276.0107	224.9131	155.5805	95.0347	67.0514 (83)
Total gains	476.1551	533.0939	581.2310	629.2452	661.8105	647.7691	616.9555	579.8771	541.0821	495.1193	461.2623	452.8509 (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	61.7851	61.9465	62.1055	62.8636	63.0075	63.6861	63.6861	63.8134	63.4230	63.0075	62.7171	62.4163	
alpha	5.1190	5.1298	5.1404	5.1909	5.2005	5.2457	5.2457	5.2542	5.2282	5.2005	5.1811	5.1611	
util living area	0.9984	0.9968	0.9925	0.9769	0.9248	0.7913	0.6229	0.6783	0.8957	0.9839	0.9968	0.9988	(86)
MIT	19.7672	19.8981	20.1224	20.4328	20.7248	20.9215	20.9824	20.9729	20.8351	20.4680	20.0655	19.7458	(87)
Th 2	19.9813	19.9837	19.9860	19.9970	19.9991	20.0087	20.0087	20.0104	20.0050	19.9991	19.9949	19.9906	(88)
util rest of house	0.9979	0.9957	0.9897	0.9673	0.8917	0.7063	0.4951	0.5520	0.8376	0.9755	0.9955	0.9984	(89)
MIT 2	18.3335	18.5264	18.8549	19.3100	19.7126	19.9521	20.0016	19.9983	19.8624	19.3660	18.7795	18.3089	(90)
Living area fraction	18.6933	18.8706	19.1730	19.5918	19.9666	20.1954	20.2478	20.2429	20.1065	19.6425	19.1022	18.6695	(92)
MIT	18.6933	18.8706	19.1730	19.5918	19.9666	20.1954	20.2478	20.2429	20.1065	19.6425	19.1022	18.6695	(93)
Temperature adjustment													
adjusted MIT	18.6933	18.8706	19.1730	19.5918	19.9666	20.1954	20.2478	20.2429	20.1065	19.6425	19.1022	18.6695	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	474.6558	529.8863	573.4063	605.4872	589.2530	469.0159	325.3998	338.4601	457.0548	480.9652	458.3688	451.7450	(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	1347.9174	1304.9269	1180.6882	984.0951	759.1411	508.3631	331.4128	348.4444	547.9747	830.3957	1107.2942	1341.3499	(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	649.7066	520.8273	451.8177	272.5977	126.3968	0.0000	0.0000	0.0000	0.0000	259.9763	467.2263	661.8660	(98)
Space heating												3410.4147	(98)
Space heating per m2												40.9315	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3651.4076 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	649.7066	520.8273	451.8177	272.5977	126.3968	0.0000	0.0000	0.0000	0.0000	259.9763	467.2263	661.8660	(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)	695.6174	557.6309	483.7449	291.8605	135.3285	0.0000	0.0000	0.0000	0.0000	278.3472	500.2423	708.6360	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	204.4898	180.1982	187.4845	166.2893	160.9974	141.7975	135.8528	151.4441	153.1166	174.3538	186.1192	199.6454	(64)
Efficiency of water heater (217)m	87.7576	87.5688	87.1841	86.2879	84.4496	80.3000	80.3000	80.3000	80.3000	86.0550	87.2730	80.3000	(216)
Fuel for water heating, kWh/month	233.0168	205.7790	215.0444	192.7146	190.6431	176.5847	169.1816	188.5979	190.6807	202.6075	213.2610	227.2839	(219)
Water heating fuel used												2405.3952	(219)
Annual totals kWh/year													
Space heating fuel - main system												3651.4076	(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)												380.2101	(232)
Total delivered energy for all uses												6512.0129	(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	3651.4076	0.2160	788.7040 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2405.3952	0.2160	519.5654 (264)
Space and water heating			1308.2694 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	380.2101	0.5190	197.3291 (268)
Total CO2, kg/m2/year			1544.5235 (272)
Emissions per m2 for space and water heating			15.7017 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3683 (272b)
Emissions per m2 for pumps and fans			0.4672 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7017 * 1.00) + 2.3683 + 0.4672, rounded to 2 d.p.			18.5400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			9.0000	374.9400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21391.4258 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							256.7382 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4400 (36)
Total fabric heat loss						(33) + (36) =	56.1084 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	97.1058	96.8617	96.6225	95.4991	95.2889	94.3104	94.3104	94.1292	94.6873	95.2889	95.7141	96.1587 (39)
Average = Sum(39)m / 12 =												95.4981 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1655	1.1625	1.1597	1.1462	1.1436	1.1319	1.1319	1.1297	1.1364	1.1436	1.1488	1.1541 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1480.8353 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.6253	28.5343	29.4449	25.6707	24.6317	21.2553	19.6961	22.6016	22.8715	26.6546	29.0956	31.5959 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5291	19.1219	15.5510	11.7731	8.8005	7.4298	8.0281	10.4353	14.0062	17.7841	20.7567	22.1274	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	43.8512	42.4618	39.5764	35.6538	33.1071	29.5212	26.4733	30.3785	31.7660	35.8260	40.4105	42.4676	(72)
Total internal gains	352.4621	351.0132	338.6409	318.3459	296.9283	277.0295	264.5977	268.5624	279.4369	299.8692	323.3246	341.6945	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.1700	10.6334	0.6300	0.7000	0.7700		10.3016 (74)	
South					3.3100	46.7521	0.6300	0.7000	0.7700		47.2934 (78)	
West					1.2600	19.6403	0.6300	0.7000	0.7700		7.5629 (80)	
North					4.2000	10.6334	0.6300	0.7000	0.7700		13.6488 (74)	
Solar gains	78.8066	138.0194	200.8028	271.9717	328.0373	336.5644	319.9037	276.0107	224.9131	155.5805	95.0347	67.0514 (83)
Total gains	431.2688	489.0325	539.4437	590.3176	624.9656	613.5939	584.5014	544.5731	504.3500	455.4498	418.3592	408.7459 (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	61.1917	61.3458	61.4977	62.2212	62.3584	63.0054	63.0054	63.1267	62.7546	62.3584	62.0814	61.7944	
alpha	5.0794	5.0897	5.0998	5.1481	5.1572	5.2004	5.2004	5.2084	5.1836	5.1572	5.1388	5.1196	
util living area	0.9991	0.9981	0.9953	0.9843	0.9449	0.8317	0.6706	0.7301	0.9253	0.9901	0.9982	0.9993	(86)
MIT	19.6894	19.8202	20.0479	20.3656	20.6733	20.8968	20.9745	20.9608	20.7935	20.4033	19.9923	19.6689	(87)
Th 2	19.9477	19.9501	19.9524	19.9633	19.9653	19.9749	19.9749	19.9766	19.9712	19.9653	19.9612	19.9569	(88)
util rest of house	0.9988	0.9974	0.9934	0.9773	0.9175	0.7495	0.5338	0.5979	0.8762	0.9845	0.9974	0.9991	(89)
MIT 2	18.7495	18.8819	19.1107	19.4336	19.7287	19.9228	19.9679	19.9644	19.8450	19.4747	19.0629	18.7363	(90)
Living area fraction	fLA = Living area / (4) =												0.2510 (91)
MIT	18.9853	19.1174	19.3459	19.6675	19.9658	20.1672	20.2205	20.2144	20.0831	19.7078	19.2962	18.9703	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9853	19.1174	19.3459	19.6675	19.9658	20.1672	20.2205	20.2144	20.0831	19.7078	19.2962	18.9703	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.5762	487.4066	535.0647	575.3847	573.4123	470.6633	332.4581	343.9389	445.2512	447.5155	416.9803	408.2506	(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	1426.0313	1377.1228	1241.2066	1028.2865	787.6344	525.0465	341.4524	359.0497	566.5203	867.8691	1167.3473	1420.2951	(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	740.6186	597.8893	525.3696	326.0893	159.3812	0.0000	0.0000	0.0000	0.0000	312.7431	540.2642	752.9611	(98)
Space heating													3955.3165 (98)
Space heating per m2	(98) / (4) =												47.4714 (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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	886.5176	697.8968	715.3818	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7998	0.8798	0.8480	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	709.0722	614.0141	606.6579	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	812.1156	776.1912	731.3068	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	74.1912	120.6597	92.7388	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			287.5897 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	18.5478	30.1649	23.1847	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												71.8974 (107)
Energy for space heating												0.8629 (108)
Energy for space cooling												47.4714 (99)
Total												0.8629 (108)
Dwelling Fabric Energy Efficiency (DFEE)												48.3343 (109)
												48.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9600	1.2000	2.3520		(26a)
TER Opening Type (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158		(28a)
External Wall 1	92.2100	13.9000	78.3100	0.1800	14.0958		(29a)
External Roof 1	41.6600		41.6600	0.1300	5.4158		(30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1089		(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)							9.5427 (36)
Total fabric heat loss						(33) + (36) =	52.6516 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	93.6490	93.4050	93.1658	92.0423	91.8321	90.8536	90.8536	90.6724	91.2305	91.8321	92.2573	92.7019 (39)
Average = Sum(39)m / 12 =												92.0413 (39)
HLP	1.1240	1.1210	1.1182	1.1047	1.1022	1.0904	1.0904	1.0882	1.0949	1.1022	1.1073	1.1126 (40)
HLP (average)												1.1047 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5228 (42)
Average daily hot water use (litres/day)												94.1175 (43)
Daily hot water use	103.5293	99.7646	95.9999	92.2352	88.4705	84.7058	84.7058	88.4705	92.2352	95.9999	99.7646	103.5293 (44)
Energy conte	153.5309	134.2791	138.5640	120.8035	115.9138	100.0248	92.6877	106.3605	107.6308	125.4333	136.9202	148.6865 (45)
Energy content (annual)										Total = Sum(45)m =		1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m	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												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.6253	28.5343	29.4449	25.6707	24.6317	21.2553	19.6961	22.6016	22.8715	26.6546	29.0956	31.5959 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	126.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5291	19.1219	15.5510	11.7731	8.8005	7.4298	8.0281	10.4353	14.0062	17.7841	20.7567	22.1274	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.2392	228.5868	222.6708	210.0763	194.1780	179.2359	169.2536	166.9059	172.8220	185.4164	201.3147	216.2569	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	35.6142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	43.8512	42.4618	39.5764	35.6538	33.1071	29.5212	26.4733	30.3785	31.7660	35.8260	40.4105	42.4676	(72)
Total internal gains	352.4621	351.0132	338.6409	318.3459	296.9283	277.0295	264.5977	268.5624	279.4369	299.8692	323.3246	341.6945	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				7.3700	10.6334	0.6300	0.7000	0.7700		23.9503 (74)		
South				3.3100	46.7521	0.6300	0.7000	0.7700		47.2934 (78)		
West				1.2600	19.6403	0.6300	0.7000	0.7700		7.5629 (80)		

Solar gains	78.8066	138.0194	200.8028	271.9717	328.0373	336.5644	319.9037	276.0107	224.9131	155.5805	95.0347	67.0514 (83)
Total gains	431.2688	489.0325	539.4437	590.3176	624.9656	613.5939	584.5014	544.5731	504.3500	455.4498	418.3592	408.7459 (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	61.7851	61.9465	62.1055	62.8636	63.0075	63.6861	63.6861	63.8134	63.4230	63.0075	62.7171	62.4163		
alpha	5.1190	5.1298	5.1404	5.1909	5.2005	5.2457	5.2457	5.2542	5.2282	5.2005	5.1811	5.1611		
util living area	0.9990	0.9979	0.9946	0.9822	0.9382	0.8165	0.6514	0.7115	0.9166	0.9888	0.9980	0.9993	(86)	
MIT	19.7167	19.8489	20.0767	20.3932	20.6956	20.9083	20.9784	20.9662	20.8096	20.4261	20.0175	19.6961	(87)	
Th 2	19.9813	19.9837	19.9860	19.9970	19.9991	20.0087	20.0087	20.0104	20.0050	19.9991	19.9949	19.9906	(88)	
util rest of house	0.9987	0.9971	0.9926	0.9746	0.9094	0.7345	0.5208	0.5839	0.8658	0.9827	0.9971	0.9990	(89)	
MIT 2	18.8059	18.9398	19.1686	19.4901	19.7787	19.9623	20.0026	19.9997	19.8888	19.5265	19.1173	18.7927	(90)	
Living area fraction									fLA = Living area / (4) =			0.2510	(91)	
MIT	19.0345	19.1679	19.3965	19.7167	20.0088	20.1997	20.2475	20.2423	20.1199	19.7523	19.3432	19.0194	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0345	19.1679	19.3965	19.7167	20.0088	20.1997	20.2475	20.2423	20.1199	19.7523	19.3432	19.0194	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	430.4982	487.2202	534.5618	573.7271	568.5502	461.5883	323.8582	335.6005	440.2718	446.6297	416.8222	408.1949	(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	1379.8695	1332.6948	1201.5120	995.5950	763.0172	508.7534	331.3881	348.3890	549.1956	840.4732	1129.5287	1373.7866	(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	706.3322	568.1590	496.2109	303.7449	144.6834	0.0000	0.0000	0.0000	0.0000	293.0196	513.1487	718.4002	(98)	
Space heating												3743.6989	(98)	
Space heating per m2										(98) / (4) =		44.9316	(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	854.0240	672.3168	689.1104	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8180	0.8937	0.8640	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	698.6201	600.8282	595.3813	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	812.1156	776.1912	731.3068	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	81.7167	130.4700	101.1285	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												313.3153	(104)	

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Calculation Type: New Build (As Designed)

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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	20.4292	32.6175	25.2821	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												78.3288 (107)
Space cooling per m2												0.9401 (108)
Energy for space heating												44.9316 (99)
Energy for space cooling												0.9401 (108)
Total												45.8717 (109)
Target Fabric Energy Efficiency (TFEE)												52.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21766.3658 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 261.2382 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4400 (36)
Total fabric heat loss (33) + (36) = 56.1084 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.9751	38.5789	38.5789	38.0208	38.0208	37.3443	37.5062	37.1872	37.3443	37.6729	37.6729	38.2020 (38)
Heat transfer coeff	95.0835	94.6873	94.6873	94.1292	94.1292	93.4527	93.6146	93.2956	93.4527	93.7813	93.7813	94.3104 (39)
Average = Sum(39)m / 12 =												94.0337 (40)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1412	1.1364	1.1364	1.1297	1.1297	1.1216	1.1236	1.1197	1.1216	1.1256	1.1256	1.1319 (40)
HLP (average)												1.1286 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1480.8353 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (46)
Water storage loss:											
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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 (57)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	25.4518 (61)
Total heat required for water heating calculated for each month	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	174.1383 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =											0.0000 (63)
Output from w/h	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	174.1383 (64)
RHI water heating demand											1779.9784 (64)
Heat gains from water heating, kWh/month	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	55.8012 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8227	47.8048	38.8775	29.4328	22.0013	18.5745	20.0704	26.0882	35.0155	44.4603	51.8917	55.3186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	574.7789	570.0883	547.8086	513.4194	478.2680	446.9210	428.7443	437.3766	457.3091	491.9133	530.2573	559.2084	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.1700	11.9814		0.6300		0.7000		0.7700		11.6075 (74)
South				3.3100	50.9848		0.6300		0.7000		0.7700		51.5752 (78)
West				1.2600	22.3313		0.6300		0.7000		0.7700		8.5992 (80)
North				4.2000	11.9814		0.6300		0.7000		0.7700		15.3791 (74)
Solar gains	87.1610	137.7553	199.1974	280.1243	330.6392	363.5203	341.6128	300.4755	242.5893	166.1342	107.7559	73.4018	(83)
Total gains	661.9399	707.8436	747.0061	793.5437	808.9072	810.4413	770.3572	737.8520	699.8984	658.0475	638.0132	632.6103	(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	63.5884	63.8545	63.8545	64.2331	64.2331	64.6981	64.5862	64.8070	64.6981	64.4714	64.4714	64.1097
alpha	5.2392	5.2570	5.2570	5.2822	5.2822	5.3132	5.3057	5.3205	5.3132	5.2981	5.2981	5.2740
util living area	0.9925	0.9884	0.9752	0.9316	0.8093	0.5630	0.3754	0.4027	0.7183	0.9360	0.9843	0.9939 (86)
MIT	20.0681	20.1723	20.3898	20.6662	20.8925	20.9880	20.9989	20.9984	20.9571	20.7096	20.3538	20.0491 (87)
Th 2	19.9673	19.9712	19.9712	19.9766	19.9766	19.9832	19.9816	19.9848	19.9832	19.9800	19.9800	19.9749 (88)
util rest of house	0.9899	0.9843	0.9660	0.9055	0.7423	0.4553	0.2528	0.2760	0.6160	0.9057	0.9778	0.9917 (89)
MIT 2	19.1406	19.2467	19.4598	19.7254	19.9151	19.9797	19.9815	19.9846	19.9659	19.7724	19.4338	19.1281 (90)
Living area fraction	19.3733	19.4790	19.6932	19.9615	20.1604	20.2327	20.2368	20.2390	20.2146	20.0076	19.6647	19.3592 (92)
MIT	19.3733	19.4790	19.6932	19.9615	20.1604	20.2327	20.2368	20.2390	20.2146	20.0076	19.6647	19.3592 (92)
Temperature adjustment	19.2233	19.3290	19.5432	19.8115	20.0104	20.0827	20.0868	20.0890	20.0646	19.8576	19.5147	-0.1500
adjusted MIT	19.2233	19.3290	19.5432	19.8115	20.0104	20.0827	20.0868	20.0890	20.0646	19.8576	19.5147	19.2092 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	653.5921	694.3413	717.9376	714.5257	602.4292	377.8216	204.5880	213.3479	437.3905	592.9835	621.3406	625.9735 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1342.8977	1299.9578	1149.8033	932.9651	659.8854	381.5417	204.7209	213.5551	454.6127	774.4085	1079.8613	1330.6446 (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	512.8433	406.9743	321.3081	157.2764	42.7474	0.0000	0.0000	0.0000	0.0000	134.9802	330.1349	524.2753 (98)
Space heating												2430.5399 (98)
RHI space heating demand												2431 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21766.3658 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 261.2382 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4400 (36)
Total fabric heat loss (33) + (36) = 56.1084 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	97.1058	96.8617	96.6225	95.4991	95.2889	94.3104	94.3104	94.1292	94.6873	95.2889	95.7141	96.1587 (39)
Average = Sum(39)m / 12 =												95.4981 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1655	1.1625	1.1597	1.1462	1.1436	1.1319	1.1319	1.1297	1.1364	1.1436	1.1488	1.1541 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (46)	
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518 (61)	
Total heat required for water heating calculated for each month													
	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum (63)m =					0.0000 (63)
Output from w/h													
	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (64)	
								Total per year (kWh/year) = Sum (64)m =					1779.9784 (64)
Heat gains from water heating, kWh/month													
	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8227	47.8048	38.8775	29.4328	22.0013	18.5745	20.0704	26.0882	35.0155	44.4603	51.8917	55.3186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	574.7789	570.0883	547.8086	513.4194	478.2680	446.9210	428.7443	437.3766	457.3091	491.9133	530.2573	559.2084	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			3.1700		10.6334		0.6300		0.7000		0.7700		10.3016 (74)
South			3.3100		46.7521		0.6300		0.7000		0.7700		47.2934 (78)
West			1.2600		19.6403		0.6300		0.7000		0.7700		7.5629 (80)
North			4.2000		10.6334		0.6300		0.7000		0.7700		13.6488 (74)
Solar gains	78.8066	138.0194	200.8028	271.9717	328.0373	336.5644	319.9037	276.0107	224.9131	155.5805	95.0347		67.0514 (83)
Total gains	653.5855	708.1077	748.6114	785.3911	806.3053	783.4854	748.6481	713.3873	682.2223	647.4938	625.2920		626.2598 (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	62.2642	62.4211	62.5756	63.3117	63.4514	64.1097	64.1097	64.2331	63.8545	63.4514	63.1695	62.8775	
alpha	5.1509	5.1614	5.1717	5.2208	5.2301	5.2740	5.2740	5.2822	5.2570	5.2301	5.2113	5.1918	
util living area	0.9944	0.9907	0.9814	0.9531	0.8764	0.7149	0.5430	0.5891	0.8215	0.9597	0.9895	0.9955	(86)
MIT	19.9452	20.0681	20.2759	20.5567	20.8043	20.9525	20.9908	20.9861	20.8986	20.5973	20.2252	19.9210	(87)
Th 2	19.9477	19.9501	19.9524	19.9633	19.9653	19.9749	19.9749	19.9766	19.9712	19.9653	19.9612	19.9569	(88)
util rest of house	0.9926	0.9875	0.9747	0.9352	0.8295	0.6224	0.4224	0.4672	0.7437	0.9407	0.9854	0.9940	(89)
MIT 2	19.0025	19.1262	19.3329	19.6125	19.8359	19.9538	19.9727	19.9729	19.9182	19.6566	19.2918	18.9860	(90)
Living area fraction	19.2391	19.3626	19.5696	19.8495	20.0789	20.2045	20.2282	20.2272	20.1642	19.8927	19.5260	19.2510	(91)
MIT	19.2391	19.3626	19.5696	19.8495	20.0789	20.2045	20.2282	20.2272	20.1642	19.8927	19.5260	19.2510	(92)
Temperature adjustment	19.0891	19.2126	19.4196	19.6995	19.9289	20.0545	20.0782	20.0772	20.0142	19.7427	19.3760	19.0706	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9905	0.9845	0.9703	0.9296	0.8276	0.6302	0.4350	0.4797	0.7474	0.9355	0.9822	0.9922	(94)	
Useful gains	647.3621	697.1270	726.3744	730.0626	667.2620	493.7275	325.6396	342.1815	509.8948	605.6989	614.1426	621.3896	(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	1436.1037	1386.3458	1248.3202	1031.3401	784.1263	514.4127	328.0271	346.1303	560.0033	871.1962	1174.9903	1429.9375	(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	586.8238	463.1551	388.3277	216.9198	86.9470	0.0000	0.0000	0.0000	0.0000	197.5300	403.8103	601.5596	(98)	
Space heating												2945.0734	(98)	
Space heating per m2												(98) / (4) =	35.3465	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.1000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3163.3441 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	586.8238	463.1551	388.3277	216.9198	86.9470	0.0000	0.0000	0.0000	0.0000	197.5300	403.8103	601.5596	(98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)
Space heating fuel (main heating system)	630.3155	497.4813	417.1082	232.9966	93.3910	0.0000	0.0000	0.0000	0.0000	212.1697	433.7383	646.1436	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)
Efficiency of water heater (217)m	89.8570	89.7865	89.6318	89.2623	88.5010	87.2000	87.2000	87.2000	87.2000	89.1506	89.6716	87.2000	(216)
Fuel for water heating, kWh/month	199.1942	175.1570	182.9622	162.8745	159.6552	142.8518	135.3603	151.0669	151.5993	169.1998	180.1463	193.7237	(219)
Water heating fuel used												2003.7911	(219)
Annual totals kWh/year													
Space heating fuel - main system												3163.3441	(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)												380.2101	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890		-569.9890	(233)
Total delivered energy for all uses												5052.3564	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3163.3441	3.4800	110.0844 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2003.7911	3.4800	69.7319 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	380.2101	13.1900	50.1497 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			284.6770 (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] =	0.9318 (257)
SAP value		87.0019
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	3163.3441	0.2160	683.2823 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.7911	0.2160	432.8189 (264)
Space and water heating			1116.1012 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	380.2101	0.5190	197.3291 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			1056.5310 (272)
CO2 emissions per m2			12.6800 (273)
EI value			88.9670
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8871 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8871 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	38.9751	38.5789	38.5789	38.0208	38.0208	37.3443	37.5062	37.1872	37.3443	37.6729	37.6729	38.2020 (38)
Average = Sum(39)m / 12 =	95.0835	94.6873	94.6873	94.1292	94.1292	93.4527	93.6146	93.2956	93.4527	93.7813	93.7813	94.3104 (39)
												94.0337 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1412	1.1364	1.1364	1.1297	1.1297	1.1216	1.1236	1.1197	1.1216	1.1256	1.1256	1.1319 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum (45)m =	1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m													
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (46)		
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)		
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)		
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518 (61)	
Total heat required for water heating calculated for each month													
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (62)		
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)		
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)	
Output from w/h													
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (64)		
								Total per year (kWh/year) = Sum (64)m =				1779.9784 (64)	
Heat gains from water heating, kWh/month													
57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (65)		

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8227	47.8048	38.8775	29.4328	22.0013	18.5745	20.0704	26.0882	35.0155	44.4603	51.8917	55.3186 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137 (71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016 (72)
Total internal gains	574.7789	570.0883	547.8086	513.4194	478.2680	446.9210	428.7443	437.3766	457.3091	491.9133	530.2573	559.2084 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North					3.1700	11.9814	0.6300	0.7000	0.7700				11.6075 (74)
South					3.3100	50.9848	0.6300	0.7000	0.7700				51.5752 (78)
West					1.2600	22.3313	0.6300	0.7000	0.7700				8.5992 (80)
North					4.2000	11.9814	0.6300	0.7000	0.7700				15.3791 (74)

Solar gains	87.1610	137.7553	199.1974	280.1243	330.6392	363.5203	341.6128	300.4755	242.5893	166.1342	107.7559	73.4018	(83)
Total gains	661.9399	707.8436	747.0061	793.5437	808.9072	810.4413	770.3572	737.8520	699.8984	658.0475	638.0132	632.6103	(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	63.5884	63.8545	63.8545	64.2331	64.2331	64.6981	64.5862	64.8070	64.6981	64.4714	64.4714	64.1097	
alpha	5.2392	5.2570	5.2570	5.2822	5.2822	5.3132	5.3057	5.3205	5.3132	5.2981	5.2981	5.2740	
util living area	0.9925	0.9884	0.9752	0.9316	0.8093	0.5630	0.3754	0.4027	0.7183	0.9360	0.9843	0.9939	(86)
MIT	20.0681	20.1723	20.3898	20.6662	20.8925	20.9880	20.9989	20.9984	20.9571	20.7096	20.3538	20.0491	(87)
Th 2	19.9673	19.9712	19.9712	19.9766	19.9766	19.9832	19.9816	19.9848	19.9832	19.9800	19.9800	19.9749	(88)
util rest of house	0.9899	0.9843	0.9660	0.9055	0.7423	0.4553	0.2528	0.2760	0.6160	0.9057	0.9778	0.9917	(89)
MIT 2	19.1406	19.2467	19.4598	19.7254	19.9151	19.9797	19.9815	19.9846	19.9659	19.7724	19.4338	19.1281	(90)
Living area fraction													
MIT	19.3733	19.4790	19.6932	19.9615	20.1604	20.2327	20.2368	20.2390	20.2146	20.0076	19.6647	19.3592	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2233	19.3290	19.5432	19.8115	20.0104	20.0827	20.0868	20.0890	20.0646	19.8576	19.5147	19.2092	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9874	0.9809	0.9611	0.9004	0.7447	0.4662	0.2656	0.2891	0.6249	0.9011	0.9739	0.9895	(94)
Useful gains	653.5921	694.3413	717.9376	714.5257	602.4292	377.8216	204.5880	213.3479	437.3905	592.9835	621.3406	625.9735	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1342.8977	1299.9578	1149.8033	932.9651	659.8854	381.5417	204.7209	213.5551	454.6127	774.4085	1079.8613	1330.6446	(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	512.8433	406.9743	321.3081	157.2764	42.7474	0.0000	0.0000	0.0000	0.0000	134.9802	330.1349	524.2753	(98)
Space heating												2430.5399	(98)
Space heating per m2												(98) / (4) =	29.1711 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.1000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2610.6765 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	512.8433	406.9743	321.3081	157.2764	42.7474	0.0000	0.0000	0.0000	0.0000	134.9802	330.1349	524.2753	(98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)
Space heating fuel (main heating system)	550.8521	437.1367	345.1214	168.9327	45.9156	0.0000	0.0000	0.0000	0.0000	144.9841	354.6025	563.1314	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383	(64)
Efficiency of water heater (217)m	89.7678	89.6965	89.4863	88.9844	87.9886	87.2000	87.2000	87.2000	87.2000	88.8186	89.5195	87.2000	(216)
Fuel for water heating, kWh/month	199.3921	175.3327	183.2597	163.3833	160.5848	142.8518	135.3603	151.0669	151.5993	169.8323	180.4524	193.9151	(219)
Water heating fuel used												2007.0307	(219)
Annual totals kWh/year													
Space heating fuel - main system												2610.6765	(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)												380.2101	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1140 * 1.00) =												-601.9727	(233)
Total delivered energy for all uses												4470.9447	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2610.6765	3.9500	103.1217 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2007.0307	3.9500	79.2777 (247)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	380.2101	18.7000	71.0993 (250)
Additional standing charges			91.0000 (251)
Energy saving/generation technologies			
PV Unit	-601.9727	18.7000	-112.5689 (252)
Total energy cost			245.9548 (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	2610.6765	0.2160	563.9061 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.0307	0.2160	433.5186 (264)
Space and water heating			997.4248 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	380.2101	0.5190	197.3291 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	0.5190	-312.4238 (269)
Total kg/year			921.2550 (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	2610.6765	1.2200	3185.0254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.0307	1.2200	2448.5775 (264)
Space and water heating			5633.6028 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	380.2101	3.0700	1167.2451 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	3.0700	-1848.0561 (269)
Primary energy kWh/year			5183.0419 (272)
Primary energy kWh/m2/year			62.2065 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 30	-187 kg (20.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30 2.24 kg/m²	B 88	B 91
Total Savings	£30 2.24 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

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

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

	Current	Potential	Saving
Electricity	£85	£94	-£9
Mains gas	£273	£234	£39
Space heating	£208	£208	£0
Water heating	£79	£50	£30
Lighting	£71	£71	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£245	£215	£30
Total cost of uses	£245	£216	£30
Delivered energy	54 kWh/m²	42 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	50 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4255	0.4171	0.4088	0.3671	0.3587	0.3170	0.3170	0.3087	0.3337	0.3587	0.3754	0.3921 (22b)
	0.5905	0.5870	0.5836	0.5674	0.5643	0.5503	0.5503	0.5476	0.5557	0.5643	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21766.3658 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 261.2382 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4400 (36)
Total fabric heat loss (33) + (36) = 56.1084 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9974	40.7533	40.5141	39.3907	39.1805	38.2020	38.2020	38.0208	38.5789	39.1805	39.6057	40.0503 (38)
Heat transfer coeff	97.1058	96.8617	96.6225	95.4991	95.2889	94.3104	94.3104	94.1292	94.6873	95.2889	95.7141	96.1587 (39)
Average = Sum(39)m / 12 =												95.4981 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1655	1.1625	1.1597	1.1462	1.1436	1.1319	1.1319	1.1297	1.1364	1.1436	1.1488	1.1541 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m =											1480.8353 (45)
Distribution loss (46)m = 0.15 x (45)m	23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198	25.4518 (61)
Total heat required for water heating calculated for each month	178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (62)
Aperture area of solar collector												
Zero-loss collector efficiency												
Collector heat loss coefficient												
Collector 2nd order heat loss coefficient												
Collector effective heat loss coefficient												
Collector performance ratio												
Annual solar radiation per m2												
Overshading factor												
Solar energy available												
Adjustment factor for showers												
Solar-to-load ratio												
Utilisation factor												
Collector performance factor												
Dedicated solar storage volume												
Effective solar volume												
Daily hot water demand												
Volume ratio Veff/V												
Solar storage volume factor												
Solar input												
Solar input	-24.6331	-41.1055	-70.0074	-93.8238	-115.9113	-113.9593	-112.4533	-98.2510	-76.9502	-52.5480	-29.2184	-849.4750 (H17)
Output from w/h												
	154.3569	116.1618	93.9849	51.5618	25.3850	10.6075	5.5809	33.4794	55.2443	98.2947	132.3217	153.5246 (64)
Heat gains from water heating, kWh/month	57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8227	47.8048	38.8775	29.4328	22.0013	18.5745	20.0704	26.0882	35.0155	44.4603	51.8917	55.3186 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137 (71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016 (72)
Total internal gains	574.7789	570.0883	547.8086	513.4194	478.2680	446.9210	428.7443	437.3766	457.3091	491.9133	530.2573	559.2084 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North						3.1700	10.6334	0.6300	0.7000	0.7700		10.3016 (74)
South						3.3100	46.7521	0.6300	0.7000	0.7700		47.2934 (78)
West						1.2600	19.6403	0.6300	0.7000	0.7700		7.5629 (80)
North						4.2000	10.6334	0.6300	0.7000	0.7700		13.6488 (74)

Solar gains	78.8066	138.0194	200.8028	271.9717	328.0373	336.5644	319.9037	276.0107	224.9131	155.5805	95.0347	67.0514 (83)
Total gains	653.5855	708.1077	748.6114	785.3911	806.3053	783.4854	748.6481	713.3873	682.2223	647.4938	625.2920	626.2598 (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	62.2642	62.4211	62.5756	63.3117	63.4514	64.1097	64.1097	64.2331	63.8545	63.4514	63.1695	62.8775
alpha	5.1509	5.1614	5.1717	5.2208	5.2301	5.2740	5.2740	5.2822	5.2570	5.2301	5.2113	5.1918
util living area	0.9944	0.9907	0.9814	0.9531	0.8764	0.7149	0.5430	0.5891	0.8215	0.9597	0.9895	0.9955 (86)
MIT	19.9452	20.0681	20.2759	20.5567	20.8043	20.9525	20.9908	20.9861	20.8986	20.5973	20.2252	19.9210 (87)
Th 2	19.9477	19.9501	19.9524	19.9633	19.9653	19.9749	19.9749	19.9766	19.9712	19.9653	19.9612	19.9569 (88)
util rest of house	0.9926	0.9875	0.9747	0.9352	0.8295	0.6224	0.4224	0.4672	0.7437	0.9407	0.9854	0.9940 (89)
MIT 2	19.0025	19.1262	19.3329	19.6125	19.8359	19.9538	19.9727	19.9729	19.9182	19.6566	19.2918	18.9860 (90)
Living area fraction	19.2391	19.3626	19.5696	19.8495	20.0789	20.2045	20.2282	20.2272	20.1642	19.8927	19.5260	0.2510 (91)
MIT	19.0891	19.2126	19.4196	19.6995	19.9289	20.0545	20.0782	20.0772	20.0142	19.7427	19.3760	19.0706 (93)
Temperature adjustment												-0.1500
adjusted MIT												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9905	0.9845	0.9703	0.9296	0.8276	0.6302	0.4350	0.4797	0.7474	0.9355	0.9822	0.9922	(94)
Useful gains	647.3621	697.1270	726.3744	730.0626	667.2620	493.7275	325.6396	342.1815	509.8948	605.6989	614.1426	621.3896	(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	1436.1037	1386.3458	1248.3202	1031.3401	784.1263	514.4127	328.0271	346.1303	560.0033	871.1962	1174.9903	1429.9375	(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	586.8238	463.1551	388.3277	216.9198	86.9470	0.0000	0.0000	0.0000	0.0000	197.5300	403.8103	601.5596	(98)
Space heating												2945.0734	(98)
Space heating per m2											(98) / (4) =	35.3465	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.1000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3163.3441	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	586.8238	463.1551	388.3277	216.9198	86.9470	0.0000	0.0000	0.0000	0.0000	197.5300	403.8103	601.5596	(98)	
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)	
Space heating fuel (main heating system)	630.3155	497.4813	417.1082	232.9966	93.3910	0.0000	0.0000	0.0000	0.0000	212.1697	433.7383	646.1436	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	154.3569	116.1618	93.9849	51.5618	25.3850	10.6075	5.5809	33.4794	55.2443	98.2947	132.3217	153.5246	(64)	
Efficiency of water heater	89.9481	89.9759	89.9961	90.0062	89.8847	87.2000	87.2000	87.2000	87.2000	89.5063	89.8103	89.9658	(216)	
Fuel for water heating, kWh/month	171.6066	129.1033	104.4322	57.2869	28.2418	12.1646	6.4001	38.3938	63.3536	109.8187	147.3346	170.6477	(219)	
Water heating fuel used												1038.7838	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3163.3441	(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)													380.2101	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890			-569.9890	(233)
Total delivered energy for all uses													4137.3491	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3163.3441	3.4800	110.0844	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1038.7838	3.4800	36.1497	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	380.2101	13.1900	50.1497	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-569.9890	13.1900	-75.1815	(252)
Total energy cost			257.6897	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.8434	(257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	88.2341	
SAP rating (Section 12)			88	(258)
SAP band			B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3163.3441	0.2160	683.2823 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1038.7838	0.2160	224.3773 (264)
Space and water heating			907.6596 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	380.2101	0.5190	197.3291 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			874.0394 (272)
CO2 emissions per m2			10.4900 (273)
EI value			90.8727
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3337 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
External door			1.9600	1.4000	2.7440		(26a)
Windows (Uw = 1.40)			7.7400	1.3258	10.2614		(27)
Glazed doors (Uw = 1.40)			4.2000	1.3258	5.5682		(27)
Heat Loss Floor 1			41.6600	0.1300	5.4158	65.5200	2729.5632 (28a)
External Wall 1	92.2100	13.9000	78.3100	0.2200	17.2282	67.8400	5312.5504 (29a)
External Roof 1	41.6600		41.6600	0.1308	5.4508	12.1700	507.0022 (30)
Total net area of external elements Aum(A, m ²)			175.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.6684		(33)
Party Wall 1			47.2800	0.0000	0.0000	140.0000	6619.2000 (32)
Internal Wall 1			56.4500			75.0000	4233.7500 (32c)
Internal Wall 2			96.0600			9.0000	864.5400 (32c)
Internal Floor 1			41.6600			18.0000	749.8800 (32d)
Internal Ceiling 1			41.6600			18.0000	749.8800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	38.9751	38.5789	38.5789	38.0208	38.0208	37.3443	37.5062	37.1872	37.3443	37.6729	37.6729	38.2020 (38)
Average = Sum(39)m / 12 =	95.0835	94.6873	94.6873	94.1292	94.1292	93.4527	93.6146	93.2956	93.4527	93.7813	93.7813	94.3104 (39)
												94.0337 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1412	1.1364	1.1364	1.1297	1.1297	1.1216	1.1236	1.1197	1.1216	1.1256	1.1256	1.1319 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum (45)m = 1480.8353 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.0296	20.1419	20.7846	18.1205	17.3871	15.0037	13.9032	15.9541	16.1446	18.8150	20.5380	22.3030 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.4590	22.9882	25.4283	24.5820	25.3826	24.5420	25.3465	25.3699	24.5638	25.4094	24.6198 (61)
Total heat required for water heating calculated for each month											
178.9900	157.2673	163.9923	145.3855	141.2964	124.5668	118.0342	131.7304	132.1946	150.8426	161.5400	174.1383 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-26.6439	-40.0457	-67.4421	-93.2256	-112.2749	-118.1645	-115.3271	-102.9878	-80.3823	-54.6826	-32.3863 (63)
Solar input (sum of months) = Sum (63)m =											
-865.6375											
Output from w/h											
152.3461	117.2216	96.5503	52.1600	29.0215	6.4023	2.7071	28.7426	51.8122	96.1600	129.1537	152.0636 (64)
Total per year (kWh/year) = Sum (64)m =											
914.3409											
Heat gains from water heating, kWh/month											
57.4138	50.3949	52.4296	46.3127	44.8870	39.3937	37.1553	41.7073	41.9282	48.0589	51.6809	55.8012 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	151.3706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8227	47.8048	38.8775	29.4328	22.0013	18.5745	20.0704	26.0882	35.0155	44.4603	51.8917	55.3186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.6704	341.1743	332.3445	313.5467	289.8179	267.5162	252.6173	249.1133	257.9432	276.7410	300.4698	322.7715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	52.6599	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	-100.9137	(71)
Water heating gains (Table 5)	77.1691	74.9924	70.4699	64.3232	60.3320	54.7135	49.9399	56.0582	58.2336	64.5953	71.7791	75.0016	(72)
Total internal gains	574.7789	570.0883	547.8086	513.4194	478.2680	446.9210	428.7443	437.3766	457.3091	491.9133	530.2573	559.2084	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W			

North				3.1700	11.9814	0.6300		0.7000		0.7700		11.6075 (74)			
South				3.3100	50.9848	0.6300		0.7000		0.7700		51.5752 (78)			
West				1.2600	22.3313	0.6300		0.7000		0.7700		8.5992 (80)			
North				4.2000	11.9814	0.6300		0.7000		0.7700		15.3791 (74)			

Solar gains				87.1610	137.7553	199.1974	280.1243	330.6392	363.5203	341.6128	300.4755	242.5893	166.1342	107.7559	73.4018 (83)
Total gains				661.9399	707.8436	747.0061	793.5437	808.9072	810.4413	770.3572	737.8520	699.8984	658.0475	638.0132	632.6103 (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	63.5884	63.8545	63.8545	64.2331	64.2331	64.6981	64.5862	64.8070	64.6981	64.4714	64.4714	64.1097	
alpha	5.2392	5.2570	5.2570	5.2822	5.2822	5.3132	5.3057	5.3205	5.3132	5.2981	5.2981	5.2740	
util living area	0.9925	0.9884	0.9752	0.9316	0.8093	0.5630	0.3754	0.4027	0.7183	0.9360	0.9843	0.9939	(86)
MIT	20.0681	20.1723	20.3898	20.6662	20.8925	20.9880	20.9989	20.9984	20.9571	20.7096	20.3538	20.0491	(87)
Th 2	19.9673	19.9712	19.9712	19.9766	19.9766	19.9832	19.9816	19.9848	19.9832	19.9800	19.9800	19.9749	(88)
util rest of house	0.9899	0.9843	0.9660	0.9055	0.7423	0.4553	0.2528	0.2760	0.6160	0.9057	0.9778	0.9917	(89)
MIT 2	19.1406	19.2467	19.4598	19.7254	19.9151	19.9797	19.9815	19.9846	19.9659	19.7724	19.4338	19.1281	(90)
Living area fraction												0.2510	(91)
MIT	19.3733	19.4790	19.6932	19.9615	20.1604	20.2327	20.2368	20.2390	20.2146	20.0076	19.6647	19.3592	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2233	19.3290	19.5432	19.8115	20.0104	20.0827	20.0868	20.0890	20.0646	19.8576	19.5147	19.2092	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9874	0.9809	0.9611	0.9004	0.7447	0.4662	0.2656	0.2891	0.6249	0.9011	0.9739	0.9895	(94)
Useful gains	653.5921	694.3413	717.9376	714.5257	602.4292	377.8216	204.5880	213.3479	437.3905	592.9835	621.3406	625.9735	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1342.8977	1299.9578	1149.8033	932.9651	659.8854	381.5417	204.7209	213.5551	454.6127	774.4085	1079.8613	1330.6446	(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	512.8433	406.9743	321.3081	157.2764	42.7474	0.0000	0.0000	0.0000	0.0000	134.9802	330.1349	524.2753	(98)
Space heating												2430.5399	(98)
Space heating per m2											(98) / (4) =	29.1711	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.1000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2610.6765 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	512.8433	406.9743	321.3081	157.2764	42.7474	0.0000	0.0000	0.0000	0.0000	134.9802	330.1349	524.2753	(98)
Space heating efficiency (main heating system 1)	93.1000	93.1000	93.1000	93.1000	93.1000	0.0000	0.0000	0.0000	0.0000	93.1000	93.1000	93.1000	(210)
Space heating fuel (main heating system)	550.8521	437.1367	345.1214	168.9327	45.9156	0.0000	0.0000	0.0000	0.0000	144.9841	354.6025	563.1314	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	152.3461	117.2216	96.5503	52.1600	29.0215	6.4023	2.7071	28.7426	51.8122	96.1600	129.1537	152.0636	(64)
Efficiency of water heater	89.8738	89.8932	89.8666	89.8023	89.2514	87.2000	87.2000	87.2000	87.2000	89.2103	89.6877	87.2000	(216)
(217)m	89.8738	89.8932	89.8666	89.8023	89.2514	87.2000	87.2000	87.2000	87.2000	89.2103	89.6877	89.8888	(217)
Fuel for water heating, kWh/month	169.5111	130.4010	107.4373	58.0831	32.5165	7.3421	3.1044	32.9616	59.4177	107.7902	144.0038	169.1686	(219)
Water heating fuel used												1021.7376	(219)
Annual totals kWh/year													
Space heating fuel - main system												2610.6765	(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)													380.2101 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1140 * 1.00) =										-601.9727		-601.9727	(233)
Total delivered energy for all uses												3535.6516	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2610.6765	3.9500	103.1217	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1021.7376	3.9500	40.3586	(247)
Pumps and fans for heating	75.0000	18.7000	14.0250	(249)
Pump for solar water heating	50.0000	18.7000	9.3500	(249)
Energy for lighting	380.2101	18.7000	71.0993	(250)
Additional standing charges			91.0000	(251)
Energy saving/generation technologies				
PV Unit	-601.9727	18.7000	-112.5689	(252)
Total energy cost			216.3858	(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	2610.6765	0.2160	563.9061	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1021.7376	0.2160	220.6953	(264)
Space and water heating			784.6015	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	380.2101	0.5190	197.3291	(268)
Energy saving/generation technologies				

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PV Unit	-601.9727	0.5190	-312.4238 (269)
Total kg/year			734.3817 (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	2610.6765	1.2200	3185.0254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1021.7376	1.2200	1246.5198 (264)
Space and water heating			4431.5452 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	380.2101	3.0700	1167.2451 (268)
Energy saving/generation technologies			
PV Unit	-601.9727	3.0700	-1848.0561 (269)
Primary energy kWh/year			4134.4842 (272)
Primary energy kWh/m2/year			49.6218 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	261.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	277.71 (P1)
Transmission heat loss coefficient	56.11 (37)
Summer heat loss coefficient	333.81 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	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
North	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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.1700	81.1852	0.6300	0.7000	0.9000	91.9305
South	3.3100	112.2060	0.6300	0.7000	0.9000	132.6685
West	1.2600	117.5071	0.6300	0.7000	0.9000	52.8881
North	4.2000	81.1852	0.6300	0.7000	0.9000	121.8007
total:						399.2877

	Jun	Jul	Aug	
Solar gains	425	399	351	(P3)
Internal gains	444	426	434	
Total summer gains	869	825	786	(P5)
Summer gain/loss ratio	2.60	2.47	2.35	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 261.2)	0.17	0.17	0.17	
Threshold temperature	18.77	20.54	20.32	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			