ASSESSMENT NOTES
Calculation Type: New Build (As Designed)

Property Reference	DE-18297 Plot 063 AS	**Issued on Date**	
Assessment Reference	DE-18297 Plot 063 AS	**Prop Type Ref**	T51 SH51 E MID E25+SH52
Property	3 bed, 2 bath		

SAP Rating	85 B	**DER**	15.61	**TER**	17.23
Environmental	88 B	**% DER<TER**	9.42		
CO_2 Emissions (t/year)	1.04	**DFEE**	36.73	**TFEE**	43.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.79		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
Client			

ASSESSMENT NOTES - Last time updated on: 22.01.2021

Eaved front
One front window
No side windows

PREDICTED ENERGY ASSESSMENT

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

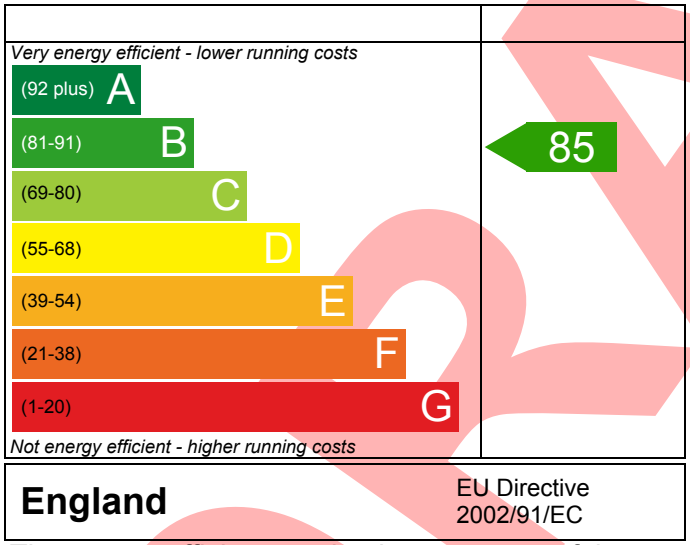
3 bed,
2 bath

Dwelling type:	House, Mid-Terrace
Date of assessment:	22/01/2021
Produced by:	Michael Brogden
Total floor area:	78.98 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

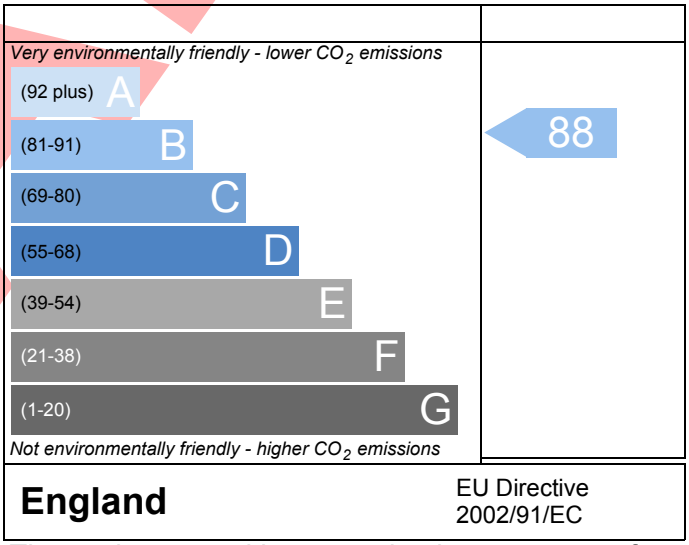
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

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

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 063 AS	**Issued on Date**	22/01/2021
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CO_2 Emissions (t/year)	1.04	**DFEE**	36.73	**TFEE**	43.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.79		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
Client			

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2017
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	9.00 m	39.49 m²	2.31 m
1st Storey:	9.00 m	39.49 m²	2.56 m

7.0 Living Area	29.96	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	216.24	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	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.26	60.00	43.83	30.34

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	85.47

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	124.21

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	Plasterboard, insulated at ceiling level	0.10	9.00	39.49	39.49

10.2 Internal Ceilings

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	39.49

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Suspended concrete floor, carpeted	0.13	75.00	39.49

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
floor	Plasterboard ceiling, carpeted chipboard floor	18.00	39.49

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
French Door	Manufacturer	Window	Double glazed			0.71		0.70	1.41
Window	Manufacturer	Window	Double glazed			0.71		0.70	1.41
Solid door	Manufacturer	Solid Door							1.00
half glazed	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front door	Solid Door	[1] External Wall 1	South							2.12	
front windows	Window	[1] External Wall 1	South	Dark-coloured curtain or roller blind	0.00					4.91	100
rear door	Half Glazed Door	[1] External Wall 1	North							2.12	100
rear windows	Window	[1] External Wall 1	North	Dark-coloured curtain or roller blind	0.00					4.34	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	9.28	0.211	No	CATNIC
Independently assessed	E3 Sill	7.26	0.019	No	APA PF-WD-03
Independently assessed	E4 Jamb	21.00	0.020	No	APA PF-WD-04
Independently assessed	E5 Ground floor (normal)	9.00	0.082	No	Spantherm Bespoke
Independently assessed	E6 Intermediate floor within a dwelling	9.00	0.001	No	APA PF-IF-01
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.00	0.060	No	
Table K1 - Approved	E18 Party wall between dwellings	14.61	0.060	No	
Table K1 - Default	E25 Staggered party wall between dwellings	4.87	0.120	No	default
Independently assessed	P1 Party wall - Ground floor	17.55	0.030	No	Spantherm Bespoke
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	17.55	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	17.55	0.036	No	Barratt Confidential Bespoke

Y-value	0.052	W/m²K

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

18.0 Pressure Testing	Yes	
Designed AP_{50}	5.00	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	15	
Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	

Combi keep hot type	None
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

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	£27	B 86	
	Typical Cost	**Typical savings per year**	**Ratings after improvement SAP rating**	**Environmental Impact**
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£345	A 97	

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 063 AS	**Issued on Date**	22/01/2021
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CO_2 Emissions (t/year)	1.04	**DFEE**	36.73	**TFEE**	43.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.79		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
Client			

SUMARY 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)	17.23	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.61	$kgCO_2/m^2$	Pass
	-1.62 (-9.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.61	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	36.73	$kWh/m^2/yr$	
	-6.9 (-15.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (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	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.36 (max. 2.00)	1.50 (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

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		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 (Severn Valley)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	4.34 m², No overhang 4.91 m², No overhang		
Air change rate	4.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

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
Roof U-value	0.10	W/m²K
Door U-value	1.00	W/m²K

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

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 063 AS	**Issued on Date**	22/01/2021
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General Requirements Compliance	Pass	**% DFEE<TFEE**	15.79		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Mid-Terrace House, total floor area 79 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) 17.23 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.61 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)43.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.50 (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
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control 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 (Severn Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.34 m², No overhang
Windows facing South: 4.91 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Door U-value 1.00 W/m²K

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4900 (1b)	x	2.3100 (2b)	=	91.2219	(1b) - (3b)
First floor	39.4900 (1c)	x	2.5600 (2c)	=	101.0944	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.3163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4060	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3146	(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	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697	(22b)
Effective ac	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.41)			9.2500	1.3347	12.3462			(27)
Solid door			2.1200	1.0000	2.1200			(26)
half glazed			2.1200	1.5000	3.1800			(26a)
Heat Loss Floor 1			39.4900	0.1300	5.1337	75.0000	2961.7500	(28a)
External Wall 1	43.8300	13.4900	30.3400	0.2600	7.8884	60.0000	1820.4000	(29a)
External Roof 1	39.4900		39.4900	0.1000	3.9490	9.0000	355.4100	(30)
Total net area of external elements Aum(A, m2)			122.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.6173			(33)
Party Wall 1			85.4700	0.0000	0.0000	110.0000	9401.7000	(32)
Internal Wall 1			124.2100			9.0000	1117.8900	(32c)
floor			39.4900			18.0000	710.8200	(32d)
Internal Ceiling 1			39.4900			18.0000	710.8200	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			17078.7900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							216.2420	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4223	(36)
Total fabric heat loss					(33) + (36) =		41.0396	(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	36.8391	36.6408	36.4464	35.5334	35.3626	34.5674	34.5674	34.4202	34.8737	35.3626	35.7082	36.0695	(38)
Heat transfer coeff	77.8787	77.6804	77.4860	76.5730	76.4022	75.6070	75.6070	75.4598	75.9133	76.4022	76.7478	77.1091	(39)
Average = Sum(39)m / 12 =												76.5722	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9861	0.9835	0.9811	0.9695	0.9674	0.9573	0.9573	0.9554	0.9612	0.9674	0.9717	0.9763	(40)
HLP (average)												0.9695	(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		2.4432 (42)
Average daily hot water use (litres/day)		92.2265 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4492	97.7601	94.0711	90.3820	86.6929	83.0039	83.0039	86.6929	90.3820	94.0711	97.7601	101.4492	(44)
Energy conte	150.4462	131.5812	135.7800	118.3763	113.5849	98.0151	90.8254	104.2235	105.4683	122.9131	134.1693	145.6991	(45)
Energy content (annual)										Total = Sum(45)m =		1451.0825	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              22.5669    19.7372    20.3670    17.7564    17.0377    14.7023    13.6238    15.6335    15.8202    18.4370    20.1254    21.8549 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss    14.1176    12.7340    14.0631    13.5696    13.9929    13.5081    13.9375    13.9734    13.5416    14.0341    13.6276    14.1062 (61)
Total heat required for water heating calculated for each month
             164.5638   144.3152   149.8431   131.9459   127.5778   111.5232   104.7629   118.1969   119.0098   136.9472   147.7969   159.8054 (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
             164.5638   144.3152   149.8431   131.9459   127.5778   111.5232   104.7629   118.1969   119.0098   136.9472   147.7969   159.8054 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1616.2882 (64)
Heat gains from water heating, kWh/month
              53.5528    46.9343    48.6626    42.7525    41.2652    35.9670    33.6838    38.1477    38.4536    44.3771    48.0182    51.9715 (65)


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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       122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.6181    19.2010    15.6153    11.8218     8.8369     7.4605     8.0614    10.4785    14.0642    17.8577    20.8425    22.2190 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.2955   219.5504   213.8682   201.7716   186.5018   172.1504   162.5627   160.3079   165.9900   178.0866   193.3564   207.7079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161 (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)
              -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289 (71)
Water heating gains (Table 5)
               71.9795    69.8426    65.4068    59.3785    55.4640    49.9542    45.2740    51.2737    53.4078    59.6467    66.6919    69.8542 (72)
Total internal gains
              373.5415   371.2424   357.5387   335.6203   313.4511   292.2135   278.5464   284.7084   296.1103   318.2393   343.5392   362.4294 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data        factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                    4.3400           10.6334           0.7100           0.7000           0.7700           15.8947 (74)
South                                    4.9100           46.7521           0.7100           0.7000           0.7700           79.0627 (78)
-------------------------------------------------------------------------------------------------------------------

Solar gains    94.9574   159.8599   216.5556   269.3258   305.9434   306.5093   294.2853   265.9486   234.3579   175.8192   113.3244    81.5681 (83)
Total gains   468.4990   531.1023   574.0943   604.9461   619.3945   598.7227   572.8317   550.6570   530.4682   494.0585   456.8637   443.9974 (84)


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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          60.9166    61.0721    61.2253    61.9553    62.0939    62.7469    62.7469    62.8694    62.4938    62.0939    61.8143    61.5247
alpha         5.0611     5.0715     5.0817     5.1304     5.1396     5.1831     5.1831     5.1913     5.1663     5.1396     5.1210     5.1016
util living area
               0.9963     0.9925     0.9836     0.9580     0.8888     0.7380     0.5657     0.6078     0.8325     0.9652     0.9925     0.9972 (86)

MIT           19.8517    20.0030    20.2295    20.5204    20.7787    20.9417    20.9880    20.9828    20.8862    20.5607    20.1527    19.8232 (87)
Th 2          20.0950    20.0971    20.0991    20.1088    20.1106    20.1191    20.1191    20.1206    20.1158    20.1106    20.1070    20.1031 (88)
util rest of house
               0.9953     0.9903     0.9787     0.9444     0.8521     0.6605     0.4598     0.5022     0.7693     0.9514     0.9900     0.9964 (89)
MIT 2         18.5543    18.7760    19.1058    19.5279    19.8781    20.0748    20.1136    20.1120    20.0173    19.5910    19.0023    18.5186 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.3793 (91)
MIT           19.0464    19.2415    19.5321    19.9044    20.2198    20.4037    20.4453    20.4424    20.3469    19.9588    19.4387    19.0135 (92)
Temperature adjustment                                                                                                         -0.1500
adjusted MIT  18.8964    19.0915    19.3821    19.7544    20.0698    20.2537    20.2953    20.2924    20.1969    19.8088    19.2887    18.8635 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9933     0.9871     0.9735     0.9378     0.8502     0.6733     0.4816     0.5237     0.7758     0.9454     0.9868     0.9948 (94)
Useful gains 465.3822   524.2409   558.8971   567.3132   526.5925   403.1005   275.8855   288.3600   411.5473   467.0672   450.8334   441.7004 (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
            1136.7497  1102.3983   998.1817   831.1549   639.4680   427.4575   279.3905   293.7163   462.8344   703.5743   935.4558  1130.6903 (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
             499.4974   388.5218   326.8278   189.9660    83.9794     0.0000     0.0000     0.0000     0.0000   175.9613   348.9282   512.6085 (98)
Space heating                                                                                                             2526.2902 (98)
Space heating per m2                                                                                        (98) / (4) =     31.9865 (99)


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8c. Space cooling requirement
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2791.4809	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	499.4974	388.5218	326.8278	189.9660	83.9794	0.0000	0.0000	0.0000	0.0000	175.9613	348.9282	512.6085	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	551.9308	429.3058	361.1357	209.9072	92.7949	0.0000	0.0000	0.0000	0.0000	194.4324	385.5560	566.4182	(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													
	164.5638	144.3152	149.8431	131.9459	127.5778	111.5232	104.7629	118.1969	119.0098	136.9472	147.7969	159.8054	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6853	89.6104	89.4691	89.1604	88.5428	87.3000	87.3000	87.3000	87.3000	89.0711	89.5236	89.7184	(217)
Fuel for water heating, kWh/month													
	183.4903	161.0475	167.4804	147.9871	144.0860	127.7471	120.0033	135.3917	136.3228	153.7504	165.0926	178.1188	(219)
Water heating fuel used												1820.5179	(219)
Annual totals kWh/year													
Space heating fuel - main system												2791.4809	(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)												381.7830	(232)
Total delivered energy for all uses												5068.7818	(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	2791.4809	0.2160	602.9599	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1820.5179	0.2160	393.2319	(264)
Space and water heating			996.1917	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	381.7830	0.5190	198.1454	(268)
Total CO2, kg/year			1233.2621	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6100	(273)

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

DER		15.6100	ZC1
Total Floor Area	TFA	78.9800	
Assumed number of occupants	N	2.4432	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3035	ZC2
CO2 emissions from cooking, equation (L16)		2.2491	ZC3
Total CO2 emissions		34.1626	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1626	ZC8

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4900	(1b)	x 2.3100	(2b) =	91.2219	(1b) - (3b)
First floor	39.4900	(1c)	x 2.5600	(2c) =	101.0944	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	192.3163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4060	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3146	(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	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697	(22b)
Effective ac	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			9.2500	1.3258	12.2633			(27)
Heat Loss Floor 1			39.4900	0.1300	5.1337			(28a)
External Wall 1	43.8300	13.4900	30.3400	0.1800	5.4612			(29a)
External Roof 1	39.4900		39.4900	0.1300	5.1337			(30)
Total net area of external elements Aum(A, m2)			122.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.6559			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.5358	(36)
Total fabric heat loss (33) + (36) =	41.1917	(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	36.8391	36.6408	36.4464	35.5334	35.3626	34.5674	34.5674	34.4202	34.8737	35.3626	35.7082	36.0695	(38)
Heat transfer coeff	78.0308	77.8325	77.6381	76.7251	76.5543	75.7591	75.7591	75.6118	76.0654	76.5543	76.8998	77.2611	(39)
Average = Sum(39)m / 12 =												76.7243	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9880	0.9855	0.9830	0.9714	0.9693	0.9592	0.9592	0.9574	0.9631	0.9693	0.9737	0.9782	(40)
HLP (average)												0.9714	(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	2.4432 (42)
Average daily hot water use (litres/day)	92.2265 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4492	97.7601	94.0711	90.3820	86.6929	83.0039	83.0039	86.6929	90.3820	94.0711	97.7601	101.4492	(44)
Energy conte	150.4462	131.5812	135.7800	118.3763	113.5849	98.0151	90.8254	104.2235	105.4683	122.9131	134.1693	145.6991	(45)
Energy content (annual)										Total = Sum(45)m =		1451.0825	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5669	19.7372	20.3670	17.7564	17.0377	14.7023	13.6238	15.6335	15.8202	18.4370	20.1254	21.8549	(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)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.9964	47.9376	44.5719	44.1778	40.9334	42.2979	44.1778	44.5719	47.9376	48.2105	50.9589 (61)
Total heat required for water heating calculated for each month												
	201.4051	176.5777	183.7176	162.9483	157.7627	138.9486	133.1233	148.4013	150.0402	170.8507	182.3797	196.6580 (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												
	201.4051	176.5777	183.7176	162.9483	157.7627	138.9486	133.1233	148.4013	150.0402	170.8507	182.3797	196.6580 (64)
								Total per year (kWh/year) = Sum(64)m =				2002.8131 (64)
Heat gains from water heating, kWh/month												
	62.7631	54.9999	57.1313	50.5031	48.8114	42.8234	40.7739	45.6988	46.2112	52.8530	56.6639	61.1847 (65)

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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	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.6181	19.2010	15.6153	11.8218	8.8369	7.4605	8.0614	10.4785	14.0642	17.8577	20.8425	22.2190	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2955	219.5504	213.8682	201.7716	186.5018	172.1504	162.5627	160.3079	165.9900	178.0866	193.3564	207.7079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	(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)													
	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	(71)
Water heating gains (Table 5)													
	84.3590	81.8450	76.7893	70.1432	65.6068	59.4769	54.8037	61.4231	64.1822	71.0390	78.6999	82.2375	(72)
Total internal gains													
	385.9210	383.2448	368.9212	346.3850	323.5939	301.7362	288.0761	294.8577	306.8847	329.6316	355.5472	374.8127	(73)

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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	4.3400	10.6334	0.6300	0.7000	0.7700	14.1037	(74)
South	4.9100	46.7521	0.6300	0.7000	0.7700	70.1543	(78)

Solar gains	84.2580	141.8475	192.1549	238.9792	271.4709	271.9730	261.1264	235.9825	207.9514	156.0085	100.5555	72.3773	(83)
Total gains	470.1790	525.0923	561.0762	585.3642	595.0648	573.7092	549.2025	530.8403	514.8361	485.6402	456.1026	447.1900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.2892	70.4683	70.6447	71.4854	71.6449	72.3969	72.3969	72.5379	72.1054	71.6449	71.3229	70.9894	
alpha	5.6859	5.6979	5.7096	5.7657	5.7763	5.8265	5.8265	5.8359	5.8070	5.7763	5.7549	5.7326	
util living area	0.9981	0.9959	0.9905	0.9729	0.9172	0.7732	0.5935	0.6349	0.8612	0.9767	0.9957	0.9985	(86)
MIT	19.9783	20.1049	20.3009	20.5589	20.7957	20.9492	20.9909	20.9867	20.8997	20.6043	20.2447	19.9548	(87)
Th 2	20.0934	20.0955	20.0975	20.1072	20.1090	20.1175	20.1175	20.1190	20.1142	20.1090	20.1053	20.1015	(88)
util rest of house	0.9974	0.9945	0.9871	0.9624	0.8838	0.6933	0.4815	0.5235	0.7983	0.9657	0.9940	0.9981	(89)
MIT 2	18.7234	18.9096	19.1961	19.5735	19.8968	20.0809	20.1138	20.1131	20.0304	19.6426	19.1215	18.6951	(90)
Living area fraction										fLA = Living area / (4) =		0.3793	(91)
MIT	19.1994	19.3630	19.6152	19.9473	20.2378	20.4103	20.4465	20.4445	20.3602	20.0074	19.5476	19.1730	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1994	19.3630	19.6152	19.9473	20.2378	20.4103	20.4465	20.4445	20.3602	20.0074	19.5476	19.1730	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9930	0.9848	0.9601	0.8893	0.7216	0.5243	0.5661	0.8178	0.9641	0.9926	0.9974	(94)
Useful gains	468.5472	521.4365	552.5361	562.0285	529.1853	414.0079	287.9540	300.5014	421.0492	468.1907	452.7287	446.0078	(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	1162.6128	1125.6944	1018.2393	847.6042	653.6013	440.1807	291.4070	305.8116	476.1827	720.1767	957.2194	1156.8292	(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	516.3848	406.0613	346.4832	205.6145	92.5655	0.0000	0.0000	0.0000	0.0000	187.4776	363.2333	528.8512	(98)
Space heating												2646.6714	(98)
Space heating per m2											(98) / (4) =	33.5107	(99)

8c. Space cooling requirement

Not applicable

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												2833.6953	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	516.3848	406.0613	346.4832	205.6145	92.5655	0.0000	0.0000	0.0000	0.0000	187.4776	363.2333	528.8512	(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)													
	552.8746	434.7551	370.9671	220.1441	99.1065	0.0000	0.0000	0.0000	0.0000	200.7255	388.9007	566.2218	(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													
	201.4051	176.5777	183.7176	162.9483	157.7627	138.9486	133.1233	148.4013	150.0402	170.8507	182.3797	196.6580	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3183	87.0806	86.6246	85.6378	83.7604	80.3000	80.3000	80.3000	80.3000	85.2854	86.7526	87.4195	(217)
Fuel for water heating, kWh/month													
	230.6561	202.7750	212.0847	190.2762	188.3499	173.0368	165.7824	184.8086	186.8496	200.3283	210.2296	224.9589	(219)
Water heating fuel used												2370.1361	(219)
Annual totals kWh/year													
Space heating fuel - main system												2833.6953	(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)												381.7830	(232)
Total delivered energy for all uses												5660.6144	(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	2833.6953	0.2160	612.0782	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2370.1361	0.2160	511.9494	(264)
Space and water heating			1124.0276	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	381.7830	0.5190	198.1454	(268)
Total CO2, kg/m2/year			1361.0980	(272)
Emissions per m2 for space and water heating			14.2318	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5088	(272b)
Emissions per m2 for pumps and fans			0.4928	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2318 * 1.00) + 2.5088 + 0.4928, rounded to 2 d.p.			17.2300	(273)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4900 (1b)	x	2.3100 (2b)	=	91.2219	(1b) - (3b)
First floor	39.4900 (1c)	x	2.5600 (2c)	=	101.0944	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.3163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4060	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3146	(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	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697	(22b)
Effective ac	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.41)			9.2500	1.3347	12.3462			(27)
Solid door			2.1200	1.0000	2.1200			(26)
half glazed			2.1200	1.5000	3.1800			(26a)
Heat Loss Floor 1			39.4900	0.1300	5.1337	75.0000	2961.7500	(28a)
External Wall 1	43.8300	13.4900	30.3400	0.2600	7.8884	60.0000	1820.4000	(29a)
External Roof 1	39.4900		39.4900	0.1000	3.9490	9.0000	355.4100	(30)
Total net area of external elements Aum(A, m2)			122.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.6173			(33)
Party Wall 1			85.4700	0.0000	0.0000	110.0000	9401.7000	(32)
Internal Wall 1			124.2100			9.0000	1117.8900	(32c)
floor			39.4900			18.0000	710.8200	(32d)
Internal Ceiling 1			39.4900			9.0000	355.4100	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16723.3800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.7420	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4223	(36)
Total fabric heat loss					(33) + (36) =		41.0396	(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	36.8391	36.6408	36.4464	35.5334	35.3626	34.5674	34.5674	34.4202	34.8737	35.3626	35.7082	36.0695	(38)
Heat transfer coeff	77.8787	77.6804	77.4860	76.5730	76.4022	75.6070	75.6070	75.4598	75.9133	76.4022	76.7478	77.1091	(39)
Average = Sum(39)m / 12 =												76.5722	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9861	0.9835	0.9811	0.9695	0.9674	0.9573	0.9573	0.9554	0.9612	0.9674	0.9717	0.9763	(40)
HLP (average)												0.9695	(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		2.4432 (42)
Average daily hot water use (litres/day)		92.2265 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4492	97.7601	94.0711	90.3820	86.6929	83.0039	83.0039	86.6929	90.3820	94.0711	97.7601	101.4492	(44)
Energy conte	150.4462	131.5812	135.7800	118.3763	113.5849	98.0151	90.8254	104.2235	105.4683	122.9131	134.1693	145.6991	(45)
Energy content (annual)										Total = Sum(45)m =		1451.0825	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Primary loss    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (59)
Heat gains from water heating, kWh/month
               31.9698    27.9610    28.8533    25.1550    24.1368    20.8282    19.3004    22.1475    22.4120    26.1190    28.5110    30.9611 (65)


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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         122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611   122.1611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.6181    19.2010    15.6153    11.8218     8.8369     7.4605     8.0614    10.4785    14.0642    17.8577    20.8425    22.2190 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.2955   219.5504   213.8682   201.7716   186.5018   172.1504   162.5627   160.3079   165.9900   178.0866   193.3564   207.7079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161    35.2161 (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)
              -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289   -97.7289 (71)
Water heating gains (Table 5)
               42.9702    41.6086    38.7813    34.9375    32.4419    28.9281    25.9414    29.7681    31.1278    35.1062    39.5986    41.6143 (72)
Total internal gains
              341.5322   340.0084   327.9132   308.1792   287.4290   268.1873   256.2138   260.2028   270.8303   290.6989   313.4459   331.1895 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a      Specific data      Specific data       factor                W
                                                         W/m2      or Table 6b        or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                  4.3400           10.6334           0.7100           0.7000           0.7700           15.8947 (74)
South                                  4.9100           46.7521           0.7100           0.7000           0.7700           79.0627 (78)
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Solar gains    94.9574   159.8599   216.5556   269.3258   305.9434   306.5093   294.2853   265.9486   234.3579   175.8192   113.3244    81.5681 (83)
Total gains   436.4896   499.8683   544.4687   577.5050   593.3724   574.6966   550.4991   526.1514   505.1882   466.5180   426.7703   412.7576 (84)


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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           59.6489    59.8012    59.9512    60.6661    60.8017    61.4412    61.4412    61.5611    61.1933    60.8017    60.5279    60.2443
alpha          4.9766     4.9867     4.9967     5.0444     5.0534     5.0961     5.0961     5.1041     5.0796     5.0534     5.0352     5.0163
util living area
                0.9971     0.9938     0.9860     0.9632     0.9001     0.7567     0.5851     0.6306     0.8502     0.9708     0.9940     0.9978 (86)

MIT            19.7882    19.9437    20.1776    20.4796    20.7519    20.9310    20.9851    20.9784    20.8673    20.5196    20.0974    19.7601 (87)
Th 2           20.0950    20.0971    20.0991    20.1088    20.1106    20.1191    20.1191    20.1206    20.1158    20.1106    20.1070    20.1031 (88)
util rest of house
                0.9963     0.9920     0.9818     0.9512     0.8662     0.6807     0.4771     0.5233     0.7907     0.9591     0.9920     0.9972 (89)
MIT 2          18.9814    19.1378    19.3713    19.6746    19.9298    20.0823    20.1143    20.1130    20.0352    19.7181    19.2994    18.9599 (90)
Living area fraction                                                                                  fLA = Living area / (4) =           0.3793 (91)
MIT            19.2874    19.4435    19.6772    19.9800    20.2417    20.4043    20.4446    20.4413    20.3509    20.0221    19.6021    19.2634 (92)
Temperature adjustment                                                                                                              0.0000
adjusted MIT   19.2874    19.4435    19.6772    19.9800    20.2417    20.4043    20.4446    20.4413    20.3509    20.0221    19.6021    19.2634 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9953     0.9904     0.9794     0.9492     0.8718     0.7070     0.5182     0.5640     0.8083     0.9576     0.9905     0.9964 (94)
Useful gains  434.4388   495.0544   533.2302   548.1450   517.3230   406.3137   285.2712   296.7359   408.3370   446.7497   422.7313   411.2721 (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
             1167.2030  1129.7478  1021.0460   848.4284   652.6018   438.8420   290.6775   304.9527   474.5228   719.8708   959.5110  1161.5281 (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
              545.1765   426.5140   362.9349   216.2041   100.6474     0.0000     0.0000     0.0000     0.0000   203.2021   386.4814   558.1905 (98)
Space heating                                                                                                                    2799.3509 (98)
Space heating per m2                                                                                                 (98) / (4) =    35.4438 (99)


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8c. Space cooling requirement
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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   710.7059   559.4919   573.4941     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation     0.0000     0.0000     0.0000     0.0000     0.0000     0.8645     0.9262     0.9101     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss     0.0000     0.0000     0.0000     0.0000     0.0000   614.4101   518.2020   521.9098     0.0000     0.0000     0.0000     0.0000 (102)
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	763.7448	733.6626	707.0457	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	107.5210	160.3027	137.7411	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												405.5648 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	26.8803	40.0757	34.4353	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												101.3912 (107)
Space cooling per m2												1.2838 (108)
Energy for space heating												35.4438 (99)
Energy for space cooling												1.2838 (108)
Total												36.7276 (109)
Dwelling Fabric Energy Efficiency (DFEE)												36.7 (109)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4900 (1b)	x	2.3100 (2b)	=	91.2219	(1b) - (3b)
First floor	39.4900 (1c)	x	2.5600 (2c)	=	101.0944	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.3163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4060	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3146	(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	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697	(22b)
Effective ac	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			9.2500	1.3258	12.2633			(27)
Heat Loss Floor 1			39.4900	0.1300	5.1337			(28a)
External Wall 1	43.8300	13.4900	30.3400	0.1800	5.4612			(29a)
External Roof 1	39.4900		39.4900	0.1300	5.1337			(30)
Total net area of external elements Aum(A, m2)			122.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.6559			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.5358	(36)
Total fabric heat loss (33) + (36) =	41.1917	(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	36.8391	36.6408	36.4464	35.5334	35.3626	34.5674	34.5674	34.4202	34.8737	35.3626	35.7082	36.0695	(38)
Heat transfer coeff	78.0308	77.8325	77.6381	76.7251	76.5543	75.7591	75.7591	75.6118	76.0654	76.5543	76.8998	77.2611	(39)
Average = Sum(39)m / 12 =												76.7243	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9880	0.9855	0.9830	0.9714	0.9693	0.9592	0.9592	0.9574	0.9631	0.9693	0.9737	0.9782	(40)
HLP (average)												0.9714	(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	2.4432	(42)
Average daily hot water use (litres/day)	92.2265	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4492	97.7601	94.0711	90.3820	86.6929	83.0039	83.0039	86.6929	90.3820	94.0711	97.7601	101.4492	(44)
Energy conte	150.4462	131.5812	135.7800	118.3763	113.5849	98.0151	90.8254	104.2235	105.4683	122.9131	134.1693	145.6991	(45)
Energy content (annual)										Total = Sum(45)m =		1451.0825	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

31.9698	27.9610	28.8533	25.1550	24.1368	20.8282	19.3004	22.1475	22.4120	26.1190	28.5110	30.9611	(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	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	122.1611	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.6181	19.2010	15.6153	11.8218	8.8369	7.4605	8.0614	10.4785	14.0642	17.8577	20.8425	22.2190	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

217.2955	219.5504	213.8682	201.7716	186.5018	172.1504	162.5627	160.3079	165.9900	178.0866	193.3564	207.7079	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	35.2161	(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)

-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	-97.7289	(71)

Water heating gains (Table 5)

42.9702	41.6086	38.7813	34.9375	32.4419	28.9281	25.9414	29.7681	31.1278	35.1062	39.5986	41.6143	(72)

Total internal gains

341.5322	340.0084	327.9132	308.1792	287.4290	268.1873	256.2138	260.2028	270.8303	290.6989	313.4459	331.1895	(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	4.3400	10.6334	0.6300	0.7000	0.7700	14.1037	(74)
South	4.9100	46.7521	0.6300	0.7000	0.7700	70.1543	(78)

Solar gains	84.2580	141.8475	192.1549	238.9792	271.4709	271.9730	261.1264	235.9825	207.9514	156.0085	100.5555	72.3773	(83)
Total gains	425.7902	481.8559	520.0681	547.1585	558.8999	540.1603	517.3402	496.1853	478.7817	446.7074	414.0014	403.5668	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.2892	70.4683	70.6447	71.4854	71.6449	72.3969	72.3969	72.5379	72.1054	71.6449	71.3229	70.9894	
alpha	5.6859	5.6979	5.7096	5.7657	5.7763	5.8265	5.8265	5.8359	5.8070	5.7763	5.7549	5.7326	
util living area	0.9988	0.9973	0.9934	0.9800	0.9341	0.8037	0.6257	0.6721	0.8893	0.9841	0.9974	0.9991	(86)
MIT	19.9244	20.0530	20.2530	20.5180	20.7665	20.9375	20.9881	20.9823	20.8780	20.5616	20.1941	19.9017	(87)
Th 2	20.0934	20.0955	20.0975	20.1072	20.1090	20.1175	20.1175	20.1190	20.1142	20.1090	20.1053	20.1015	(88)
util rest of house	0.9984	0.9964	0.9910	0.9718	0.9055	0.7263	0.5098	0.5576	0.8330	0.9761	0.9963	0.9989	(89)
MIT 2	19.1043	19.2342	19.4349	19.7039	19.9397	20.0858	20.1141	20.1134	20.0420	19.7501	19.3834	19.0882	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	19.4154	19.5448	19.7452	20.0127	20.2534	20.4089	20.4456	20.4430	20.3591	20.0579	19.6909	19.3968	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4154	19.5448	19.7452	20.0127	20.2534	20.4089	20.4456	20.4430	20.3591	20.0579	19.6909	19.3968	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9957	0.9898	0.9708	0.9108	0.7540	0.5543	0.6016	0.8507	0.9755	0.9957	0.9986	(94)
Useful gains	424.9600	479.7903	514.7710	531.1723	509.0655	407.2684	286.7663	298.4891	407.2944	435.7801	412.2121	402.9853	(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	1179.4659	1139.8424	1028.3342	852.6237	654.7957	440.0765	291.3422	305.7019	476.1031	724.0431	968.2395	1174.1221	(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	561.3524	443.5550	382.0911	231.4450	108.4233	0.0000	0.0000	0.0000	0.0000	214.4677	400.3397	573.7258	(98)
Space heating												2915.3999	(98)
Space heating per m2											(98) / (4) =	36.9131	(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	712.1353	560.6171	574.6498	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8601	0.9281	0.9115	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	612.5152	520.3076	523.8138	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	723.3778	694.9054	672.0205	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	79.8210	129.9008	110.2658	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												319.9875	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	19.9553	32.4752	27.5664	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	79.9969 (107)
Space cooling per m2	1.0129 (108)
Energy for space heating	36.9131 (99)
Energy for space cooling	1.0129 (108)
Total	37.9260 (109)
Target Fabric Energy Efficiency (TFEE)	43.6 (109)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	216.2 (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	253.86 (P1)
Transmission heat loss coefficient	41.04 (37)
Summer heat loss coefficient	294.90 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.3400	82.4373	0.7100	0.7000	0.7650	122.4261
South	4.9100	113.6726	0.7100	0.7000	0.7650	190.9843
total:						313.4104

	Jun	Jul	Aug	
Solar gains	339	313	287	(P3)
Internal gains	427	409	418	
Total summer gains	766	722	705	(P5)
Summer gain/loss ratio	2.60	2.45	2.39	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 216.2)	0.49	0.49	0.49	
Threshold temperature	18.08	19.64	19.58	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant