ASSESSMENT NOTES
Calculation Type: New Build (As Designed)

Property Reference	DE-18297 Plot 021 OP	**Issued on Date**	
Assessment Reference	DE-18297 Plot 021 OP	**Prop Type Ref**	T52 SH52 E END 2SW
Property	3 bed, 2 bath		

SAP Rating	85 B	**DER**	16.06	**TER**	17.25
Environmental	87 B	**% DER<TER**	6.91		
CO_2 Emissions (t/year)	1.27	**DFEE**	42.70	**TFEE**	48.86
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.61		

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
No Side Windows

PREDICTED ENERGY ASSESSMENT

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

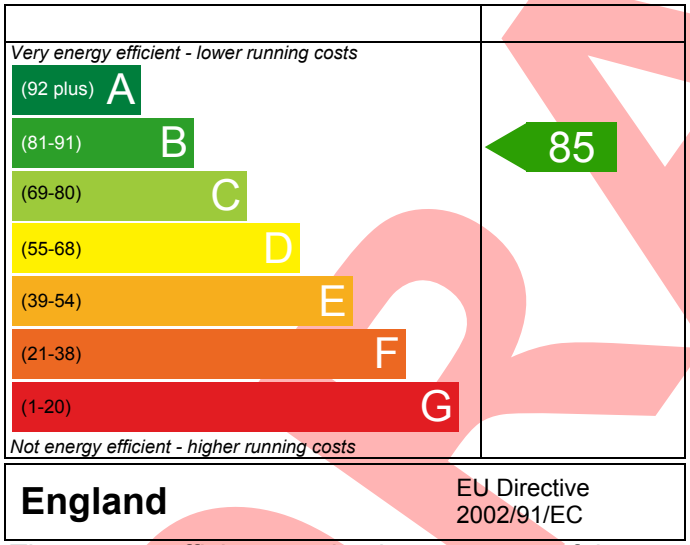
3 bed,
2 bath

Dwelling type:	House, End-Terrace
Date of assessment:	22/01/2021
Produced by:	Michael Brogden
Total floor area:	93 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.

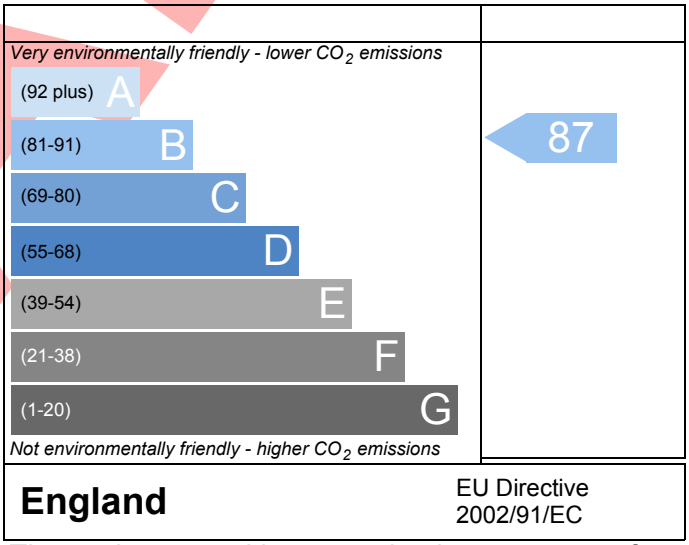
Energy Efficiency Rating



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 021 OP	**Issued on Date**	22/01/2021
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CO_2 Emissions (t/year)	1.27	**DFEE**	42.70	**TFEE**	48.86
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.61		

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, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2017
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:	19.31 m	46.50 m²	2.31 m
1st Storey:	19.31 m	46.50 m²	2.56 m

7.0 Living Area	19.29	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	192.55	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	94.03	79.19

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	49.23

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	133.42
Internal Wall 2	Other	62.70	15.31

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	46.50	46.50

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	46.50

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	0.14	75.00	46.50

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
floor	Plasterboard ceiling, carpeted chipboard floor	18.00	46.50

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 tall window	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	Window	[1] External Wall 1	North	Dark-coloured curtain or roller blind	0.00					2.12	100
rear windows	Window	[1] External Wall 1	North	Dark-coloured curtain or roller blind	0.00					4.37	100
side windows	Window	[1] External Wall 1	East	Dark-coloured curtain or roller blind	0.00					1.32	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

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	10.56	0.211	No	CATNIC
Independently assessed	E3 Sill	8.54	0.019	No	APA PF-WD-03
Independently assessed	E4 Jamb	27.60	0.020	No	APA PF-WD-04
Independently assessed	E5 Ground floor (normal)	19.31	0.082	No	Spantherm Bespoke
Independently assessed	E6 Intermediate floor within a dwelling	19.31	0.001	No	APA PF-IF-01
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.20	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	10.11	0.047	No	APA PF-RG-01
Independently assessed	E16 Corner (normal)	9.74	0.047	No	H+H CN01-EW01
Table K1 - Approved	E18 Party wall between dwellings	9.74	0.060	No	
Independently assessed	P1 Party wall - Ground floor	10.11	0.030	No	Spantherm Bespoke
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	10.11	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	10.11	0.036	No	Barratt Confidential Bespoke

Y-value	0.039	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 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	£28	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 96	

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 021 OP	**Issued on Date**	22/01/2021
Assessment Reference	DE-18297 Plot 021 OP	**Prop Type Ref**	T52 SH52 E END 2SW
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Environmental	87 B	**% DER<TER**	6.91		
CO_2 Emissions (t/year)	1.27	**DFEE**	42.70	**TFEE**	48.86
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.61		

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)	17.25	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	16.06	$kgCO_2/m^2$	Pass
	-1.19 (-6.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.86	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	42.70	$kWh/m^2/yr$	
	-6.2 (-12.7%)	$kWh/m^2/yr$	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	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.35 (max. 2.00)	1.41 (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 East Windows facing South	6.49 m², No overhang 1.32 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
Thermal bridging y-value	0.039	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 021 OP	**Issued on Date**	22/01/2021
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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

End-Terrace House, total floor area 93 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) 17.25 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.06 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)48.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 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	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.41 (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: 6.49 m², No overhang
Windows facing East: 1.32 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
Thermal bridging y-value 0.039 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	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(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) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(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) =	0.3251	(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	0.4145	0.4064	0.3983	0.3576	0.3495	0.3088	0.3088	0.3007	0.3251	0.3495	0.3657	0.3820	(22b)
Effective ac	0.5859	0.5826	0.5793	0.5639	0.5611	0.5477	0.5477	0.5452	0.5528	0.5611	0.5669	0.5730	(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	
French Door (Uw = 1.41)			2.1200	1.3347	2.8296			(27)
Window (Uw = 1.41)			10.6000	1.3347	14.1480			(27)
Solid door tall window			2.1200	1.0000	2.1200			(26)
Heat Loss Floor 1			46.5000	0.1400	6.5100	75.0000	3487.5000	(28a)
External Wall 1	94.0300	14.8400	79.1900	0.2600	20.5894	60.0000	4751.4000	(29a)
External Roof 1	46.5000		46.5000	0.1000	4.6500	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.8471			(33)
Party Wall 1			49.2300	0.0000	0.0000	110.0000	5415.3000	(32)
Internal Wall 1			133.4200			9.0000	1200.7800	(32c)
Internal Wall 2			15.3100			62.7000	959.9370	(32c)
floor			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			18.0000	837.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 17907.4170	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	192.5529	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.2818	(36)
Total fabric heat loss	(33) + (36) = 58.1288	(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	43.7851	43.5358	43.2914	42.1437	41.9289	40.9293	40.9293	40.7441	41.3143	41.9289	42.3633	42.8175	(38)
Heat transfer coeff	101.9139	101.6646	101.4202	100.2725	100.0577	99.0581	99.0581	98.8730	99.4431	100.0577	100.4922	100.9463	(39)
Average = Sum(39)m / 12 =												100.2714	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0958	1.0932	1.0905	1.0782	1.0759	1.0651	1.0651	1.0632	1.0693	1.0759	1.0806	1.0854	(40)
HLP (average)												1.0782	(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	2.6646	(42)
Average daily hot water use (litres/day)	97.4842	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1533.8058 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8534	20.8624	21.5281	18.7687	18.0090	15.5404	14.4005	16.5248	16.7221	19.4880	21.2727	23.1008	(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	14.1382	12.7591	14.0991	13.5997	14.0206	13.5310	13.9587	13.9988	13.5684	14.0666	13.6532	14.1262	(61)
Total heat required for water heating calculated for each month													
	173.1611	151.8415	157.6196	138.7244	134.0807	117.1337	109.9619	124.1639	125.0492	143.9867	155.4711	168.1313	(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													
	173.1611	151.8415	157.6196	138.7244	134.0807	117.1337	109.9619	124.1639	125.0492	143.9867	155.4711	168.1313	(64)
								Total per year (kWh/year) = Sum(64)m =				1699.3253	(64)
Heat gains from water heating, kWh/month													
	56.4097	49.4347	51.2454	45.0039	43.4251	37.8307	35.4107	40.1296	40.4595	46.7151	50.5678	54.7383	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	75.8194	73.5635	68.8782	62.5054	58.3671	52.5426	47.5951	53.9376	56.1937	62.7891	70.2330	73.5729	(72)
Total internal gains													
	409.7813	407.4346	392.4577	368.3501	343.7860	320.3174	305.2356	311.6690	324.2166	348.5468	376.4166	397.4005	(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	2.1200	10.6334	0.7100	0.7000	0.7700	7.7642	(74)
North	4.3700	10.6334	0.7100	0.7000	0.7700	16.0045	(74)
East	1.3200	19.6403	0.7100	0.7000	0.7700	8.9292	(76)
South	4.9100	46.7521	0.7100	0.7000	0.7700	79.0627	(78)

Solar gains	111.7607	192.3750	270.8916	352.3513	412.6868	418.3723	399.6929	352.8638	298.5575	214.4580	134.1717	95.4752	(83)
Total gains	521.5420	599.8096	663.3493	720.7015	756.4727	738.6897	704.9285	664.5328	622.7741	563.0048	510.5884	492.8757	(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	48.8087	48.9284	49.0463	49.6077	49.7141	50.2158	50.2158	50.3098	50.0214	49.7141	49.4992	49.2765	
alpha	4.2539	4.2619	4.2698	4.3072	4.3143	4.3477	4.3477	4.3540	4.3348	4.3143	4.2999	4.2851	
util living area													
	0.9955	0.9912	0.9814	0.9540	0.8853	0.7462	0.5867	0.6367	0.8497	0.9663	0.9916	0.9964	(86)
MIT	19.5226	19.6973	19.9750	20.3407	20.6727	20.8959	20.9720	20.9601	20.8027	20.3769	19.8838	19.4916	(87)
Th 2	20.0042	20.0064	20.0086	20.0187	20.0206	20.0294	20.0294	20.0310	20.0260	20.0206	20.0167	20.0127	(88)
util rest of house													
	0.9943	0.9888	0.9762	0.9401	0.8485	0.6671	0.4712	0.5226	0.7894	0.9534	0.9889	0.9955	(89)
MIT 2	18.0249	18.2808	18.6852	19.2153	19.6702	19.9464	20.0156	20.0094	19.8463	19.2748	18.5608	17.9854	(90)
Living area fraction									fLA = Living area / (4) =			0.2074	(91)
MIT	18.3356	18.5746	18.9527	19.4488	19.8782	20.1433	20.2139	20.2066	20.0447	19.5034	18.8352	18.2978	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1856	18.4246	18.8027	19.2988	19.7282	19.9933	20.0639	20.0566	19.8947	19.3534	18.6852	18.1478	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9834	0.9673	0.9268	0.8354	0.6638	0.4756	0.5258	0.7797	0.9413	0.9836	0.9927	(94)
Useful gains	516.8014	589.8282	641.6417	667.9210	631.9270	490.3446	335.2670	349.4308	485.5832	529.9650	502.2000	489.2955	(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													
	1415.1304	1374.9743	1247.7469	1042.7092	803.2807	534.2536	343.1312	361.5385	576.2385	875.8432	1164.2241	1407.9793	(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													
	668.3567	527.6182	450.9422	269.8475	127.4871	0.0000	0.0000	0.0000	0.0000	257.3334	476.6573	683.5007	(98)
Space heating												3461.7432	(98)
Space heating per m2											(98) / (4) =	37.2230	(99)

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 %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3825.1306	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	668.3567	527.6182	450.9422	269.8475	127.4871	0.0000	0.0000	0.0000	0.0000	257.3334	476.6573	683.5007	(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)													
	738.5157	583.0035	498.2787	298.1740	140.8697	0.0000	0.0000	0.0000	0.0000	284.3463	526.6932	755.2494	(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													
	173.1611	151.8415	157.6196	138.7244	134.0807	117.1337	109.9619	124.1639	125.0492	143.9867	155.4711	168.1313	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8225	89.7647	89.6489	89.3875	88.8309	87.3000	87.3000	87.3000	87.3000	89.3253	89.6914	89.8498	(217)
Fuel for water heating, kWh/month													
	192.7814	169.1550	175.8188	155.1944	150.9393	134.1738	125.9587	142.2267	143.2408	161.1937	173.3401	187.1249	(219)
Water heating fuel used												1911.1476	(219)
Annual totals kWh/year													
Space heating fuel - main system												3825.1306	(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)												415.0697	(232)
Total delivered energy for all uses												6226.3478	(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	3825.1306	0.2160	826.2282	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.1476	0.2160	412.8079	(264)
Space and water heating			1239.0361	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.0697	0.5190	215.4212	(268)
Total CO2, kg/year			1493.3822	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0600	(273)

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

DER		16.0600	ZC1
Total Floor Area	TFA	93.0000	
Assumed number of occupants	N	2.6646	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5785	ZC2
CO2 emissions from cooking, equation (L16)		1.9672	ZC3
Total CO2 emissions		33.6057	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		33.6057	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	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(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) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(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) =	0.3251	(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	0.4145	0.4064	0.3983	0.3576	0.3495	0.3088	0.3088	0.3007	0.3251	0.3495	0.3657	0.3820	(22b)
Effective ac	0.5859	0.5826	0.5793	0.5639	0.5611	0.5477	0.5477	0.5452	0.5528	0.5611	0.5669	0.5730	(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 Opening Type (Uw = 1.40)			12.7200	1.3258	16.8636			(27)
Heat Loss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	94.0300	14.8400	79.1900	0.1800	14.2542			(29a)
External Roof 1	46.5000		46.5000	0.1300	6.0450			(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3278			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0662	(36)
Total fabric heat loss					(33) + (36) =		55.3940	(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	43.7851	43.5358	43.2914	42.1437	41.9289	40.9293	40.9293	40.7441	41.3143	41.9289	42.3633	42.8175	(38)
Heat transfer coeff	99.1791	98.9298	98.6854	97.5377	97.3230	96.3233	96.3233	96.1382	96.7084	97.3230	97.7574	98.2115	(39)
Average = Sum(39)m / 12 =												97.5367	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0664	1.0638	1.0611	1.0488	1.0465	1.0357	1.0357	1.0337	1.0399	1.0465	1.0512	1.0560	(40)
HLP (average)												1.0488	(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		2.6646 (42)
Average daily hot water use (litres/day)		97.4842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)
Energy content (annual)										Total = Sum(45)m =		1533.8058	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8534	20.8624	21.5281	18.7687	18.0090	15.5404	14.4005	16.5248	16.7221	19.4880	21.2727	23.1008	(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													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6704	47.1129	46.6963	43.2670	44.7092	46.6963	47.1129	50.6704	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	209.9818	185.1098	194.1910	172.2376	166.7564	146.8697	140.7124	156.8613	158.5937	180.5905	191.1330	204.9640	(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													
	209.9818	185.1098	194.1910	172.2376	166.7564	146.8697	140.7124	156.8613	158.5937	180.5905	191.1330	204.9640	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.0013	(64)
Heat gains from water heating, kWh/month													
	65.6148	57.7517	60.3882	53.3822	51.5941	45.2647	43.0984	48.3040	48.8456	55.8660	59.4832	63.9464	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	88.1920	85.9401	81.1669	74.1419	69.3469	62.8676	57.9279	64.9247	67.8411	75.0888	82.6156	85.9495	(72)
Total internal gains													
	422.1539	419.8112	404.7464	379.9867	354.7657	330.6424	315.5684	322.6560	335.8640	360.8465	388.7992	409.7771	(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	6.4900	10.6334	0.6300	0.7000	0.7700	21.0906	(74)
East	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231	(76)
South	4.9100	46.7521	0.6300	0.7000	0.7700	70.1543	(78)

Solar gains	99.1679	170.6990	240.3686	312.6498	366.1868	371.2317	354.6570	313.1045	264.9172	190.2938	119.0538	84.7174	(83)
Total gains	521.3218	590.5102	645.1151	692.6364	720.9525	701.8742	670.2255	635.7605	600.7812	551.1402	507.8530	494.4945	(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	65.1179	65.2820	65.4436	66.2137	66.3598	67.0485	67.0485	67.1776	66.7815	66.3598	66.0649	65.7594	
alpha	5.3412	5.3521	5.3629	5.4142	5.4240	5.4699	5.4699	5.4785	5.4521	5.4240	5.4043	5.3840	
util living area													
	0.9986	0.9969	0.9923	0.9762	0.9229	0.7858	0.6124	0.6636	0.8857	0.9828	0.9969	0.9989	(86)
MIT	19.8354	19.9698	20.1883	20.4814	20.7532	20.9330	20.9862	20.9790	20.8607	20.5157	20.1233	19.8123	(87)
Th 2	20.0283	20.0305	20.0327	20.0429	20.0448	20.0537	20.0537	20.0553	20.0502	20.0448	20.0409	20.0369	(88)
util rest of house													
	0.9981	0.9958	0.9895	0.9665	0.8899	0.7029	0.4909	0.5429	0.8262	0.9740	0.9957	0.9986	(89)
MIT 2	18.4669	18.6649	18.9846	19.4139	19.7877	20.0053	20.0481	20.0459	19.9309	19.4684	18.8971	18.4394	(90)
Living area fraction										fLA = Living area / (4) =		0.2074	(91)
MIT	18.7508	18.9355	19.2342	19.6353	19.9880	20.1978	20.2427	20.2394	20.1238	19.6856	19.1514	18.7242	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7508	18.9355	19.2342	19.6353	19.9880	20.1978	20.2427	20.2394	20.1238	19.6856	19.1514	18.7242	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9941	0.9862	0.9611	0.8876	0.7168	0.5162	0.5678	0.8317	0.9695	0.9939	0.9978	(94)
Useful gains	519.8236	587.0011	636.2005	665.7135	639.9066	503.0973	345.9506	361.0024	499.6697	534.3508	504.7785	493.4163	(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													
	1433.2146	1388.5340	1256.6845	1047.0972	806.6093	539.1944	350.8759	369.1152	582.5498	884.2394	1178.1164	1426.4411	(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													
	679.5629	538.6301	461.6401	274.5963	124.0268	0.0000	0.0000	0.0000	0.0000	260.3171	484.8033	694.1704	(98)
Space heating												3517.7471	(98)
Space heating per m2											(98) / (4) =	37.8252	(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												3766.3245	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	679.5629	538.6301	461.6401	274.5963	124.0268	0.0000	0.0000	0.0000	0.0000	260.3171	484.8033	694.1704	(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)													
	727.5834	576.6918	494.2614	294.0003	132.7910	0.0000	0.0000	0.0000	0.0000	278.7121	519.0613	743.2232	(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													
	209.9818	185.1098	194.1910	172.2376	166.7564	146.8697	140.7124	156.8613	158.5937	180.5905	191.1330	204.9640	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7934	87.5825	87.1541	86.2198	84.3181	80.3000	80.3000	80.3000	80.3000	85.9710	87.2953	87.8803	(217)
Fuel for water heating, kWh/month													
	239.1773	211.3549	222.8133	199.7657	197.7706	182.9013	175.2334	195.3441	197.5015	210.0598	218.9501	233.2310	(219)
Water heating fuel used												2484.1028	(219)
Annual totals kWh/year													
Space heating fuel - main system												3766.3245	(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)												415.0697	(232)
Total delivered energy for all uses												6740.4970	(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	3766.3245	0.2160	813.5261	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.1028	0.2160	536.5662	(264)
Space and water heating			1350.0923	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.0697	0.5190	215.4212	(268)
Total CO2, kg/m2/year			1604.4385	(272)
Emissions per m2 for space and water heating			14.5171	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3164	(272b)
Emissions per m2 for pumps and fans			0.4185	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5171 * 1.00) + 2.3164 + 0.4185, rounded to 2 d.p.			17.2500	(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	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(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) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(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) =	0.3251	(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	0.4145	0.4064	0.3983	0.3576	0.3495	0.3088	0.3088	0.3007	0.3251	0.3495	0.3657	0.3820	(22b)
Effective ac	0.5859	0.5826	0.5793	0.5639	0.5611	0.5477	0.5477	0.5452	0.5528	0.5611	0.5669	0.5730	(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	
French Door (Uw = 1.41)			2.1200	1.3347	2.8296			(27)
Window (Uw = 1.41)			10.6000	1.3347	14.1480			(27)
Solid door tall window			2.1200	1.0000	2.1200			(26)
Heat Loss Floor 1			46.5000	0.1400	6.5100	75.0000	3487.5000	(28a)
External Wall 1	94.0300	14.8400	79.1900	0.2600	20.5894	60.0000	4751.4000	(29a)
External Roof 1	46.5000		46.5000	0.1000	4.6500	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.8471			(33)
Party Wall 1			49.2300	0.0000	0.0000	110.0000	5415.3000	(32)
Internal Wall 1			133.4200			9.0000	1200.7800	(32c)
Internal Wall 2			15.3100			62.7000	959.9370	(32c)
floor			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17488.9170	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		188.0529	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2818	(36)
Total fabric heat loss	(33) + (36) =	58.1288	(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	43.7851	43.5358	43.2914	42.1437	41.9289	40.9293	40.9293	40.7441	41.3143	41.9289	42.3633	42.8175	(38)
Heat transfer coeff	101.9139	101.6646	101.4202	100.2725	100.0577	99.0581	99.0581	98.8730	99.4431	100.0577	100.4922	100.9463	(39)
Average = Sum(39)m / 12 =												100.2714	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0958	1.0932	1.0905	1.0782	1.0759	1.0651	1.0651	1.0632	1.0693	1.0759	1.0806	1.0854	(40)
HLP (average)												1.0782	(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		2.6646 (42)
Average daily hot water use (litres/day)		97.4842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1533.8058 (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

33.7924	29.5550	30.4981	26.5890	25.5128	22.0156	20.4007	23.4101	23.6897	27.6080	30.1363	32.7261	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)

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

23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)

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

244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)

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

36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)

-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)

Water heating gains (Table 5)

45.4198	43.9807	40.9921	36.9292	34.2914	30.5772	27.4203	31.4652	32.9023	37.1076	41.8560	43.9867	(72)

Total internal gains

376.3817	374.8518	361.5716	339.7739	316.7102	295.3521	282.0608	286.1965	297.9252	319.8652	345.0396	364.8142	(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	2.1200	10.6334	0.7100	0.7000	0.7700	7.7642	(74)
North	4.3700	10.6334	0.7100	0.7000	0.7700	16.0045	(74)
East	1.3200	19.6403	0.7100	0.7000	0.7700	8.9292	(76)
South	4.9100	46.7521	0.7100	0.7000	0.7700	79.0627	(78)

Solar gains 111.7607	192.3750	270.8916	352.3513	412.6868	418.3723	399.6929	352.8638	298.5575	214.4580	134.1717	95.4752	(83)
Total gains 488.1424	567.2268	632.4632	692.1252	729.3969	713.7243	681.7537	639.0603	596.4827	534.3233	479.2113	460.2894	(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	47.6680	47.7849	47.9000	48.4483	48.5523	49.0423	49.0423	49.1341	48.8524	48.5523	48.3424	48.1249	
alpha	4.1779	4.1857	4.1933	4.2299	4.2368	4.2695	4.2695	4.2756	4.2568	4.2368	4.2228	4.2083	
util living area													
	0.9961	0.9922	0.9832	0.9578	0.8931	0.7594	0.6016	0.6542	0.8618	0.9702	0.9928	0.9970	(86)
MIT	19.4543	19.6336	19.9196	20.2974	20.6435	20.8822	20.9671	20.9529	20.7799	20.3330	19.8248	19.4235	(87)
Th 2	20.0042	20.0064	20.0086	20.0187	20.0206	20.0294	20.0294	20.0310	20.0260	20.0206	20.0167	20.0127	(88)
util rest of house													
	0.9951	0.9902	0.9786	0.9450	0.8584	0.6819	0.4852	0.5398	0.8048	0.9588	0.9906	0.9962	(89)
MIT 2	18.5869	18.7671	19.0524	19.4303	19.7570	19.9640	20.0180	20.0131	19.8863	19.4710	18.9662	18.5628	(90)
Living area fraction										fLA = Living area / (4) =		0.2074	(91)
MIT	18.7668	18.9468	19.2322	19.6102	19.9408	20.1544	20.2148	20.2080	20.0716	19.6498	19.1443	18.7413	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7668	18.9468	19.2322	19.6102	19.9408	20.1544	20.2148	20.2080	20.0716	19.6498	19.1443	18.7413	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9873	0.9738	0.9384	0.8551	0.6930	0.5087	0.5623	0.8080	0.9532	0.9878	0.9948	(94)
Useful gains	484.9086	559.9966	615.8798	649.4656	623.7376	494.5878	346.8227	359.3474	481.9379	509.3062	473.3788	457.8846	(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													
	1474.3704	1428.0662	1291.3063	1073.9362	824.5599	550.2111	358.0776	376.5089	593.8361	905.4987	1210.3576	1467.8885	(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													
	736.1596	583.3428	502.5174	305.6189	149.4118	0.0000	0.0000	0.0000	0.0000	294.7672	530.6248	751.4429	(98)
Space heating												3853.8853	(98)
Space heating per m2											(98) / (4) =	41.4396	(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												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	931.1460	733.0298	751.4345	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8123	0.8819	0.8562	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	756.3572	646.4648	643.3806	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.9022	896.4444	848.5370	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	129.2724	185.9849	152.6364	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												467.8937 (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	32.3181	46.4962	38.1591	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												116.9734 (107)
Space cooling per m2												1.2578 (108)
Energy for space heating												41.4396 (99)
Energy for space cooling												1.2578 (108)
Total												42.6974 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.7 (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	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(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) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(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) =	0.3251	(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	0.4145	0.4064	0.3983	0.3576	0.3495	0.3088	0.3088	0.3007	0.3251	0.3495	0.3657	0.3820	(22b)
Effective ac	0.5859	0.5826	0.5793	0.5639	0.5611	0.5477	0.5477	0.5452	0.5528	0.5611	0.5669	0.5730	(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 Opening Type (Uw = 1.40)			12.7200	1.3258	16.8636			(27)
Heat Loss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	94.0300	14.8400	79.1900	0.1800	14.2542			(29a)
External Roof 1	46.5000		46.5000	0.1300	6.0450			(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3278			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0662	(36)
Total fabric heat loss					(33) + (36) =		55.3940	(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	43.7851	43.5358	43.2914	42.1437	41.9289	40.9293	40.9293	40.7441	41.3143	41.9289	42.3633	42.8175	(38)
Heat transfer coeff	99.1791	98.9298	98.6854	97.5377	97.3230	96.3233	96.3233	96.1382	96.7084	97.3230	97.7574	98.2115	(39)
Average = Sum(39)m / 12 =												97.5367	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0664	1.0638	1.0611	1.0488	1.0465	1.0357	1.0357	1.0337	1.0399	1.0465	1.0512	1.0560	(40)
HLP (average)												1.0488	(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		2.6646 (42)
Average daily hot water use (litres/day)		97.4842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)
Energy content (annual)										Total = Sum(45)m =		1533.8058	(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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	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													
	33.7924	29.5550	30.4981	26.5890	25.5128	22.0156	20.4007	23.4101	23.6897	27.6080	30.1363	32.7261	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	45.4198	43.9807	40.9921	36.9292	34.2914	30.5772	27.4203	31.4652	32.9023	37.1076	41.8560	43.9867	(72)
Total internal gains													
	376.3817	374.8518	361.5716	339.7739	316.7102	295.3521	282.0608	286.1965	297.9252	319.8652	345.0396	364.8142	(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	6.4900	10.6334	0.6300	0.7000	0.7700	21.0906	(74)
East	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231	(76)
South	4.9100	46.7521	0.6300	0.7000	0.7700	70.1543	(78)

Solar gains	99.1679	170.6990	240.3686	312.6498	366.1868	371.2317	354.6570	313.1045	264.9172	190.2938	119.0538	84.7174	(83)
Total gains	475.5496	545.5507	601.9402	652.4237	682.8970	666.5838	636.7178	599.3010	562.8424	510.1590	464.0934	449.5317	(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	65.1179	65.2820	65.4436	66.2137	66.3598	67.0485	67.0485	67.1776	66.7815	66.3598	66.0649	65.7594	
alpha	5.3412	5.3521	5.3629	5.4142	5.4240	5.4699	5.4699	5.4785	5.4521	5.4240	5.4043	5.3840	
util living area													
	0.9991	0.9979	0.9944	0.9815	0.9363	0.8106	0.6398	0.6954	0.9072	0.9878	0.9980	0.9993	(86)
MIT	19.7888	19.9244	20.1456	20.4446	20.7265	20.9215	20.9830	20.9737	20.8385	20.4769	20.0789	19.7663	(87)
Th 2	20.0283	20.0305	20.0327	20.0429	20.0448	20.0537	20.0537	20.0553	20.0502	20.0448	20.0409	20.0369	(88)
util rest of house													
	0.9988	0.9971	0.9923	0.9738	0.9074	0.7303	0.5152	0.5729	0.8542	0.9813	0.9972	0.9991	(89)
MIT 2	18.9158	19.0529	19.2750	19.5783	19.8467	20.0140	20.0489	20.0470	19.9527	19.6140	19.2159	18.9003	(90)
Living area fraction										fLA = Living area / (4) =		0.2074	(91)
MIT	19.0968	19.2337	19.4556	19.7580	20.0292	20.2022	20.2426	20.2392	20.1364	19.7930	19.3949	19.0799	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0968	19.2337	19.4556	19.7580	20.0292	20.2022	20.2426	20.2392	20.1364	19.7930	19.3949	19.0799	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9963	0.9906	0.9708	0.9069	0.7444	0.5414	0.5985	0.8600	0.9790	0.9964	0.9988	(94)
Useful gains	474.7671	543.5250	596.2873	633.3881	619.3048	496.1985	344.6909	358.6823	484.0513	499.4530	462.4253	448.9862	(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													
	1467.5370	1418.0283	1278.5263	1059.0658	810.6217	539.6211	350.8713	369.0949	583.7734	894.6855	1201.9171	1461.3822	(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													
	738.6208	587.6662	507.5858	306.4880	142.3398	0.0000	0.0000	0.0000	0.0000	294.0530	532.4341	753.2226	(98)
Space heating												3862.4102	(98)
Space heating per m2											(98) / (4) =	41.5313	(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	905.4390	712.7924	730.6502	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8335	0.9071	0.8822	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	754.7210	646.5997	644.5772	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.8029	843.8052	802.0651	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	90.7789	146.7209	117.1710	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												354.6709	(104)

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Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)

0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	22.6947	36.6802	29.2928	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	88.6677 (107)
Space cooling per m2	0.9534 (108)
Energy for space heating	41.5313 (99)
Energy for space cooling	0.9534 (108)
Total	42.4847 (109)
Target Fabric Energy Efficiency (TFEE)	48.9 (109)

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	Severn Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	192.6 (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	298.92 (P1)
Transmission heat loss coefficient	58.13 (37)
Summer heat loss coefficient	357.05 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	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)
East	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	2.1200	82.4373	0.7100	0.7000	0.7650	59.8026
North	4.3700	82.4373	0.7100	0.7000	0.7650	123.2724
East	1.3200	119.1985	0.7100	0.7000	0.7650	53.8400
South	4.9100	113.6726	0.7100	0.7000	0.7650	190.9843
total:						427.8993

	Jun	Jul	Aug	
Solar gains	465	428	383	(P3)
Internal gains	469	449	459	
Total summer gains	934	877	842	(P5)
Summer gain/loss ratio	2.62	2.46	2.36	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 192.6)	0.65	0.65	0.65	
Threshold temperature	18.27	19.81	19.71	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

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