elmhurst energy

SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 80

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 28/03/2023

EXCELLENCE IN ENERGY ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Design SAP
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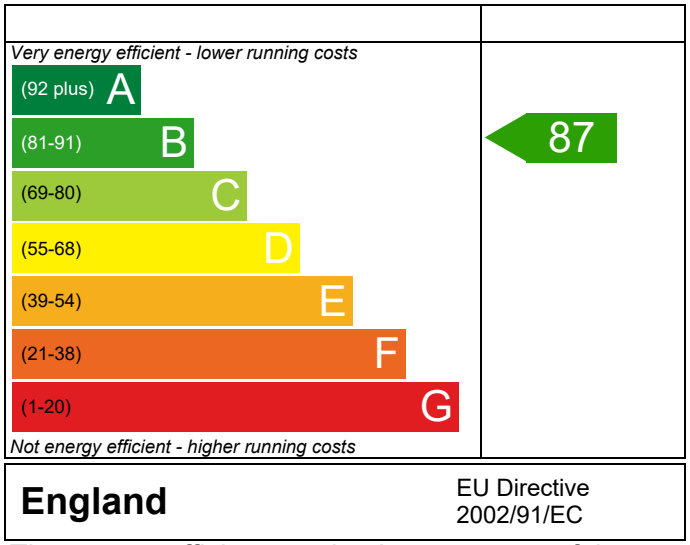
Plot 80

Dwelling type:	House, Semi-Detached
Date of assessment:	28/03/2023
Produced by:	Abacus Energy (UK) Ltd
Total floor area:	70.34 m²
DRRN:	8778-2907-2374

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.

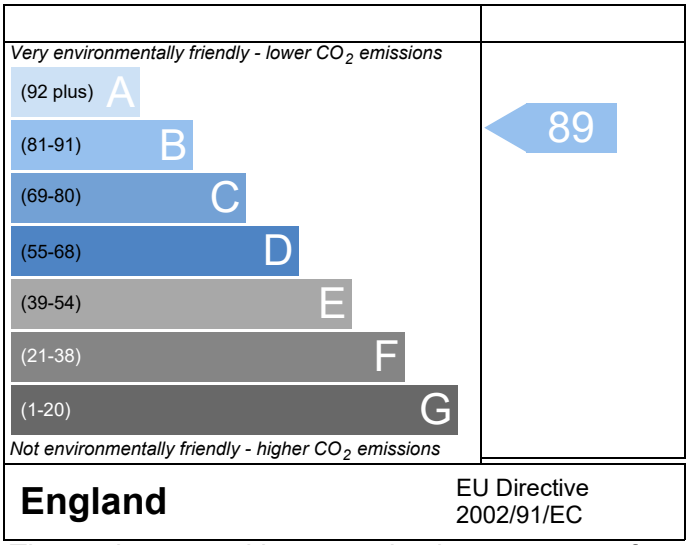
Energy Efficiency Rating



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.

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elmhurst energy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Designed)

Design SAP
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Property Reference	SAP 0879 Plot 80	**Issued on Date**	28/03/2023
Assessment Reference	Rev A	**Prop Type Ref**	Beeley
Property	Plot 80		

SAP Rating	87 B	**DER**	15.30	**TER**	19.10
Environmental	89 B	**% DER<TER**	19.90		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	**Assessor ID**	E477-0001
Client	Foreman Homes, FORE		

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)	19.10	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.30	$kgCO_2/m^2$	Pass
	-3.80 (-19.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.85	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.58	$kWh/m^2/yr$	
	-2.2 (-4.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (max. 2.00)	1.20 (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)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar 32CDi Compact ErP Combi boiler Efficiency: 89.8% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Programmer, room thermostat and TRVs		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Slight		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South West	3.35 m², No overhang 6.60 m², No overhang		
Air change rate	4.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.10	W/m²K
Floor U-value	0.12	W/m²K
Door U-value	1.10	W/m²K
Photovoltaic array	0.75	kW

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RECOMMENDATIONS

Design SAP
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	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£77	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	**£4,000 - £6,000**	**£77**	**B 88**	**B 91**	

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THERMAL BRIDGING
Calculation Type: New Build (As Designed)

Design SAP
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Assessment Reference	Rev A	**Prop Type Ref**	Beeley
Property	Plot 80		

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Environmental	89 B	**% DER<TER**	19.90		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	**Assessor ID**	E477-0001
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.110	0.46	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.910	5.46	4.97	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.02	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	5.92	0.12	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.32	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Default	0.320	16.79	5.37	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.79	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.10	0.55	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	15.64	0.69	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.46	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	9.55	0.57	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	7.82	1.25	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	7.82	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.069	7.82	0.54	Knauf P29

Total: 15.09 **W/mK:**

Y-Value: 0.098 **W/m²K:**

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

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CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

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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

Semi-Detached House, total floor area 70 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) 19.10 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.30 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (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

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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

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8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North East: 3.35 m², No overhang
Windows facing South West: 6.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 0.75 kW

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	35.1700 (1b)	x	2.3900 (2b)	=	84.0563	(1b) - (3b)
First floor	35.1700 (1c)	x	2.6200 (2c)	=	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2017	(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) =	0.1703	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4203	(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) =	0.3572	(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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197	(22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			18.0000	633.0600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.0903 (36)
Total fabric heat loss	(33) + (36) =	53.8634 (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	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953	(38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587	(39)
Average = Sum(39)m / 12 =												87.4247	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2615	1.2582	1.2429	1.2400	1.2267	1.2267	1.2242	1.2318	1.2400	1.2458	1.2519	(40)
HLP (average)												1.2429	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m													
	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750	(61)
Total heat required for water heating calculated for each month													
	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(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													
	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
								Total per year (kWh/year) = Sum(64)m =				1677.1472	(64)
Heat gains from water heating, kWh/month													
	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074	(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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401	(72)
Total internal gains													
	349.2702	347.1770	334.6408	314.5603	294.3053	274.7763	262.1083	267.8751	278.2211	298.5020	321.7358	339.0331	(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	
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)

Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	435.0365	497.1058	549.9715	598.4482	627.8758	612.7930	585.1383	552.7912	517.1286	466.9531	425.1628	411.9790	(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	33.4862	33.5746	33.6617	34.0768	34.1556	34.5273	34.5273	34.5971	34.3832	34.1556	33.9966	33.8318	
alpha	3.2324	3.2383	3.2441	3.2718	3.2770	3.3018	3.3018	3.3065	3.2922	3.2770	3.2664	3.2555	
util living area													
	0.9866	0.9784	0.9624	0.9262	0.8534	0.7261	0.5842	0.6280	0.8193	0.9415	0.9789	0.9887	(86)
MIT	19.0202	19.2329	19.5847	20.0510	20.4807	20.7970	20.9284	20.9073	20.6708	20.1184	19.4900	18.9845	(87)
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787	(88)
util rest of house													
	0.9836	0.9736	0.9537	0.9076	0.8129	0.6456	0.4622	0.5093	0.7556	0.9231	0.9734	0.9862	(89)
MIT 2	18.0749	18.2874	18.6365	19.0994	19.5038	19.7821	19.8719	19.8630	19.6842	19.1732	18.5533	18.0469	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	18.3138	18.5264	18.8762	19.3400	19.7507	20.0387	20.1389	20.1269	19.9336	19.4121	18.7901	18.2839	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3138	18.5264	18.8762	19.3400	19.7507	20.0387	20.1389	20.1269	19.9336	19.4121	18.7901	18.2839	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9661	0.9437	0.8964	0.8071	0.6569	0.4908	0.5359	0.7582	0.9130	0.9661	0.9814	(94)
Useful gains	425.5050	480.2567	519.0119	536.4410	506.7627	402.5704	287.1990	296.2611	392.0828	426.3409	410.7593	404.2981	(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													
	1246.7766	1209.1178	1095.3391	912.7225	702.2175	469.2753	305.3574	320.9309	505.4598	768.6269	1024.4281	1240.2074	(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													
	611.0261	489.7946	428.7874	270.9227	145.4184	0.0000	0.0000	0.0000	0.0000	254.6607	441.8415	621.9165	(98)
Space heating												3264.3680	(98)
Space heating per m2											(98) / (4) =	46.4084	(99)

8c. Space cooling requirement

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 %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3599.0826	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	611.0261	489.7946	428.7874	270.9227	145.4184	0.0000	0.0000	0.0000	0.0000	254.6607	441.8415	621.9165	(98)
Space heating efficiency (main heating system 1)													
	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)													
	673.6781	540.0161	472.7535	298.7020	160.3290	0.0000	0.0000	0.0000	0.0000	280.7726	487.1461	685.6853	(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													
	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
Efficiency of water heater												87.2000	(216)
(217)m	89.9202	89.8630	89.7463	89.4937	88.9923	87.2000	87.2000	87.2000	87.2000	89.4145	89.7773	89.9470	(217)
Fuel for water heating, kWh/month													
	187.2946	164.6934	172.0426	153.0726	149.6926	134.8128	127.8737	142.5331	142.9834	158.9577	169.3904	182.2046	(219)
Water heating fuel used												1885.5517	(219)
Annual totals kWh/year													
Space heating fuel - main system												3599.0826	(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)												333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1029 * 1.00) =										-617.5120		-617.5120	(233)
Total delivered energy for all uses												5275.9590	(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	3599.0826	0.2160	777.4019	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1885.5517	0.2160	407.2792	(264)
Space and water heating			1184.6810	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-617.5120	0.5190	-320.4887	(269)
Total CO2, kg/year			1076.3785	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3000	(273)

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

DER		15.3000	ZC1
Total Floor Area	TFA	70.3400	
Assumed number of occupants	N	2.2544	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6880	ZC2
CO2 emissions from cooking, equation (L16)		2.4610	ZC3
Total CO2 emissions		34.4490	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		34.4490	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	35.1700 (1b)	x	2.3900 (2b)	=	84.0563	(1b) - (3b)
First floor	35.1700 (1c)	x	2.6200 (2c)	=	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2017	(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) =	0.1703	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4203	(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) =	0.3572	(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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197	(22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881	(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			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.40)			9.9500	1.3258	13.1913			(27)
Ground Floor			35.3100	0.1300	4.5903			(28a)
Brick and Block	84.0200	12.1000	71.9200	0.1800	12.9456			(29a)
External Roof 1	35.1700		35.1700	0.1300	4.5721			(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.4493			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1877	(36)
Total fabric heat loss					(33) + (36) =		46.6370	(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	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953	(38)
Heat transfer coeff	81.7412	81.5070	81.2775	80.1993	79.9976	79.0585	79.0585	78.8846	79.4202	79.9976	80.4057	80.8323	(39)
Average = Sum(39)m / 12 =												80.1983	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1621	1.1588	1.1555	1.1402	1.1373	1.1239	1.1239	1.1215	1.1291	1.1373	1.1431	1.1492	(40)
HLP (average)												1.1402	(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	2.2544	(42)
Average daily hot water use (litres/day)	87.7408	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(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	49.1829	42.8079	45.6060	42.4041	42.0291	38.9425	40.2406	42.0291	42.4041	45.6060	45.8656	49.1829	(61)
Total heat required for water heating calculated for each month													
	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(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													
	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(64)
								Total per year (kWh/year) = Sum(64)m =				1906.8058	(64)
Heat gains from water heating, kWh/month													
	59.8861	52.3248	54.3525	48.0468	46.4373	40.7406	38.7908	43.4761	43.9636	50.2823	53.9079	58.3844	(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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	80.4920	77.8643	73.0545	66.7316	62.4158	56.5841	52.1381	58.4356	61.0605	67.5838	74.8721	78.4737	(72)
Total internal gains													
	357.2998	354.6141	341.4889	320.8215	299.9756	279.8574	267.1965	273.5520	284.4922	305.3601	329.1785	347.0666	(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	
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)

Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	443.0662	504.5428	556.8197	604.7095	633.5460	617.8741	590.2266	558.4681	523.3998	473.8112	432.6055	420.0126	(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	59.7584	59.9301	60.0993	60.9073	61.0609	61.7862	61.7862	61.9224	61.5048	61.0609	60.7510	60.4303	
alpha	4.9839	4.9953	5.0066	5.0605	5.0707	5.1191	5.1191	5.1282	5.1003	5.0707	5.0501	5.0287	
util living area													
	0.9975	0.9948	0.9875	0.9635	0.8945	0.7433	0.5725	0.6229	0.8547	0.9744	0.9949	0.9981	(86)
MIT	19.7702	19.9198	20.1615	20.4813	20.7628	20.9373	20.9867	20.9799	20.8651	20.5044	20.0813	19.7464	(87)
Th 2	19.9504	19.9531	19.9558	19.9682	19.9705	19.9813	19.9813	19.9833	19.9771	19.9705	19.9658	19.9609	(88)
util rest of house													
	0.9967	0.9930	0.9830	0.9494	0.8528	0.6532	0.4486	0.4984	0.7848	0.9617	0.9928	0.9975	(89)
MIT 2	18.3159	18.5358	18.8885	19.3539	19.7327	19.9384	19.9763	19.9748	19.8672	19.3943	18.7812	18.2886	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	18.6835	18.8856	19.2103	19.6389	19.9931	20.1909	20.2317	20.2289	20.1194	19.6749	19.1099	18.6571	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6835	18.8856	19.2103	19.6389	19.9931	20.1909	20.2317	20.2289	20.1194	19.6749	19.1099	18.6571	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9904	0.9786	0.9436	0.8539	0.6733	0.4801	0.5300	0.7960	0.9569	0.9904	0.9963	(94)
Useful gains	440.9284	499.7111	544.8984	570.6255	540.9876	416.0122	283.3850	295.9687	416.6272	453.3685	428.4339	418.4423	(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													
	1175.7253	1139.9286	1033.0594	861.2483	663.4266	442.0089	287.1165	302.0405	478.0632	725.9719	965.6600	1168.5970	(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													
	546.6889	430.2262	363.1918	209.2484	91.0946	0.0000	0.0000	0.0000	0.0000	202.8169	386.8028	558.1151	(98)
Space heating												2788.1847	(98)
Space heating per m2											(98) / (4) =	39.6387	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	2985.2085	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	546.6889	430.2262	363.1918	209.2484	91.0946	0.0000	0.0000	0.0000	0.0000	202.8169	386.8028	558.1151	(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)													
	585.3201	460.6276	388.8563	224.0347	97.5317	0.0000	0.0000	0.0000	0.0000	217.1487	414.1357	597.5537	(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													
	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5348	87.3159	86.8509	85.8070	83.8378	80.3000	80.3000	80.3000	80.3000	85.6096	87.0110	87.6252	(217)
Fuel for water heating, kWh/month													
	219.6974	192.3925	201.2437	180.6646	179.0235	164.6207	157.7191	175.8199	177.7616	189.8629	199.4106	214.3169	(219)
Water heating fuel used												2252.5335	(219)
Annual totals kWh/year													
Space heating fuel - main system												2985.2085	(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)												333.8367	(232)
Total delivered energy for all uses												5646.5786	(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	2985.2085	0.2160	644.8050	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2252.5335	0.2160	486.5472	(264)
Space and water heating			1131.3523	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Total CO2, kg/m2/year			1343.5385	(272)
Emissions per m2 for space and water heating			16.0841	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4632	(272b)
Emissions per m2 for pumps and fans			0.5534	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0841 * 1.00) + 2.4632 + 0.5534, rounded to 2 d.p.			19.1000	(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	35.1700	(1b)	x 2.3900	(2b) =	84.0563	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6200	(2c) =	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	176.2017	(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) =	0.1703	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4203	(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) =		0.3572	(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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197	(22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			9.0000	316.5300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10408.5494 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		147.9748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.0903 (36)
Total fabric heat loss	(33) + (36) =	53.8634 (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	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953	(38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587	(39)
Average = Sum(39)m / 12 =												87.4247	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2615	1.2582	1.2429	1.2400	1.2267	1.2267	1.2242	1.2318	1.2400	1.2458	1.2519	(40)
HLP (average)												1.2429	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

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

	30.4149	26.6010	27.4499	23.9315	22.9628	19.8152	18.3617	21.0703	21.3219	24.8487	27.1243	29.4552 (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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)

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

	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286	(67)

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

	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)

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

	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)

	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)

Water heating gains (Table 5)

	40.8802	39.5849	36.8950	33.2382	30.8640	27.5211	24.6797	28.3203	29.6138	33.3987	37.6726	39.5903	(72)

Total internal gains

	314.6880	313.3347	302.3295	284.3281	265.4238	247.7943	236.7381	240.4367	250.0455	268.1750	288.9790	305.1832	(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	
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)

Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	400.4544	463.2635	517.6602	568.2160	598.9942	585.8111	559.7681	525.3528	488.9531	436.6262	392.4061	378.1292	(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	32.4979	32.5837	32.6682	33.0711	33.1476	33.5083	33.5083	33.5760	33.3685	33.1476	32.9932	32.8334	
alpha	3.1665	3.1722	3.1779	3.2047	3.2098	3.2339	3.2339	3.2384	3.2246	3.2098	3.1995	3.1889	
util living area	0.9885	0.9808	0.9659	0.9318	0.8629	0.7408	0.6012	0.6475	0.8336	0.9480	0.9818	0.9904	(86)
MIT	18.9160	19.1356	19.4997	19.9839	20.4336	20.7716	20.9167	20.8919	20.6330	20.0508	19.3997	18.8802	(87)
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787	(88)
util rest of house	0.9859	0.9767	0.9580	0.9147	0.8247	0.6622	0.4787	0.5291	0.7733	0.9315	0.9771	0.9883	(89)
MIT 2	17.9751	18.1947	18.5566	19.0383	19.4643	19.7649	19.8666	19.8553	19.6555	19.1117	18.4676	17.9468	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	18.2129	18.4326	18.7950	19.2773	19.7093	20.0194	20.1320	20.1173	19.9026	19.3491	18.7032	18.1828	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2129	18.4326	18.7950	19.2773	19.7093	20.0194	20.1320	20.1173	19.9026	19.3491	18.7032	18.1828	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9695	0.9482	0.9030	0.8175	0.6718	0.5069	0.5548	0.7738	0.9212	0.9703	0.9838	(94)
Useful gains	392.7832	449.1311	490.8550	513.1107	489.6493	393.5717	283.7196	291.4537	378.3601	402.2269	380.7387	372.0143	(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	1237.7983	1200.7923	1088.1521	907.2462	698.6053	467.6095	304.7581	320.1003	502.7762	763.1324	1016.8140	1231.3058	(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	628.6912	505.1163	444.3890	283.7775	155.4633	0.0000	0.0000	0.0000	0.0000	268.5137	457.9742	639.3129	(98)
Space heating												3383.2381	(98)
Space heating per m2											(98) / (4) =	48.0984	(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	811.0781	638.5083	654.4436	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7431	0.8154	0.7882	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	602.6993	520.6147	515.8187	0.0000	0.0000	0.0000	0.0000	(102)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	769.0125	736.9225	698.2302	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	119.7455	160.9330	135.7142	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												416.3927 (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	29.9364	40.2333	33.9285	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												104.0982 (107)
Space cooling per m2												1.4799 (108)
Energy for space heating												48.0984 (99)
Energy for space cooling												1.4799 (108)
Total												49.5783 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.6 (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	35.1700 (1b)	x	2.3900 (2b)	=	84.0563	(1b) - (3b)
First floor	35.1700 (1c)	x	2.6200 (2c)	=	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2017	(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) =	0.1703	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4203	(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) =	0.3572	(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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197	(22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881	(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			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.40)			9.9500	1.3258	13.1913			(27)
Ground Floor			35.3100	0.1300	4.5903			(28a)
Brick and Block	84.0200	12.1000	71.9200	0.1800	12.9456			(29a)
External Roof 1	35.1700		35.1700	0.1300	4.5721			(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.4493			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1877	(36)
Total fabric heat loss (33) + (36) =	46.6370	(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	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953	(38)
Heat transfer coeff	81.7412	81.5070	81.2775	80.1993	79.9976	79.0585	79.0585	78.8846	79.4202	79.9976	80.4057	80.8323	(39)
Average = Sum(39)m / 12 =												80.1983	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1621	1.1588	1.1555	1.1402	1.1373	1.1239	1.1239	1.1215	1.1291	1.1373	1.1431	1.1492	(40)
HLP (average)												1.1402	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(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													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													
	30.4149	26.6010	27.4499	23.9315	22.9628	19.8152	18.3617	21.0703	21.3219	24.8487	27.1243	29.4552	(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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	40.8802	39.5849	36.8950	33.2382	30.8640	27.5211	24.6797	28.3203	29.6138	33.3987	37.6726	39.5903	(72)
Total internal gains													
	314.6880	313.3347	302.3295	284.3281	265.4238	247.7943	236.7381	240.4367	250.0455	268.1750	288.9790	305.1832	(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	
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)

Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	400.4544	463.2635	517.6602	568.2160	598.9942	585.8111	559.7681	525.3528	488.9531	436.6262	392.4061	378.1292	(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	59.7584	59.9301	60.0993	60.9073	61.0609	61.7862	61.7862	61.9224	61.5048	61.0609	60.7510	60.4303	
alpha	4.9839	4.9953	5.0066	5.0605	5.0707	5.1191	5.1191	5.1282	5.1003	5.0707	5.0501	5.0287	
util living area													
	0.9984	0.9964	0.9908	0.9713	0.9113	0.7698	0.5996	0.6550	0.8798	0.9816	0.9967	0.9988	(86)
MIT	19.7141	19.8660	20.1122	20.4402	20.7349	20.9262	20.9836	20.9748	20.8421	20.4601	20.0287	19.6909	(87)
Th 2	19.9504	19.9531	19.9558	19.9682	19.9705	19.9813	19.9813	19.9833	19.9771	19.9705	19.9658	19.9609	(88)
util rest of house													
	0.9979	0.9952	0.9874	0.9596	0.8739	0.6812	0.4718	0.5275	0.8161	0.9720	0.9953	0.9984	(89)
MIT 2	18.7785	18.9322	19.1788	19.5102	19.7856	19.9459	19.9770	19.9759	19.8863	19.5353	19.1050	18.7638	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	19.0150	19.1682	19.4147	19.7453	20.0255	20.1937	20.2315	20.2284	20.1279	19.7690	19.3385	18.9981	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0150	19.1682	19.4147	19.7453	20.0255	20.1937	20.2315	20.2284	20.1279	19.7690	19.3385	18.9981	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9939	0.9851	0.9565	0.8762	0.7015	0.5046	0.5601	0.8271	0.9695	0.9942	0.9979	(94)
Useful gains	399.3406	460.4444	509.9318	543.4973	524.8433	410.9306	282.4356	294.2306	404.4248	423.3238	390.1254	377.3387	(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													
	1202.8215	1162.9599	1049.6768	869.7847	666.0209	442.2311	287.0979	301.9994	478.7396	733.5016	984.0436	1196.1680	(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													
	597.7898	472.0904	401.5703	234.9269	105.0361	0.0000	0.0000	0.0000	0.0000	230.7723	427.6211	609.2090	(98)
Space heating												3079.0159	(98)
Space heating per m2											(98) / (4) =	43.7733	(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	743.1498	585.0328	599.5228	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8505	0.9164	0.8934	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	632.0811	536.1259	535.6232	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	769.0125	736.9225	698.2302	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	98.5906	149.3926	120.9796	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												368.9629	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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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   24.6477   37.3482   30.2449    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              92.2407 (107)
Space cooling per m2                                                                                                        1.3114 (108)
Energy for space heating                                                                                                   43.7733 (99)
Energy for space cooling                                                                                                    1.3114 (108)
Total                                                                                                                      45.0847 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        51.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.3900	(2b) =	84.0563	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6200	(2c) =	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	176.2017	(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) =	0.1703	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4203	(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) =	0.3572	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.4555	0.4197	0.4108	0.3840	0.3840	0.3572	0.3572	0.3483	0.3572	0.4019	0.3929	0.4197	(22b)
Effective ac	0.6037	0.5881	0.5844	0.5737	0.5737	0.5638	0.5638	0.5607	0.5638	0.5808	0.5772	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			18.0000	633.0600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.0903 (36)
Total fabric heat loss	(33) + (36) =	53.8634 (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	35.1043	34.1953	33.9797	33.3606	33.3606	32.7832	32.7832	32.6000	32.7832	33.7687	33.5623	34.1953	(38)
Heat transfer coeff	88.9677	88.0587	87.8431	87.2240	87.2240	86.6466	86.6466	86.4634	86.6466	87.6321	87.4257	88.0587	(39)
Average = Sum(39)m / 12 =												87.4031	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2519	1.2488	1.2400	1.2400	1.2318	1.2318	1.2292	1.2318	1.2458	1.2429	1.2519	(40)
HLP (average)												1.2426	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m

	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)

Total heat required for water heating calculated for each month

	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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

	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (64)

Total per year (kWh/year) = Sum(64)m = 1677.1472 (64)

RHI water heating demand 1677 (64)

Heat gains from water heating, kWh/month

	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)

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

	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715 (67)

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

	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)

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

	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)

	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)

Water heating gains (Table 5)

	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)

Total internal gains

	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896 (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	
Northeast	3.3500	15.0428	0.6300	0.7000	0.7700	15.4009	(75)
Southwest	6.6000	46.3896	0.6300	0.7000	0.7700	93.5699	(79)

Solar gains	108.9708	163.1027	234.0429	316.2670	356.7664	392.0139	365.3684	327.8407	276.0202	194.0828	130.2646	88.4697 (83)
Total gains	623.2144	673.0952	724.2448	775.9813	785.4546	792.9238	750.0936	720.4905	686.2704	635.0209	605.2078	588.9593 (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	33.4862	33.8318	33.9149	34.1556	34.1556	34.3832	34.3832	34.4561	34.3832	33.9966	34.0768	33.8318	
alpha	3.2324	3.2555	3.2610	3.2770	3.2770	3.2922	3.2922	3.2971	3.2922	3.2664	3.2718	3.2555	
util living area	0.9571	0.9449	0.9141	0.8509	0.7389	0.5583	0.4121	0.4265	0.6518	0.8476	0.9312	0.9621	(86)
MIT	19.5170	19.6627	19.9813	20.3701	20.7127	20.9196	20.9783	20.9761	20.8629	20.4954	19.9862	19.4992	(87)
Th 2	19.8685	19.8787	19.8811	19.8881	19.8881	19.8946	19.8946	19.8967	19.8946	19.8835	19.8858	19.8787	(88)
util rest of house	0.9481	0.9335	0.8959	0.8185	0.6798	0.4659	0.2957	0.3070	0.5626	0.8056	0.9144	0.9540	(89)
MIT 2	18.5637	18.7127	19.0226	19.3936	19.6962	19.8568	19.8890	19.8904	19.8227	19.5129	19.0364	18.5545	(90)

Living area fraction fLA = Living area / (4) = 0.2528 (91)

MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933	(92)

Temperature adjustment 0.0000

adjusted MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9374	0.9219	0.8839	0.8102	0.6836	0.4863	0.3250	0.3371	0.5793	0.8003	0.9030	0.9439	(94)
Useful gains	584.1957	620.5545	640.1959	628.7310	536.9006	385.5679	243.7912	242.8447	397.5331	508.1850	546.5193	555.9100	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1192.5794	1167.0259	1051.0373	875.7665	641.3691	409.4430	248.1833	247.7041	440.6547	697.6626	950.8811	1170.5911	(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	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(98)

Space heating 2270.5569 (98)

RHI space heating demand 2271 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.3900	(2b) =	84.0563	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6200	(2c) =	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	176.2017	(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) =	0.1703	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4203	(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) =		0.3572	(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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197	(22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			18.0000	633.0600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.0903 (36)
Total fabric heat loss	(33) + (36) =	53.8634 (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	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953	(38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587	(39)
Average = Sum(39)m / 12 =												87.4247	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2615	1.2582	1.2429	1.2400	1.2267	1.2267	1.2242	1.2318	1.2400	1.2458	1.2519	(40)
HLP (average)												1.2429	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
               21.4693    18.7772    19.3764    16.8928    16.2091    13.9872    12.9612    14.8731    15.0508    17.5402    19.1465    20.7919 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     25.2867    22.8171    25.2259    24.3716    25.1544    24.3089    25.0980    25.1346    24.3430    25.1963    24.4306    25.2750 (61)
Total heat required for water heating calculated for each month
              168.4156   147.9985   154.4019   136.9903   133.2148   117.5568   111.5059   124.2889   124.6816   142.1312   152.0742   163.8876 (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
              168.4156   147.9985   154.4019   136.9903   133.2148   117.5568   111.5059   124.2889   124.6816   142.1312   152.0742   163.8876 (64)
                                                                                        Total per year (kWh/year) = Sum(64)m =   1677.1472 (64)
Heat gains from water heating, kWh/month
               53.9120    47.3271    49.2575    43.5386    42.2187    37.0822    35.0051    39.2524    39.4483    45.1799    48.5491    52.4074 (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         135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               47.2580    41.9742    34.1357    25.8429    19.3179    16.3090    17.6224    22.9063    30.7448    39.0375    45.5626    48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.6557   298.7237   290.9924   274.5336   253.7573   234.2305   221.1854   218.1174   225.8486   242.3074   263.0837   282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805 (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)
              -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740 (71)
Water heating gains (Table 5)
               72.4624    70.4272    66.2063    60.4703    56.7455    51.5030    47.0499    52.7587    54.7893    60.7257    67.4294    70.4401 (72)
Total internal gains
              514.2436   509.9925   490.2019   459.7143   428.6882   400.9099   384.7251   392.6498   410.2502   440.9381   474.9432   500.4896 (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
----------------------------------------------------------------------------------------------------
Northeast                                  3.3500          11.2829          0.6300          0.7000          0.7700         11.5515 (75)
Southwest                                  6.6000          36.7938          0.6300          0.7000          0.7700         74.2148 (79)
----------------------------------------------------------------------------------------------------

Solar gains     85.7664   149.9288   215.3307   283.8879   333.5704   338.0168   323.0300   284.9161   238.9075   168.4512   103.4271    72.9460 (83)
Total gains    600.0100   659.9213   705.5326   743.6022   762.2586   738.9267   707.7552   677.5659   649.1577   609.3893   578.3702   573.4356 (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            33.4862    33.5746    33.6617    34.0768    34.1556    34.5273    34.5273    34.5971    34.3832    34.1556    33.9966    33.8318
alpha           3.2324     3.2383     3.2441     3.2718     3.2770     3.3018     3.3018     3.3065     3.2922     3.2770     3.2664     3.2555
util living area
                0.9675     0.9541     0.9298     0.8795     0.7894     0.6463     0.5023     0.5389     0.7345     0.8910     0.9519     0.9715 (86)

MIT            19.3037    19.5016    19.8225    20.2390    20.6051    20.8587    20.9543    20.9414    20.7713    20.3133    19.7430    19.2660 (87)
Th 2           19.8685    19.8711    19.8737    19.8858    19.8881    19.8987    19.8987    19.9007    19.8946    19.8881    19.8835    19.8787 (88)
util rest of house
                0.9609     0.9449     0.9152     0.8530     0.7407     0.5634     0.3900     0.4274     0.6609     0.8616     0.9406     0.9657 (89)
MIT 2          18.3534    18.5492    18.8640    19.2712    19.6059    19.8213    19.8825    19.8782    19.7565    19.3505    18.7985    18.3241 (90)
Living area fraction                                                                         fLA = Living area / (4) =      0.2528 (91)
MIT            18.5936    18.7899    19.1063    19.5158    19.8585    20.0835    20.1534    20.1470    20.0130    19.5938    19.0373    18.5622 (92)
Temperature adjustment                                                                                                      0.0000
adjusted MIT   18.5936    18.7899    19.1063    19.5158    19.8585    20.0835    20.1534    20.1470    20.0130    19.5938    19.0373    18.5622 (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     0.9514     0.9339     0.9030     0.8427     0.7392     0.5784     0.4173     0.4538     0.6696     0.8523     0.9299     0.9569 (94)
Useful gains  570.8403   616.2794   637.1000   626.6361   563.4653   427.3650   295.3201   307.4953   434.6867   519.3836   537.8118   548.7110 (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
             1271.6705  1232.5027  1115.7036   928.0967   711.6159   473.1458   306.6046   322.6547   512.3418   784.4771  1046.0869  1264.7180 (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
              521.4177   414.1021   356.0811   217.0517   110.2241     0.0000     0.0000     0.0000     0.0000   197.2295   365.9580   532.7092 (98)
Space heating                                                                                                            2714.7734 (98)
Space heating per m2                                                                                    (98) / (4) =      38.5950 (99)


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8c. Space cooling requirement
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CALCULATION OF ENERGY RATINGS 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 %)	90.7000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2993.1349 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092	(98)
Space heating efficiency (main heating system 1)													
	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)													
	574.8817	456.5624	392.5921	239.3072	121.5260	0.0000	0.0000	0.0000	0.0000	217.4526	403.4818	587.3309	(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													
	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
Efficiency of water heater												87.2000	(216)
(217)m	89.8198	89.7515	89.6121	89.3129	88.7507	87.2000	87.2000	87.2000	87.2000	89.2005	89.6437	89.8515	(217)
Fuel for water heating, kWh/month													
	187.5038	164.8981	172.3003	153.3824	150.1000	134.8128	127.8737	142.5331	142.9834	159.3390	169.6428	182.3983	(219)
Water heating fuel used												1887.7678	(219)
Annual totals kWh/year													
Space heating fuel - main system												2993.1349	(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)												333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1029 * 1.00) =										-617.5120		-617.5120	(233)
Total delivered energy for all uses												4672.2274	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2993.1349	3.4800	104.1611	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1887.7678	3.4800	65.6943	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	333.8367	13.1900	44.0331	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-617.5120	13.1900	-81.4498	(252)
Total energy cost			262.3311	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9553 (257)
SAP value		86.6742
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2993.1349	0.2160	646.5171	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1887.7678	0.2160	407.7578	(264)
Space and water heating			1054.2750	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-617.5120	0.5190	-320.4887	(269)
Total kg/year			945.9725	(272)
CO2 emissions per m2			13.4500	(273)
EI value			89.0099	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency 3.48 × (1 + 0.29 × 0.00) / 0.9070 = 3.837, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9070 = 0.2381, stars = 4
Water heating energy efficiency	3.48 / 0.8873 = 3.922, stars = 4
Water heating environmental impact	0.216 / 0.8873 = 0.2434, stars = 4

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.3900	(2b) =	84.0563	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6200	(2c) =	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	176.2017	(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) =	0.1703	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4203	(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) =	0.3572	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.4555	0.4197	0.4108	0.3840	0.3840	0.3572	0.3572	0.3483	0.3572	0.4019	0.3929	0.4197	(22b)
Effective ac	0.6037	0.5881	0.5844	0.5737	0.5737	0.5638	0.5638	0.5607	0.5638	0.5808	0.5772	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			18.0000	633.0600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10725.0794	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	152.4748	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.0903	(36)
Total fabric heat loss	(33) + (36) = 53.8634	(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	35.1043	34.1953	33.9797	33.3606	33.3606	32.7832	32.7832	32.6000	32.7832	33.7687	33.5623	34.1953	(38)
Heat transfer coeff	88.9677	88.0587	87.8431	87.2240	87.2240	86.6466	86.6466	86.4634	86.6466	87.6321	87.4257	88.0587	(39)
Average = Sum(39)m / 12 =												87.4031	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2519	1.2488	1.2400	1.2400	1.2318	1.2318	1.2292	1.2318	1.2458	1.2429	1.2519	(40)
HLP (average)												1.2426	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

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

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Distribution loss  (46)m = 0.15 x (45)m
               21.4693    18.7772    19.3764    16.8928    16.2091    13.9872    12.9612    14.8731    15.0508    17.5402    19.1465    20.7919 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     25.2867    22.8171    25.2259    24.3716    25.1544    24.3089    25.0980    25.1346    24.3430    25.1963    24.4306    25.2750 (61)
Total heat required for water heating calculated for each month
              168.4156   147.9985   154.4019   136.9903   133.2148   117.5568   111.5059   124.2889   124.6816   142.1312   152.0742   163.8876 (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
              168.4156   147.9985   154.4019   136.9903   133.2148   117.5568   111.5059   124.2889   124.6816   142.1312   152.0742   163.8876 (64)
                                                                                          Total per year (kWh/year) = Sum(64)m =   1677.1472 (64)
Heat gains from water heating, kWh/month
               53.9120    47.3271    49.2575    43.5386    42.2187    37.0822    35.0051    39.2524    39.4483    45.1799    48.5491    52.4074 (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         135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               47.2580    41.9742    34.1357    25.8429    19.3179    16.3090    17.6224    22.9063    30.7448    39.0375    45.5626    48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.6557   298.7237   290.9924   274.5336   253.7573   234.2305   221.1854   218.1174   225.8486   242.3074   263.0837   282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805 (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)
              -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740 (71)
Water heating gains (Table 5)
               72.4624    70.4272    66.2063    60.4703    56.7455    51.5030    47.0499    52.7587    54.7893    60.7257    67.4294    70.4401 (72)
Total internal gains
              514.2436   509.9925   490.2019   459.7143   428.6882   400.9099   384.7251   392.6498   410.2502   440.9381   474.9432   500.4896 (73)


----------------------------------------------------------------------------------------------------
6. Solar gains
----------------------------------------------------------------------------------------------------

[Jan]                                         Area         Solar flux              g                FF             Access              Gains
                                                m2          Table 6a     Specific data     Specific data          factor                  W
                                                                W/m2       or Table 6b        or Table 6c        Table 6d
----------------------------------------------------------------------------------------------------
Northeast                                   3.3500           15.0428           0.6300            0.7000           0.7700            15.4009 (75)
Southwest                                   6.6000           46.3896           0.6300            0.7000           0.7700            93.5699 (79)
----------------------------------------------------------------------------------------------------

Solar gains   108.9708   163.1027   234.0429   316.2670   356.7664   392.0139   365.3684   327.8407   276.0202   194.0828   130.2646    88.4697 (83)
Total gains   623.2144   673.0952   724.2448   775.9813   785.4546   792.9238   750.0936   720.4905   686.2704   635.0209   605.2078   588.9593 (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            33.4862    33.8318    33.9149    34.1556    34.1556    34.3832    34.3832    34.4561    34.3832    33.9966    34.0768    33.8318
alpha           3.2324     3.2555     3.2610     3.2770     3.2770     3.2922     3.2922     3.2971     3.2922     3.2664     3.2718     3.2555
util living area
                0.9571     0.9449     0.9141     0.8509     0.7389     0.5583     0.4121     0.4265     0.6518     0.8476     0.9312     0.9621 (86)

MIT            19.5170    19.6627    19.9813    20.3701    20.7127    20.9196    20.9783    20.9761    20.8629    20.4954    19.9862    19.4992 (87)
Th 2           19.8685    19.8787    19.8811    19.8881    19.8881    19.8946    19.8946    19.8967    19.8946    19.8835    19.8858    19.8787 (88)
util rest of house
                0.9481     0.9335     0.8959     0.8185     0.6798     0.4659     0.2957     0.3070     0.5626     0.8056     0.9144     0.9540 (89)
MIT 2          18.5637    18.7127    19.0226    19.3936    19.6962    19.8568    19.8890    19.8904    19.8227    19.5129    19.0364    18.5545 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.2528 (91)
MIT            18.8046    18.9528    19.2649    19.6404    19.9531    20.1254    20.1643    20.1648    20.0857    19.7613    19.2764    18.7933 (92)
Temperature adjustment                                                                                                              0.0000
adjusted MIT   18.8046    18.9528    19.2649    19.6404    19.9531    20.1254    20.1643    20.1648    20.0857    19.7613    19.2764    18.7933 (93)


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

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9374     0.9219     0.8839     0.8102     0.6836     0.4863     0.3250     0.3371     0.5793     0.8003     0.9030     0.9439 (94)
Useful gains  584.1957   620.5545   640.1959   628.7310   536.9006   385.5679   243.7912   242.8447   397.5331   508.1850   546.5193   555.9100 (95)
Ext temp.       5.4000     5.7000     7.3000     9.6000    12.6000    15.4000    17.3000    17.3000    15.0000    11.8000     8.4000     5.5000 (96)
Heat loss rate W
             1192.5794  1167.0259  1051.0373   875.7665   641.3691   409.4430   248.1833   247.7041   440.6547   697.6626   950.8811  1170.5911 (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
              452.6374   367.2288   305.6660   177.8655    77.7245     0.0000     0.0000     0.0000     0.0000   140.9713   291.1405   457.3227 (98)
Space heating                                                                                                                    2270.5569 (98)
Space heating per m2                                                                                       (98) / (4) =         32.2797 (99)


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8c. Space cooling requirement
----------------------------------------------------------------------------------------------------
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.7000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2503.3703	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(98)
Space heating efficiency (main heating system 1)													
	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)													
	499.0490	404.8829	337.0077	196.1031	85.6941	0.0000	0.0000	0.0000	0.0000	155.4260	320.9928	504.2147	(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													
	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
Efficiency of water heater												87.2000	(216)
(217)m	89.7234	89.6662	89.4945	89.1433	88.4578	87.2000	87.2000	87.2000	87.2000	88.9084	89.4679	89.7496	(217)
Fuel for water heating, kWh/month													
	187.7053	165.0550	172.5267	153.6743	150.5971	134.8128	127.8737	142.5331	142.9834	159.8625	169.9763	182.6053	(219)
Water heating fuel used												1890.2057	(219)
Annual totals kWh/year													
Space heating fuel - main system												2503.3703	(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)												333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1182 * 1.00) =										-709.0239		-709.0239	(233)
Total delivered energy for all uses												4093.3888	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2503.3703	9.7400	243.8283	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1890.2057	9.7400	184.1060	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	333.8367	36.8500	123.0188	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-709.0239	36.8500	-261.2753	(252)
Total energy cost			421.3153	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2503.3703	0.2160	540.7280	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.2057	0.2160	408.2844	(264)
Space and water heating			949.0124	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-709.0239	0.5190	-367.9834	(269)
Total kg/year			793.2153	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2503.3703	1.2200	3054.1118	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.2057	1.2200	2306.0509	(264)
Space and water heating			5360.1627	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	333.8367	3.0700	1024.8788	(268)
Energy saving/generation technologies				
PV Unit	-709.0239	3.0700	-2176.7035	(269)
Primary energy kWh/year			4438.5880	(272)
Primary energy kWh/m2/year			63.1019	(273)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 77	-185 kg (23.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£77	2.62 kg/m²	B 88	B 91
Total Savings	£77	2.62 kg/m²		

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

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

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

	Current	Potential	Saving
Electricity	£151	£169	-£18
Mains gas	£532	£437	£95
Space heating	£375	£375	£0
Water heating	£184	£108	£77
Lighting	£123	£123	£0
Generated (PV)	-£261	-£261	£0
Total cost of fuels	£422	£345	£77
Total cost of uses	£421	£345	£77
Delivered energy	58 kWh/m²	45 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	3 kg/m²
Primary energy	63 kWh/m²	48 kWh/m²	15 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.3900	(2b) =	84.0563	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6200	(2c) =	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	176.2017	(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) =	0.1703	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4203	(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) =	0.3572	(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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197	(22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			18.0000	633.0600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10725.0794	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	152.4748	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.0903	(36)
Total fabric heat loss	(33) + (36) = 53.8634	(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	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953	(38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587	(39)
Average = Sum(39)m / 12 =												87.4247	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2615	1.2582	1.2429	1.2400	1.2267	1.2267	1.2242	1.2318	1.2400	1.2458	1.2519	(40)
HLP (average)												1.2429	(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	2.2544	(42)
Average daily hot water use (litres/day)	87.7408	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m													
	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750	(61)
Total heat required for water heating calculated for each month													
	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3137	(H8)
Utilisation factor												0.5329	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												87.7408	(H14)
Volume ratio Veff/V												0.8548	(H15)
Solar storage volume factor												0.9686	(H16)
Solar input												-823.1303	(H17)
Solar input	-23.8691	-39.8307	-67.8363	-90.9140	-112.3166	-110.4251	-108.9658	-95.2040	-74.5638	-50.9183	-28.3122	-19.9744	(63)
								Solar input (sum of months) = Sum(63)m =				-823.1303	(63)
Output from w/h													
	144.5464	108.1678	86.5656	46.0763	20.8982	7.1317	2.5401	29.0849	50.1178	91.2129	123.7619	143.9132	(64)
								Total per year (kWh/year) = Sum(64)m =				854.0169	(64)
Heat gains from water heating, kWh/month													
	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074	(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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401	(72)
Total internal gains													
	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896	(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	
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)

Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	600.0100	659.9213	705.5326	743.6022	762.2586	738.9267	707.7552	677.5659	649.1577	609.3893	578.3702	573.4356	(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	33.4862	33.5746	33.6617	34.0768	34.1556	34.5273	34.5273	34.5971	34.3832	34.1556	33.9966	33.8318	
alpha	3.2324	3.2383	3.2441	3.2718	3.2770	3.3018	3.3018	3.3065	3.2922	3.2770	3.2664	3.2555	
util living area													
	0.9675	0.9541	0.9298	0.8795	0.7894	0.6463	0.5023	0.5389	0.7345	0.8910	0.9519	0.9715	(86)
MIT	19.3037	19.5016	19.8225	20.2390	20.6051	20.8587	20.9543	20.9414	20.7713	20.3133	19.7430	19.2660	(87)
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787	(88)
util rest of house													
	0.9609	0.9449	0.9152	0.8530	0.7407	0.5634	0.3900	0.4274	0.6609	0.8616	0.9406	0.9657	(89)
MIT 2	18.3534	18.5492	18.8640	19.2712	19.6059	19.8213	19.8825	19.8782	19.7565	19.3505	18.7985	18.3241	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	18.5936	18.7899	19.1063	19.5158	19.8585	20.0835	20.1534	20.1470	20.0130	19.5938	19.0373	18.5622	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5936	18.7899	19.1063	19.5158	19.8585	20.0835	20.1534	20.1470	20.0130	19.5938	19.0373	18.5622	(93)

8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9514	0.9339	0.9030	0.8427	0.7392	0.5784	0.4173	0.4538	0.6696	0.8523	0.9299	0.9569	(94)
Useful gains	570.8403	616.2794	637.1000	626.6361	563.4653	427.3650	295.3201	307.4953	434.6867	519.3836	537.8118	548.7110	(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	1271.6705	1232.5027	1115.7036	928.0967	711.6159	473.1458	306.6046	322.6547	512.3418	784.4771	1046.0869	1264.7180	(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	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092	(98)
Space heating												2714.7734	(98)
Space heating per m2											(98) / (4) =	38.5950	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.7000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2993.1349	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	574.8817	456.5624	392.5921	239.3072	121.5260	0.0000	0.0000	0.0000	0.0000	217.4526	403.4818	587.3309	(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	144.5464	108.1678	86.5656	46.0763	20.8982	7.1317	2.5401	29.0849	50.1178	91.2129	123.7619	143.9132	(64)
Efficiency of water heater												87.2000	(216)
(217)m	89.9167	89.9522	89.9936	90.0670	90.1235	87.2000	87.2000	87.2000	87.2000	89.5632	89.7892	89.9322	(217)
Fuel for water heating, kWh/month	160.7560	120.2502	96.1908	51.1578	23.1884	8.1786	2.9129	33.3543	57.4745	101.8419	137.8361	160.0240	(219)
Water heating fuel used												953.1657	(219)
Annual totals kWh/year													
Space heating fuel - main system												2993.1349	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1029 * 1.00) =										-617.5120		-617.5120	(233)
Total delivered energy for all uses												3787.6253	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2993.1349	3.4800	104.1611	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	953.1657	3.4800	33.1702	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	333.8367	13.1900	44.0331	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-617.5120	13.1900	-81.4498	(252)
Total energy cost			236.4020	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8608	(257)
SAP value	87.9913	
SAP rating (Section 12)	88	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2993.1349	0.2160	646.5171 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	953.1657	0.2160	205.8838 (264)
Space and water heating			852.4009 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	333.8367	0.5190	173.2613 (268)
Energy saving/generation technologies			
PV Unit	-617.5120	0.5190	-320.4887 (269)
Total kg/year			770.0484 (272)
CO2 emissions per m2			10.9500 (273)
EI value			91.0537
EI rating			91 (274)
EI band			B

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700 (1b)	x	2.3900 (2b)	=	84.0563	(1b) - (3b)
First floor	35.1700 (1c)	x	2.6200 (2c)	=	92.1454	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2017	(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) =	0.1703	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4203	(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) =	0.3572	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.4555	0.4197	0.4108	0.3840	0.3840	0.3572	0.3572	0.3483	0.3572	0.4019	0.3929	0.4197	(22b)
Effective ac	0.6037	0.5881	0.5844	0.5737	0.5737	0.5638	0.5638	0.5607	0.5638	0.5808	0.5772	0.5881	(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	
Front Door			2.1500	1.1000	2.3650			(26)
Windows & Fully Glazed Do (Uw = 1.20)			9.9500	1.1450	11.3931			(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000	(28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624	(29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470	(30)
Total net area of external elements Aum(A, m2)			154.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7731			(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000	(32)
GF Timber Stud			62.5300			9.0000	562.7700	(32c)
FF Timber Stud			67.5400			9.0000	607.8600	(32c)
Internal Floor 1			35.3100			18.0000	635.5800	(32d)
Internal Ceiling 1			35.1700			18.0000	633.0600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.0903 (36)
Total fabric heat loss	(33) + (36) =	53.8634 (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	35.1043	34.1953	33.9797	33.3606	33.3606	32.7832	32.7832	32.6000	32.7832	33.7687	33.5623	34.1953	(38)
Heat transfer coeff	88.9677	88.0587	87.8431	87.2240	87.2240	86.6466	86.6466	86.4634	86.6466	87.6321	87.4257	88.0587	(39)
Average = Sum(39)m / 12 =												87.4031	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2648	1.2519	1.2488	1.2400	1.2400	1.2318	1.2318	1.2292	1.2318	1.2458	1.2429	1.2519	(40)
HLP (average)												1.2426	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

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

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Distribution loss  (46)m = 0.15 x (45)m
                21.4693    18.7772    19.3764    16.8928    16.2091    13.9872    12.9612    14.8731    15.0508    17.5402    19.1465    20.7919 (46)
Water storage loss:
Total storage loss
                 0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                 0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss      25.2867    22.8171    25.2259    24.3716    25.1544    24.3089    25.0980    25.1346    24.3430    25.1963    24.4306    25.2750 (61)
Total heat required for water heating calculated for each month
               168.4156   147.9985   154.4019   136.9903   133.2148   117.5568   111.5059   124.2889   124.6816   142.1312   152.0742   163.8876 (62)
Aperture area of solar collector                                                                                                        3.0000 (H1)
Zero-loss collector efficiency                                                                                                          0.7000 (H2)
Collector heat loss coefficient                                                                                                         1.8000 (H3)
Collector 2nd order heat loss coefficient                                                                                               0.0050 (H3a)
Collector effective heat loss coefficient                                                                                               1.8063 (H3b)
Collector performance ratio                                                                                                             2.5804 (H4)
Annual solar radiation per m2                                                                                                        1234.4649 (H5)
Overshading factor                                                                                                                      0.8000 (H6)
Solar energy available                                                                                                               2073.9010 (H7)
Adjustment factor for showers                                                                                                           1.0000 (H7a)
Solar-to-load ratio                                                                                                                     1.5023 (H8)
Utilisation factor                                                                                                                      0.4861 (H9)
Collector performance factor                                                                                                            0.8793 (H10)
Dedicated solar storage volume                                                                                                         75.0000 (H11)
Effective solar volume                                                                                                                 75.0000 (H13)
Daily hot water demand                                                                                                                 87.7408 (H14)
Volume ratio Veff/V                                                                                                                     0.8548 (H15)
Solar storage volume factor                                                                                                             0.9686 (H16)
Solar input                                                                                                                          -858.5560 (H17)
Solar input    -28.1750   -40.2207   -68.1672   -93.0184  -109.7820  -116.8288  -112.5156  -100.3787   -79.4438   -54.3950   -33.1253   -22.5055 (63)
                                                                                           Solar input (sum of months) = Sum(63)m =   -858.5560 (63)
Output from w/h
               140.2406   107.7778    86.2347    43.9719    23.4328     0.7280     0.0000    23.9102    45.2377    87.7362   118.9488   141.3821 (64)
                                                                                             Total per year (kWh/year) = Sum(64)m =    819.6009 (64)
Heat gains from water heating, kWh/month
                53.9120    47.3271    49.2575    43.5386    42.2187    37.0822    35.0051    39.2524    39.4483    45.1799    48.5491    52.4074 (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          135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611   135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                47.2580    41.9742    34.1357    25.8429    19.3179    16.3090    17.6224    22.9063    30.7448    39.0375    45.5626    48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               295.6557   298.7237   290.9924   274.5336   253.7573   234.2305   221.1854   218.1174   225.8486   242.3074   263.0837   282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805    50.7805 (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)
               -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740   -90.1740 (71)
Water heating gains (Table 5)
                72.4624    70.4272    66.2063    60.4703    56.7455    51.5030    47.0499    52.7587    54.7893    60.7257    67.4294    70.4401 (72)
Total internal gains
               514.2436   509.9925   490.2019   459.7143   428.6882   400.9099   384.7251   392.6498   410.2502   440.9381   474.9432   500.4896 (73)


-----------------------------------------------------------------------------------------------------
6. Solar gains
-----------------------------------------------------------------------------------------------------
[Jan]                                        Area          Solar flux              g              FF            Access              Gains
                                               m2          Table 6a    Specific data   Specific data           factor                  W
                                                               W/m2      or Table 6b      or Table 6c         Table 6d
-----------------------------------------------------------------------------------------------------
Northeast                                  3.3500           15.0428          0.6300          0.7000           0.7700            15.4009 (75)
Southwest                                  6.6000           46.3896          0.6300          0.7000           0.7700            93.5699 (79)
-----------------------------------------------------------------------------------------------------

Solar gains    108.9708   163.1027   234.0429   316.2670   356.7664   392.0139   365.3684   327.8407   276.0202   194.0828   130.2646    88.4697 (83)
Total gains    623.2144   673.0952   724.2448   775.9813   785.4546   792.9238   750.0936   720.4905   686.2704   635.0209   605.2078   588.9593 (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             33.4862    33.8318    33.9149    34.1556    34.1556    34.3832    34.3832    34.4561    34.3832    33.9966    34.0768    33.8318
alpha            3.2324     3.2555     3.2610     3.2770     3.2770     3.2922     3.2922     3.2971     3.2922     3.2664     3.2718     3.2555
util living area
                 0.9571     0.9449     0.9141     0.8509     0.7389     0.5583     0.4121     0.4265     0.6518     0.8476     0.9312     0.9621 (86)

MIT             19.5170    19.6627    19.9813    20.3701    20.7127    20.9196    20.9783    20.9761    20.8629    20.4954    19.9862    19.4992 (87)
Th 2            19.8685    19.8787    19.8811    19.8881    19.8881    19.8946    19.8946    19.8967    19.8946    19.8835    19.8858    19.8787 (88)
util rest of house
                 0.9481     0.9335     0.8959     0.8185     0.6798     0.4659     0.2957     0.3070     0.5626     0.8056     0.9144     0.9540 (89)
MIT 2           18.5637    18.7127    19.0226    19.3936    19.6962    19.8568    19.8890    19.8904    19.8227    19.5129    19.0364    18.5545 (90)
Living area fraction                                                                              fLA = Living area / (4) =     0.2528 (91)
MIT             18.8046    18.9528    19.2649    19.6404    19.9531    20.1254    20.1643    20.1648    20.0857    19.7613    19.2764    18.7933 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT    18.8046    18.9528    19.2649    19.6404    19.9531    20.1254    20.1643    20.1648    20.0857    19.7613    19.2764    18.7933 (93)


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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9374	0.9219	0.8839	0.8102	0.6836	0.4863	0.3250	0.3371	0.5793	0.8003	0.9030	0.9439	(94)
Useful gains	584.1957	620.5545	640.1959	628.7310	536.9006	385.5679	243.7912	242.8447	397.5331	508.1850	546.5193	555.9100	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1192.5794	1167.0259	1051.0373	875.7665	641.3691	409.4430	248.1833	247.7041	440.6547	697.6626	950.8811	1170.5911	(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	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(98)
Space heating												2270.5569	(98)
Space heating per m2											(98) / (4) =	32.2797	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2503.3703	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	499.0490	404.8829	337.0077	196.1031	85.6941	0.0000	0.0000	0.0000	0.0000	155.4260	320.9928	504.2147	(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	140.2406	107.7778	86.2347	43.9719	23.4328	0.7280	0.0000	23.9102	45.2377	87.7362	118.9488	141.3821	(64)
Efficiency of water heater												87.2000	(216)
(217)m	89.8470	89.8814	89.9060	89.9841	89.8645	87.2000	87.2000	87.2000	87.2000	89.3246	89.6562	89.8484	(217)
Fuel for water heating, kWh/month	156.0883	119.9111	95.9166	48.8664	26.0757	0.8349	0.0000	27.4199	51.8781	98.2217	132.6722	157.3563	(219)
Water heating fuel used												915.2411	(219)
Annual totals kWh/year													
Space heating fuel - main system												2503.3703	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1182 * 1.00) =										-709.0239		-709.0239	(233)
Total delivered energy for all uses												3168.4242	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2503.3703	9.7400	243.8283	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	915.2411	9.7400	89.1445	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	333.8367	36.8500	123.0188	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-709.0239	36.8500	-261.2753	(252)
Total energy cost			344.7788	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2503.3703	0.2160	540.7280	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	915.2411	0.2160	197.6921	(264)
Space and water heating			738.4201	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-709.0239	0.5190	-367.9834	(269)
Total kg/year			608.5729	(272)

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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2503.3703	1.2200	3054.1118	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	915.2411	1.2200	1116.5942	(264)
Space and water heating			4170.7059	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	333.8367	3.0700	1024.8788	(268)
Energy saving/generation technologies				
PV Unit	-709.0239	3.0700	-2176.7035	(269)
Primary energy kWh/year			3402.6312	(272)
Primary energy kWh/m2/year			48.3741	(273)

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0879 Plot 80	**Issued on Date**	28/03/2023
Assessment Reference	Rev A	**Prop Type Ref**	Beeley
Project	Plot 80		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	**DER**	15.30	**TER**	19.10
Environmental	89 B	**% DER<TER**	19.90		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	**Assessor ID**	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)	Density (kg/m³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	**Earthwool Loft Roll 40**						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	**Earthwool Loft Roll 40**						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	**Earthwool Loft Roll 40**						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	**Plasterboard, standard**						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: **Upper limit =** 11.200 m² K/W **Lower limit =** 10.901 m² K/W **Average =** 11.050 m² K/W

Total correction = 0.0065 m² K/W **U-value (unrounded) =** 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm **U-value: 0.10 W/m² K** **Kappa: 9.10 kJ/m² K**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0879 Plot 80	**Issued on Date**	28/03/2023
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Project	Plot 80		
Calculation Type	New Build (As Designed)		

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Environmental	89 B	**% DER<TER**	19.90		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	**Assessor ID**	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)	Density (kg/m³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	**Brick, outer leaf**						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	**Supafil 34**						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	**Supabloc**						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	**airspace/plaster dabs**						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	**Plasterboard, standard**						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance: **Upper limit =** 4.321 m² K/W **Lower limit =** 4.110 m² K/W **Average =** 4.215 m² K/W

Total correction = 0.0002 m² K/W **U-value (unrounded) =** 0.24 W/m² K

Unheated space: None

Total thickness: 330 mm **U-value: 0.24 W/m² K** **Kappa: 42.22 kJ/m² K**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

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Project	Plot 80		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	**DER**	15.30	**TER**	19.10
Environmental	89 B	**% DER<TER**	19.90		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	**Assessor ID**	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Floor 000008

Floor Type: Suspended Floor
Area = 42.22 m², Perimeter = 18.37 m, Wall thickness = 300.00 mm, Soil: Unknown
Depth of underfloor space below ground:0.200 m Floor wind shielding: Average (suburban)
Floor height above ground:h = 0.200 m
U-value of walls above ground:Uw = 1.500 m
Ventilation openings per perimeter length:e = 0.0015 %
Mean wind speed:v = 5.000 m/s
Resistance on solum:Rg = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)	Density (kg/m³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	**EPS 200 Lower portion**						
	Main construction	55	0.0340	1.6176	80.65		
	Main construction	55	2.0000	0.0275	19.35		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	**EPS Upper portion**						
	Main construction	100	0.0340	2.9412	87.10		
	Main construction	100	2.0000	0.0500	12.90		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	**Grey EPS 100 Topsheet**						
	Main construction	155	0.0300	5.1667	100.00	15	1450
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	**Screed**						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance: **Upper limit =** 9.271 m² K/W **Lower limit =** 6.052 m² K/W **Average =** 7.661 m² K/W

Total correction = 0.0046 m² K/W **U-value (unrounded) =** 0.12 W/m² K

Unheated space: None

Total thickness: 385 mm **U-value: 0.12 W/m² K** **Kappa: 90.00 kJ/m² K**

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

Design SAP
elmhurst energy

Property Reference	SAP 0879 Plot 80	**Issued on Date**	28/03/2023
Assessment Reference	Rev A	**Prop Type Ref**	Beeley
Property	Plot 80		

SAP Rating	87 B	**DER**	15.30	**TER**	19.10
Environmental	89 B	**% DER<TER**	19.90		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.58	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.38		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	**Assessor ID**	E477-0001
Client	Foreman Homes, FORE		

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

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	16.77 m	35.17 m²	2.39 m
1st Storey:	16.77 m	35.17 m²	2.62 m

7.0 Living Area	17.78	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	152.47	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Brick and Block	Cavity Wall	Other	0.24	42.22	84.02	71.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	38.92

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
GF Timber Stud	Plasterboard on timber frame	9.00	62.53
FF Timber Stud	Plasterboard on timber frame	9.00	67.54

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Plane Roof	Other	0.10	9.10	35.17	35.17

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	35.31

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.31

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.10
Windows & Fully Glazed Do	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

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] Brick and Block	North East							2.15	
Front Elevation	Window	[1] Brick and Block	North East	None	0.00					3.35	
Rear Elevation	Window	[1] Brick and Block	South West	None	0.00					6.60	

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)	0.46	0.110	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.46	0.910	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.02	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	5.92	0.021	No	Knauf P5
Independently assessed	E4 Jamb	24.32	0.016	No	Knauf P6
Table K1 - Default	E5 Ground floor (normal)	16.79	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	16.79	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.10	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	15.64	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.46	0.039	No	Knauf P23
Table K1 - Approved	E18 Party wall between dwellings	9.55	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	7.82	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.82	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	7.82	0.069	No	Knauf P29

Y-value	0.098	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	Yes
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	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes	
Light and motion sensor	Yes	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17513	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
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	Gas/Oil, time clock	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.75	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£77	B 88	