Energy Calculations Ltd

SAP ◆ CODE ◆ SBEM ◆ DESIGN

01754-761035

SAP Report Submission for Building Regulations Compliance

Client: Carlford Properties Limited

Project: Flat 3:01, 9-10 George Street
Richmond, London, TW9 1JY

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 30/11/2020

EXCELLENCE IN ENERGY ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

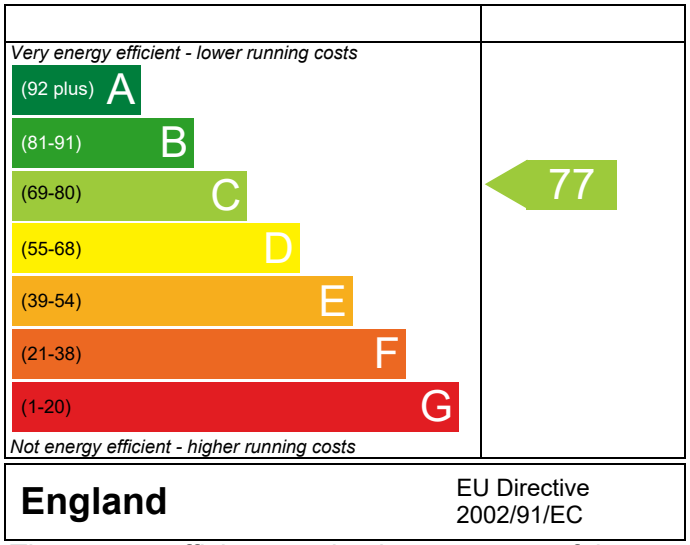
Flat 3:01, 9-10 George Street,
Richmond,
London,
TW9 1JY

Dwelling type:	Flat, End-Terrace
Date of assessment:	30/11/2020
Produced by:	Energy Calculations Limited
Total floor area:	50 m²
DRRN:	9320-2199-7000

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

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

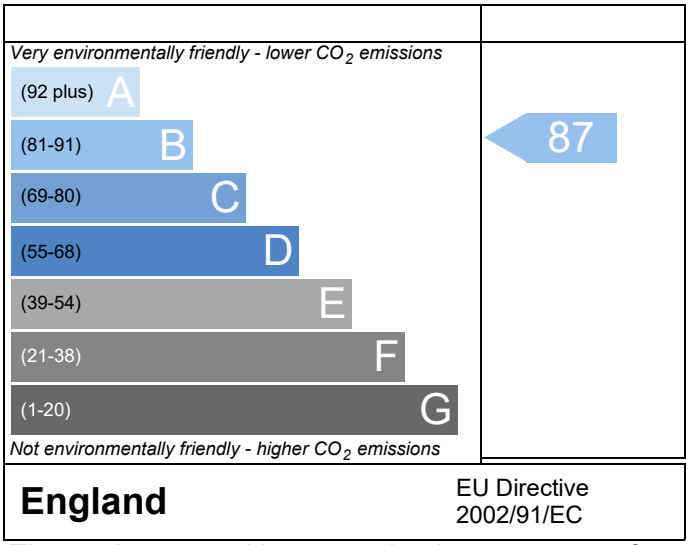
Energy Efficiency Rating



England EU Directive 2002/91/EC

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

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

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

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

THERMAL BRIDGING
Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016860	**Issued on Date**	30/11/2020
Assessment Reference	003 - Green	**Prop Type Ref**	
Property	Flat 3:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	77 C	**DER**	20.69	**TER**	32.22
Environmental	87 B	**% DER<TER**	35.80		
CO_2 Emissions (t/year)	0.72	**DFEE**	46.93	**TFEE**	60.92
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.97		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	**Assessor ID**	7869-0001
Client	Carlford Properties		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	9.73	0.49	
External wall	E3 Sill	Table K1 - Approved	0.040	1.80	0.07	
External wall	E4 Jamb	Table K1 - Approved	0.050	18.40	0.92	
External wall	E7 Party floor between dwellings (in blocks of flats)	Independently assessed	0.000	27.07	0.00	
External wall	E14 Flat roof	Table K1 - Default	0.080	27.09	2.17	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	5.10	0.46	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	5.10	-0.46	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	5.10	0.31	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.040	10.00	0.40	

Total: 4.35 **W/mK:**

Y-Value: 0.036 **W/m²K:**

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

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 50 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:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 32.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.69 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	0.88 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.07 kWh/day
Permitted by DBSCG 1.41 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

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

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.63
Maximum 1.5 OK
MVHR efficiency: 90%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 5.97 m², No overhang
Windows facing East: 13.87 m², No overhang
Windows facing West: 3.78 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Window U-value 0.84 W/m²K
Thermal bridging y-value 0.036 W/m²K
Photovoltaic array 1100.00 kWh/Year

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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3534	0.3488	0.3441	0.3210	0.3164	0.2933	0.2933	0.2886	0.3025	0.3164	0.3256	0.3349	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.6200	0.8127	19.1958			(27)
New Wall / Mabsard	47.2000	23.6200	23.5800	0.1800	4.2444	9.0000	212.2200	(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1705	3.4643	18.0000	365.7600	(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0085			(33)
Party Wall 1			30.0900	0.0000	0.0000	180.0000	5416.2000	(32)
Party Floor 1			50.0000			30.0000	1500.0000	(32d)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8588 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.3517 (36)
Total fabric heat loss	(33) + (36) =	40.3602 (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	14.8683	14.6737	14.4791	13.5061	13.3115	12.3385	12.3385	12.1439	12.7277	13.3115	13.7007	14.0899	(38)
Heat transfer coeff	55.2285	55.0339	54.8393	53.8663	53.6717	52.6987	52.6987	52.5041	53.0879	53.6717	54.0609	54.4501	(39)
Average = Sum(39)m / 12 =												53.8176	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1046	1.1007	1.0968	1.0773	1.0734	1.0540	1.0540	1.0501	1.0618	1.0734	1.0812	1.0890	(40)
HLP (average)												1.0764	(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	1.6901 (42)
Average daily hot water use (litres/day)	74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1169.6560	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
										Total per year (kWh/year) = Sum(64)m =		1403.9860	(64)
Heat gains from water heating, kWh/month													
	56.2433	49.6464	52.3126	47.1345	46.3640	41.6774	40.2641	43.8550	43.6750	48.8640	51.3673	54.9710	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.1260	11.6584	9.4813	7.1779	5.3656	4.5298	4.8947	6.3623	8.5394	10.8428	12.6551	13.4908	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.5959	73.8786	70.3126	65.4646	62.3171	57.8853	54.1184	58.9449	60.6597	65.6775	71.3434	73.8858	(72)
Total internal gains													
	284.3073	282.6503	273.0571	257.7094	242.4032	227.4114	217.5130	222.2792	230.0213	245.5387	263.3634	276.4657	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9700	10.6334	0.6300	0.7000	0.7700	19.4007	(74)
East	13.8700	19.6403	0.6300	0.7000	0.7700	83.2522	(76)
West	3.7800	19.6403	0.6300	0.7000	0.7700	22.6888	(80)

Solar gains	125.3417	244.3187	404.3005	598.9606	746.3495	770.4083	730.7730	618.7836	472.6930	290.0451	156.0292	103.2941	(83)
Total gains	409.6490	526.9691	677.3575	856.6700	988.7526	997.8197	948.2860	841.0628	702.7143	535.5838	419.3926	379.7598	(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	41.2073	41.3530	41.4998	42.2494	42.4026	43.1854	43.1854	43.3455	42.8688	42.4026	42.0973	41.7964	
alpha	3.7472	3.7569	3.7667	3.8166	3.8268	3.8790	3.8790	3.8897	3.8579	3.8268	3.8065	3.7864	
util living area													
	0.9729	0.9372	0.8484	0.6732	0.4858	0.3347	0.2437	0.2856	0.5002	0.8089	0.9489	0.9787	(86)
MIT	19.6323	19.9749	20.4232	20.8027	20.9506	20.9912	20.9980	20.9964	20.9609	20.6711	20.0715	19.5763	(87)
Th 2	19.9971	20.0003	20.0035	20.0194	20.0226	20.0386	20.0386	20.0418	20.0322	20.0226	20.0162	20.0098	(88)
util rest of house													
	0.9673	0.9254	0.8239	0.6338	0.4397	0.2856	0.1908	0.2268	0.4367	0.7695	0.9372	0.9743	(89)
MIT 2	18.1970	18.6857	19.3043	19.8039	19.9765	20.0323	20.0377	20.0400	20.0012	19.6618	18.8420	18.1251	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	19.1156	19.5108	20.0204	20.4431	20.5999	20.6460	20.6523	20.6521	20.6154	20.3078	19.6289	19.0539	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1156	19.5108	20.0204	20.4431	20.5999	20.6460	20.6523	20.6521	20.6154	20.3078	19.6289	19.0539	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9612	0.9186	0.8244	0.6513	0.4672	0.3167	0.2247	0.2643	0.4755	0.7818	0.9318	0.9689	(94)
Useful gains	393.7453	484.0982	558.3835	557.9767	461.9494	316.0170	213.0412	222.3099	334.1091	418.7012	390.7769	367.9355	(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													
	818.2424	804.0884	741.4485	621.7858	477.6740	318.6154	213.5512	223.2538	345.8873	521.0315	677.3230	808.7948	(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													
	315.8258	215.0334	136.2004	45.9425	11.6991	0.0000	0.0000	0.0000	0.0000	76.1337	206.3131	327.9994	(98)
Space heating												1335.1475	(98)
Space heating per m2											(98) / (4) =	26.7030	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1335.1475	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	315.8258	215.0334	136.2004	45.9425	11.6991	0.0000	0.0000	0.0000	0.0000	76.1337	206.3131	327.9994	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	315.8258	215.0334	136.2004	45.9425	11.6991	0.0000	0.0000	0.0000	0.0000	76.1337	206.3131	327.9994	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(219)
Water heating fuel used												1403.9860	(219)
Annual totals kWh/year													
Space heating fuel - main system												1335.1475	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)													
mechanical ventilation fans (SFP = 0.7875)												122.4956	(230a)
Total electricity for the above, kWh/year												122.4956	(231)
Electricity for lighting (calculated in Appendix L)												231.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3093.4387	(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	1335.1475	0.5190	692.9416	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1403.9860	0.5190	728.6688	(264)
Space and water heating			1421.6103	(265)
Pumps and fans	122.4956	0.5190	63.5752	(267)
Energy for lighting	231.8095	0.5190	120.3091	(268)
Energy saving/generation technologies				
PV Unit	-1100.0000	0.5190	-570.9000	(269)
Total CO2, kg/year			1034.5947	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.6900	(273)

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

DER		20.6900	ZC1
Total Floor Area	TFA	50.0000	
Assumed number of occupants	N	1.6901	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4495	ZC2
CO2 emissions from cooking, equation (L16)		3.1912	ZC3
Total CO2 emissions		41.3308	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		41.3308	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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1569	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3763	(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	0.4798	0.4704	0.4610	0.4140	0.4046	0.3575	0.3575	0.3481	0.3763	0.4046	0.4234	0.4422	(22b)
Effective ac	0.6151	0.6107	0.6063	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5978	(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			1.8600	1.0000	1.8600			(26)
TER Opening Type (Uw = 1.40)			10.6400	1.3258	14.1061			(27)
New Wall / Mabsard	47.2000	10.6400	36.5600	0.1800	6.5808			(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1800	3.6576			(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000			(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.7045			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2646	(36)
Total fabric heat loss					(33) + (36) =		38.9691	(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	25.8814	25.6933	25.5089	24.6429	24.4809	23.7267	23.7267	23.5870	24.0172	24.4809	24.8087	25.1514	(38)
Heat transfer coeff	64.8504	64.6624	64.4780	63.6120	63.4500	62.6957	62.6957	62.5561	62.9863	63.4500	63.7778	64.1204	(39)
Average = Sum(39)m / 12 =												63.6112	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2970	1.2932	1.2896	1.2722	1.2690	1.2539	1.2539	1.2511	1.2597	1.2690	1.2756	1.2824	(40)
HLP (average)												1.2722	(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	1.6901	(42)
Average daily hot water use (litres/day)	74.3399	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)
Energy content (annual)										Total = Sum(45)m =		1169.6560	(45)
Distribution loss (46)m = 0.15 x (45)m	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0406	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5619	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
17.4196 15.7338 17.4196 16.8577 17.4196 16.8577 17.4196 17.4196 16.8577 17.4196 16.8577 17.4196 (56)
If cylinder contains dedicated solar storage
17.4196 15.7338 17.4196 16.8577 17.4196 16.8577 17.4196 17.4196 16.8577 17.4196 16.8577 17.4196 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
161.9503 142.8071 150.1285 134.7878 132.2380 118.3755 113.8925 124.6922 124.3832 139.7570 147.5178 158.1239 (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
161.9503 142.8071 150.1285 134.7878 132.2380 118.3755 113.8925 124.6922 124.3832 139.7570 147.5178 158.1239 (64)
Total per year (kWh/year) = Sum(64)m = 1648.6538 (64)
Heat gains from water heating, kWh/month
72.8673 64.6617 68.9366 63.2223 62.9880 57.7652 56.8881 60.4790 59.7627 65.4881 67.4550 71.5950 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
13.1507 11.6803 9.4991 7.1914 5.3757 4.5384 4.9039 6.3742 8.5555 10.8631 12.6789 13.5162 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
147.2339 148.7618 144.9117 136.7153 126.3689 116.6447 110.1484 108.6205 112.4706 120.6670 131.0134 140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 31.4505 (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)
-67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 -67.6040 (71)
Water heating gains (Table 5)
97.9399 96.2227 92.6567 87.8087 84.6612 80.2294 76.4625 81.2889 83.0038 88.0216 93.6875 96.2299 (72)
Total internal gains
309.6761 308.0163 298.4190 283.0670 267.7573 252.7640 242.8663 247.6352 255.3814 270.9032 288.7313 301.8352 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6900	10.6334	0.6300	0.7000	0.7700	8.7417	(74)
East	6.2500	19.6403	0.6300	0.7000	0.7700	37.5145	(76)
West	1.7000	19.6403	0.6300	0.7000	0.7700	10.2039	(80)

Solar gains	56.4601	110.0532	182.1172	269.8031	336.1964	347.0346	329.1804	278.7330	212.9249	130.6507	70.2833	46.5288	(83)
Total gains	366.1362	418.0695	480.5361	552.8701	603.9537	599.7987	572.0466	526.3682	468.3063	401.5539	359.0146	348.3640	(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	53.5420	53.6977	53.8513	54.5844	54.7238	55.3821	55.3821	55.5058	55.1267	54.7238	54.4425	54.1516	
alpha	4.5695	4.5798	4.5901	4.6390	4.6483	4.6921	4.6921	4.7004	4.6751	4.6483	4.6295	4.6101	
util living area	0.9953	0.9908	0.9765	0.9282	0.8133	0.6316	0.4740	0.5317	0.7917	0.9586	0.9909	0.9963	(86)
MIT	19.6855	19.8525	20.1470	20.5286	20.8182	20.9587	20.9913	20.9855	20.8824	20.4945	20.0253	19.6608	(87)
Th 2	19.8432	19.8461	19.8490	19.8626	19.8652	19.8771	19.8771	19.8793	19.8725	19.8652	19.8600	19.8546	(88)
util rest of house	0.9938	0.9877	0.9684	0.9033	0.7546	0.5359	0.3573	0.4097	0.7066	0.9390	0.9872	0.9950	(89)
MIT 2	18.1173	18.3620	18.7882	19.3300	19.6974	19.8517	19.8742	19.8739	19.7844	19.2976	18.6245	18.0893	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	19.1209	19.3159	19.6578	20.0971	20.4147	20.5602	20.5891	20.5853	20.4871	20.0636	19.5210	19.0951	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1209	19.3159	19.6578	20.0971	20.4147	20.5602	20.5891	20.5853	20.4871	20.0636	19.5210	19.0951	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9858	0.9667	0.9091	0.7848	0.5957	0.4321	0.4878	0.7560	0.9431	0.9858	0.9939	(94)
Useful gains	363.3685	412.1421	464.5353	502.6277	473.9944	357.2719	247.1737	256.7820	354.0626	378.7038	353.9238	346.2396	(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	961.1449	932.1682	848.3915	712.2709	552.9462	373.6767	250.1008	261.8147	402.3017	600.4656	792.1858	955.0795	(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	444.7456	349.4575	285.5890	150.9431	58.7401	0.0000	0.0000	0.0000	0.0000	164.9908	315.5487	452.9769	(98)
Space heating												2222.9918	(98)
Space heating per m2											(98) / (4) =	44.4598	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2377.5313	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	444.7456	349.4575	285.5890	150.9431	58.7401	0.0000	0.0000	0.0000	0.0000	164.9908	315.5487	452.9769	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	475.6637	373.7514	305.4428	161.4365	62.8237	0.0000	0.0000	0.0000	0.0000	176.4607	337.4852	484.4673	(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													
	161.9503	142.8071	150.1285	134.7878	132.2380	118.3755	113.8925	124.6922	124.3832	139.7570	147.5178	158.1239	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.3727	87.1115	86.5036	85.1162	82.8115	79.8000	79.8000	79.8000	79.8000	85.2574	86.7926	87.4654	(217)
Fuel for water heating, kWh/month													
	185.3557	163.9360	173.5518	158.3574	159.6856	148.3403	142.7225	156.2558	155.8686	163.9236	169.9658	180.7845	(219)
Water heating fuel used												1958.7476	(219)
Annual totals kWh/year													
Space heating fuel - main system												2377.5313	(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)												232.2452	(232)
Total delivered energy for all uses												4643.5241	(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	2377.5313	0.2160	513.5468	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1958.7476	0.2160	423.0895	(264)
Space and water heating			936.6363	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	232.2452	0.5190	120.5352	(268)
Total CO2, kg/m2/year			1096.0965	(272)
Emissions per m2 for space and water heating			18.7327	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4107	(272b)
Emissions per m2 for pumps and fans			0.7785	(272c)
Target Carbon Dioxide Emission Rate (TER) = (18.7327 * 1.55) + 2.4107 + 0.7785, rounded to 2 d.p.			32.2200	(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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1569	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.3569	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(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	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3053	0.3301	0.3549	0.3714	0.3879	(22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.6200	0.8127	19.1958			(27)
New Wall / Mabsard	47.2000	23.6200	23.5800	0.1800	4.2444	9.0000	212.2200	(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1705	3.4643	18.0000	365.7600	(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0085			(33)
Party Wall 1			30.0900	0.0000	0.0000	180.0000	5416.2000	(32)
Party Floor 1			50.0000			30.0000	1500.0000	(32d)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8588 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.3517 (36)
Total fabric heat loss	(33) + (36) =	40.3602 (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	24.7640	24.6193	24.4775	23.8112	23.6866	23.1063	23.1063	22.9989	23.3298	23.6866	23.9387	24.2024	(38)
Heat transfer coeff	65.1242	64.9795	64.8377	64.1715	64.0468	63.4666	63.4666	63.3591	63.6901	64.0468	64.2990	64.5626	(39)
Average = Sum(39)m / 12 =												64.1709	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3025	1.2996	1.2968	1.2834	1.2809	1.2693	1.2693	1.2672	1.2738	1.2809	1.2860	1.2913	(40)
HLP (average)												1.2834	(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	1.6901 (42)
Average daily hot water use (litres/day)	74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)
Energy content (annual)										Total = Sum(45)m =		1169.6560	(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:													

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Total storage loss

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

If cylinder contains dedicated solar storage

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

Heat gains from water heating, kWh/month

25.7695	22.5382	23.2574	20.2764	19.4556	16.7887	15.5572	17.8522	18.0654	21.0534	22.9815	24.9564	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

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

13.1260	11.6584	9.4813	7.1779	5.3656	4.5298	4.8947	6.3623	8.5394	10.8428	12.6551	13.4908	(67)

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

147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)

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

31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)

-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

34.6364	33.5390	31.2599	28.1616	26.1501	23.3177	20.9103	23.9948	25.0908	28.2976	31.9187	33.5435	(72)

Total internal gains

243.3479	242.3107	234.0044	220.4064	206.2361	192.8438	184.3048	187.3292	194.4523	208.1589	223.9387	236.1235	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9700	10.6334	0.6300	0.7000	0.7700	19.4007	(74)
East	13.8700	19.6403	0.6300	0.7000	0.7700	83.2522	(76)
West	3.7800	19.6403	0.6300	0.7000	0.7700	22.6888	(80)

Solar gains	125.3417	244.3187	404.3005	598.9606	746.3495	770.4083	730.7730	618.7836	472.6930	290.0451	156.0292	103.2941	(83)
Total gains	368.6896	486.6294	638.3049	819.3670	952.5855	963.2521	915.0778	806.1128	667.1453	498.2040	379.9679	339.4176	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.9458	35.0236	35.1002	35.4646	35.5336	35.8585	35.8585	35.9193	35.7327	35.5336	35.3943	35.2498	
alpha	3.3297	3.3349	3.3400	3.3643	3.3689	3.3906	3.3906	3.3946	3.3822	3.3689	3.3596	3.3500	
util living area	0.9818	0.9568	0.8918	0.7497	0.5700	0.4083	0.3014	0.3542	0.5935	0.8682	0.9667	0.9859	(86)
MIT	19.1958	19.5553	20.0764	20.5949	20.8684	20.9678	20.9913	20.9851	20.8910	20.4162	19.6858	19.1299	(87)
Th 2	19.8389	19.8412	19.8434	19.8538	19.8558	19.8649	19.8649	19.8666	19.8614	19.8558	19.8518	19.8477	(88)
util rest of house	0.9777	0.9475	0.8704	0.7086	0.5131	0.3406	0.2253	0.2701	0.5147	0.8330	0.9580	0.9827	(89)
MIT 2	18.2189	18.5727	19.0726	19.5484	19.7718	19.8497	19.8623	19.8618	19.8024	19.4114	18.7137	18.1604	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	18.8441	19.2016	19.7150	20.2181	20.4736	20.5653	20.5848	20.5807	20.4991	20.0545	19.3358	18.7809	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8441	19.2016	19.7150	20.2181	20.4736	20.5653	20.5848	20.5807	20.4991	20.0545	19.3358	18.7809	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9732	0.9414	0.8678	0.7224	0.5445	0.3828	0.2738	0.3235	0.5602	0.8399	0.9532	0.9788	(94)
Useful gains	358.7932	458.1016	553.8911	591.9054	518.6787	368.7429	250.5579	260.7860	373.7053	418.4168	362.1888	332.2138	(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	947.1717	929.3100	856.8290	726.3008	561.9222	378.5942	252.9041	264.8839	407.5584	605.5302	786.7491	941.3807	(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	437.7536	316.6520	225.3858	96.7647	32.1732	0.0000	0.0000	0.0000	0.0000	139.2124	305.6834	453.2201	(98)
Space heating												2006.8452	(98)
Space heating per m2											(98) / (4) =	40.1369	(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	596.5856	469.6525	481.5292	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9496	0.9698	0.9555	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	566.5003	455.4471	460.0980	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1189.8489	1132.3305	1005.9070	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)

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Space cooling kWh
               0.0000     0.0000     0.0000     0.0000     0.0000   448.8110   503.6012   406.0819     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                          1358.4942 (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   112.2028   125.9003   101.5205     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                           339.6235 (107)
Space cooling per m2                                                                                                                      6.7925 (108)
Energy for space heating                                                                                                                 40.1369 (99)
Energy for space cooling                                                                                                                  6.7925 (108)
Total                                                                                                                                    46.9294 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                 46.9 (109)


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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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1569	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3763	(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	0.4798	0.4704	0.4610	0.4140	0.4046	0.3575	0.3575	0.3481	0.3763	0.4046	0.4234	0.4422	(22b)
Effective ac	0.6151	0.6107	0.6063	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5978	(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			1.8600	1.0000	1.8600			(26)
TER Opening Type (Uw = 1.40)			10.6400	1.3258	14.1061			(27)
New Wall / Mabsard	47.2000	10.6400	36.5600	0.1800	6.5808			(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1800	3.6576			(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000			(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.7045			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2646	(36)
Total fabric heat loss					(33) + (36) =		38.9691	(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	25.8814	25.6933	25.5089	24.6429	24.4809	23.7267	23.7267	23.5870	24.0172	24.4809	24.8087	25.1514	(38)
Heat transfer coeff	64.8504	64.6624	64.4780	63.6120	63.4500	62.6957	62.6957	62.5561	62.9863	63.4500	63.7778	64.1204	(39)
Average = Sum(39)m / 12 =												63.6112	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2970	1.2932	1.2896	1.2722	1.2690	1.2539	1.2539	1.2511	1.2597	1.2690	1.2756	1.2824	(40)
HLP (average)												1.2722	(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		1.6901 (42)
Average daily hot water use (litres/day)		74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)
Energy content (annual)										Total = Sum(45)m =		1169.6560	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	25.7695	22.5382	23.2574	20.2764	19.4556	16.7887	15.5572	17.8522	18.0654	21.0534	22.9815	24.9564	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.1507	11.6803	9.4991	7.1914	5.3757	4.5384	4.9039	6.3742	8.5555	10.8631	12.6789	13.5162	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	34.6364	33.5390	31.2599	28.1616	26.1501	23.3177	20.9103	23.9948	25.0908	28.2976	31.9187	33.5435	(72)
Total internal gains													
	243.3726	242.3326	234.0222	220.4199	206.2461	192.8523	184.3140	187.3411	194.4684	208.1793	223.9625	236.1488	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6900	10.6334	0.6300	0.7000	0.7700	8.7417	(74)
East	6.2500	19.6403	0.6300	0.7000	0.7700	37.5145	(76)
West	1.7000	19.6403	0.6300	0.7000	0.7700	10.2039	(80)

Solar gains	56.4601	110.0532	182.1172	269.8031	336.1964	347.0346	329.1804	278.7330	212.9249	130.6507	70.2833	46.5288	(83)
Total gains	299.8327	352.3858	416.1394	490.2230	542.4425	539.8869	513.4944	466.0741	407.3933	338.8299	294.2458	282.6777	(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	53.5420	53.6977	53.8513	54.5844	54.7238	55.3821	55.3821	55.5058	55.1267	54.7238	54.4425	54.1516	
alpha	4.5695	4.5798	4.5901	4.6390	4.6483	4.6921	4.6921	4.7004	4.6751	4.6483	4.6295	4.6101	
util living area													
	0.9980	0.9954	0.9863	0.9514	0.8557	0.6851	0.5233	0.5912	0.8493	0.9775	0.9959	0.9985	(86)
MIT	19.5662	19.7363	20.0393	20.4427	20.7685	20.9421	20.9869	20.9775	20.8369	20.3958	19.9102	19.5419	(87)
Th 2	19.8432	19.8461	19.8490	19.8626	19.8652	19.8771	19.8771	19.8793	19.8725	19.8652	19.8600	19.8546	(88)
util rest of house													
	0.9972	0.9937	0.9813	0.9329	0.8035	0.5874	0.3968	0.4600	0.7739	0.9658	0.9942	0.9979	(89)
MIT 2	18.5462	18.7180	19.0204	19.4216	19.7141	19.8518	19.8740	19.8733	19.7836	19.3860	18.9028	18.5310	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	19.1990	19.3697	19.6725	20.0751	20.3889	20.5496	20.5862	20.5800	20.4577	20.0322	19.5476	19.1780	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1990	19.3697	19.6725	20.0751	20.3889	20.5496	20.5862	20.5800	20.4577	20.0322	19.5476	19.1780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9928	0.9803	0.9369	0.8296	0.6480	0.4780	0.5441	0.8166	0.9679	0.9936	0.9975	(94)
Useful gains	298.8464	349.8661	407.9590	459.2783	449.9894	349.8514	245.4733	253.6051	332.6912	327.9475	292.3677	281.9670	(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													
	966.2071	935.6470	849.3356	710.8710	551.3122	373.0154	249.9201	261.4835	400.4463	598.4760	793.8772	960.3951	(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													
	496.5163	393.6448	328.3842	181.1467	75.3842	0.0000	0.0000	0.0000	0.0000	201.2732	361.0869	504.7505	(98)
Space heating												2542.1869	(98)
Space heating per m2											(98) / (4) =	50.8437	(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	589.3400	463.9485	475.4261	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8848	0.9353	0.9092	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	521.4666	433.9202	432.2537	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	695.0178	662.9595	608.4752	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	124.9569	170.4052	131.1088	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												426.4708	(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   31.2392   42.6013   32.7772    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          106.6177 (107)
Space cooling per m2                                                                                                     2.1324 (108)
Energy for space heating                                                                                                50.8437 (99)
Energy for space cooling                                                                                                 2.1324 (108)
Total                                                                                                                   52.9761 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     60.9 (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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.4000	(22)
Wind factor	0.9250	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8500	(22a)
Adj infilt rate	0.1711	0.1619	0.1619	0.1573	0.1573	0.1434	0.1480	0.1388	0.1341	0.1434	0.1388	0.1573	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2886	0.2794	0.2794	0.2748	0.2748	0.2609	0.2655	0.2563	0.2516	0.2609	0.2563	0.2748	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.6200	0.8127	19.1958			(27)
New Wall / Mabsard	47.2000	23.6200	23.5800	0.1800	4.2444	9.0000	212.2200	(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1705	3.4643	18.0000	365.7600	(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0085			(33)
Party Wall 1			30.0900	0.0000	0.0000	180.0000	5416.2000	(32)
Party Floor 1			50.0000			30.0000	1500.0000	(32d)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8588 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.3517 (36)
Total fabric heat loss	(33) + (36) =	40.3602 (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	12.1439	11.7547	11.7547	11.5601	11.5601	10.9763	11.1709	10.7817	10.5871	10.9763	10.7817	11.5601	(38)
Heat transfer coeff	52.5041	52.1149	52.1149	51.9203	51.9203	51.3365	51.5311	51.1419	50.9473	51.3365	51.1419	51.9203	(39)
Average = Sum(39)m / 12 =												51.6609	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0501	1.0423	1.0423	1.0384	1.0384	1.0267	1.0306	1.0228	1.0189	1.0267	1.0228	1.0384	(40)
HLP (average)												1.0332	(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	1.6901 (42)
Average daily hot water use (litres/day)	74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1169.6560 (45)
Distribution loss (46)m = 0.15 x (45)m													
	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
										Total per year (kWh/year) = Sum(64)m =		1403.9860	(64)
RHI water heating demand												1404	(64)
Heat gains from water heating, kWh/month													
	56.2433	49.6464	52.3126	47.1345	46.3640	41.6774	40.2641	43.8550	43.6750	48.8640	51.3673	54.9710	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.8150	29.1460	23.7031	17.9448	13.4139	11.3246	12.2367	15.9057	21.3485	27.1069	31.6377	33.7271	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.5959	73.8786	70.3126	65.4646	62.3171	57.8853	54.1184	58.9449	60.6597	65.6775	71.3434	73.8858	(72)
Total internal gains													
	408.7958	405.6899	390.9346	368.0949	344.9741	323.9393	311.3883	317.6035	330.5076	353.5171	379.1563	398.3017	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9700	11.9672	0.6300	0.7000	0.7700	21.8343	(74)
East	13.8700	22.3142	0.6300	0.7000	0.7700	94.5864	(76)
West	3.7800	22.3142	0.6300	0.7000	0.7700	25.7777	(80)

Solar gains	142.1984	240.7910	404.1225	610.6577	742.9984	817.5966	774.1160	670.0404	509.0928	316.6068	176.7700	115.9994	(83)
Total gains	550.9942	646.4809	795.0571	978.7526	1087.9725	1141.5359	1085.5044	987.6439	839.6004	670.1238	555.9263	514.3011	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.3455	43.6692	43.6692	43.8329	43.8329	44.3313	44.1639	44.5000	44.6700	44.3313	44.5000	43.8329	
alpha	3.8897	3.9113	3.9113	3.9222	3.9222	3.9554	3.9443	3.9667	3.9780	3.9554	3.9667	3.9222	
util living area													
	0.9168	0.8622	0.7318	0.5350	0.3538	0.2021	0.1187	0.1449	0.3309	0.6310	0.8530	0.9299	(86)
MIT	20.1827	20.4187	20.7323	20.9289	20.9881	20.9991	20.9999	20.9998	20.9936	20.8957	20.5462	20.1329	(87)
Th 2	20.0418	20.0482	20.0482	20.0515	20.0515	20.0611	20.0579	20.0643	20.0676	20.0611	20.0643	20.0515	(88)
util rest of house													
	0.9018	0.8402	0.6975	0.4932	0.3104	0.1601	0.0740	0.0965	0.2759	0.5789	0.8258	0.9168	(89)
MIT 2	19.0079	19.3344	19.7429	19.9799	20.0419	20.0607	20.0579	20.0643	20.0636	19.9601	19.5275	18.9468	(90)
Living area fraction										fLA = Living area / (4) =		0.6400	(91)
MIT	19.7598	20.0283	20.3761	20.5873	20.6475	20.6613	20.6608	20.6631	20.6588	20.5589	20.1795	19.7059	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7598	20.0283	20.3761	20.5873	20.6475	20.6613	20.6608	20.6631	20.6588	20.5589	20.1795	19.7059	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8968	0.8397	0.7097	0.5171	0.3378	0.1869	0.1026	0.1275	0.3109	0.6072	0.8294	0.9114	(94)
Useful gains	494.1546	542.8754	564.2454	506.0729	367.4827	213.3962	111.3356	125.9342	261.0438	406.8754	461.0836	468.7236	(95)
Ext temp.	5.5000	6.1000	7.9000	10.4000	13.5000	16.5000	18.5000	18.2000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	748.6983	725.8745	650.1896	528.9279	371.0997	213.6258	111.3482	125.9654	262.8280	439.3823	602.4239	737.5763	(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													
	189.3805	122.9754	63.9425	16.4556	2.6910	0.0000	0.0000	0.0000	0.0000	24.1851	101.7651	200.0265	(98)
Space heating												721.4217	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand 721 (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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3534	0.3488	0.3441	0.3210	0.3164	0.2933	0.2933	0.2886	0.3025	0.3164	0.3256	0.3349	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.6200	0.8127	19.1958			(27)
New Wall / Mabsard	47.2000	23.6200	23.5800	0.1800	4.2444	9.0000	212.2200	(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1705	3.4643	18.0000	365.7600	(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0085			(33)
Party Wall 1			30.0900	0.0000	0.0000	180.0000	5416.2000	(32)
Party Floor 1			50.0000			30.0000	1500.0000	(32d)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8588 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.3517 (36)
Total fabric heat loss	(33) + (36) =	40.3602 (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	14.8683	14.6737	14.4791	13.5061	13.3115	12.3385	12.3385	12.1439	12.7277	13.3115	13.7007	14.0899	(38)
Heat transfer coeff	55.2285	55.0339	54.8393	53.8663	53.6717	52.6987	52.6987	52.5041	53.0879	53.6717	54.0609	54.4501	(39)
Average = Sum(39)m / 12 =												53.8176	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1046	1.1007	1.0968	1.0773	1.0734	1.0540	1.0540	1.0501	1.0618	1.0734	1.0812	1.0890	(40)
HLP (average)												1.0764	(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	1.6901 (42)
Average daily hot water use (litres/day)	74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1169.6560	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
										Total per year (kWh/year) = Sum(64)m =		1403.9860	(64)
Heat gains from water heating, kWh/month													
	56.2433	49.6464	52.3126	47.1345	46.3640	41.6774	40.2641	43.8550	43.6750	48.8640	51.3673	54.9710	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.8150	29.1460	23.7031	17.9448	13.4139	11.3246	12.2367	15.9057	21.3485	27.1069	31.6377	33.7271	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.5959	73.8786	70.3126	65.4646	62.3171	57.8853	54.1184	58.9449	60.6597	65.6775	71.3434	73.8858	(72)
Total internal gains													
	408.7958	405.6899	390.9346	368.0949	344.9741	323.9393	311.3883	317.6035	330.5076	353.5171	379.1563	398.3017	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9700	10.6334	0.6300	0.7000	0.7700	19.4007	(74)
East	13.8700	19.6403	0.6300	0.7000	0.7700	83.2522	(76)
West	3.7800	19.6403	0.6300	0.7000	0.7700	22.6888	(80)

Solar gains	125.3417	244.3187	404.3005	598.9606	746.3495	770.4083	730.7730	618.7836	472.6930	290.0451	156.0292	103.2941	(83)
Total gains	534.1374	650.0086	795.2350	967.0555	1091.3236	1094.3476	1042.1614	936.3871	803.2006	643.5622	535.1855	501.5958	(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	41.2073	41.3530	41.4998	42.2494	42.4026	43.1854	43.1854	43.3455	42.8688	42.4026	42.0973	41.7964	
alpha	3.7472	3.7569	3.7667	3.8166	3.8268	3.8790	3.8790	3.8897	3.8579	3.8268	3.8065	3.7864	
util living area													
	0.9413	0.8921	0.7902	0.6167	0.4446	0.3060	0.2220	0.2569	0.4438	0.7330	0.9017	0.9508	(86)
MIT	19.9045	20.1997	20.5636	20.8543	20.9634	20.9936	20.9986	20.9976	20.9740	20.7725	20.2937	19.8522	(87)
Th 2	19.9971	20.0003	20.0035	20.0194	20.0226	20.0386	20.0386	20.0418	20.0322	20.0226	20.0162	20.0098	(88)
util rest of house													
	0.9305	0.8744	0.7612	0.5773	0.4013	0.2608	0.1737	0.2039	0.3856	0.6885	0.8824	0.9416	(89)
MIT 2	18.5824	18.9948	19.4853	19.8627	19.9888	20.0341	20.0379	20.0406	20.0120	19.7812	19.1467	18.5180	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	19.4285	19.7659	20.1754	20.4973	20.6126	20.6481	20.6528	20.6530	20.6277	20.4156	19.8808	19.3719	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4285	19.7659	20.1754	20.4973	20.6126	20.6481	20.6528	20.6530	20.6277	20.4156	19.8808	19.3719	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9234	0.8698	0.7664	0.5969	0.4276	0.2895	0.2046	0.2378	0.4217	0.7072	0.8794	0.9346	(94)
Useful gains	493.2090	565.3954	609.5029	577.1894	466.6949	316.8374	213.2123	222.6577	338.7151	455.1016	470.6536	468.7929	(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													
	835.5244	818.1304	749.9503	624.7046	478.3529	318.7291	213.5753	223.3025	346.5402	526.8206	690.9410	826.1098	(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													
	254.6827	169.8379	104.4929	34.2109	8.6736	0.0000	0.0000	0.0000	0.0000	53.3590	158.6069	265.8438	(98)
Space heating												1049.7076	(98)
Space heating per m2											(98) / (4) =	20.9942	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1049.7076	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	254.6827	169.8379	104.4929	34.2109	8.6736	0.0000	0.0000	0.0000	0.0000	53.3590	158.6069	265.8438	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	254.6827	169.8379	104.4929	34.2109	8.6736	0.0000	0.0000	0.0000	0.0000	53.3590	158.6069	265.8438	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(219)
Water heating fuel used												1403.9860	(219)
Annual totals kWh/year													
Space heating fuel - main system												1049.7076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)													
mechanical ventilation fans (SFP = 0.7875)												122.4956	(230a)
Total electricity for the above, kWh/year												122.4956	(231)
Electricity for lighting (calculated in Appendix L)												231.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2807.9987	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1049.7076	13.1900	138.4564	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1403.9860	13.1900	185.1858	(247)
Mechanical ventilation fans	122.4956	13.1900	16.1572	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	231.8095	13.1900	30.5757	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			370.3750	(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] =	1.6374	(257)
SAP value		77.1576	
SAP rating (Section 12)		77	(258)
SAP band		C	

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	1049.7076	0.5190	544.7982	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1403.9860	0.5190	728.6688	(264)
Space and water heating			1273.4670	(265)
Pumps and fans	122.4956	0.5190	63.5752	(267)
Energy for lighting	231.8095	0.5190	120.3091	(268)
Energy saving/generation technologies				
PV Unit	-1100.0000	0.5190	-570.9000	(269)
Total kg/year			886.4513	(272)
CO2 emissions per m2			17.7300	(273)
EI value			87.4964	
EI rating			87	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

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	50.0000 (1b)	x	2.5500 (2b)	=	127.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.5000	(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							0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.4000	(22)
Wind factor	0.9250	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8500	(22a)
Adj infilt rate	0.1711	0.1619	0.1619	0.1573	0.1573	0.1434	0.1480	0.1388	0.1341	0.1434	0.1388	0.1573	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2886	0.2794	0.2794	0.2748	0.2748	0.2609	0.2655	0.2563	0.2516	0.2609	0.2563	0.2748	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.6200	0.8127	19.1958			(27)
New Wall / Mabsard	47.2000	23.6200	23.5800	0.1800	4.2444	9.0000	212.2200	(29a)
Wall to hall	22.1800	1.8600	20.3200	0.1705	3.4643	18.0000	365.7600	(29a)
External Roof 1	50.0000		50.0000	0.1300	6.5000	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			119.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0085			(33)
Party Wall 1			30.0900	0.0000	0.0000	180.0000	5416.2000	(32)
Party Floor 1			50.0000			30.0000	1500.0000	(32d)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8588 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.3517 (36)
Total fabric heat loss	(33) + (36) =	40.3602 (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	12.1439	11.7547	11.7547	11.5601	11.5601	10.9763	11.1709	10.7817	10.5871	10.9763	10.7817	11.5601	(38)
Heat transfer coeff	52.5041	52.1149	52.1149	51.9203	51.9203	51.3365	51.5311	51.1419	50.9473	51.3365	51.1419	51.9203	(39)
Average = Sum(39)m / 12 =												51.6609	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0501	1.0423	1.0423	1.0384	1.0384	1.0267	1.0306	1.0228	1.0189	1.0267	1.0228	1.0384	(40)
HLP (average)												1.0332	(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	1.6901 (42)
Average daily hot water use (litres/day)	74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739	(44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419	(45)

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

Energy content (annual)											Total = Sum(45)m =	1169.6560	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
										Total per year (kWh/year) = Sum(64)m =		1403.9860	(64)
Heat gains from water heating, kWh/month													
	56.2433	49.6464	52.3126	47.1345	46.3640	41.6774	40.2641	43.8550	43.6750	48.8640	51.3673	54.9710	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.8150	29.1460	23.7031	17.9448	13.4139	11.3246	12.2367	15.9057	21.3485	27.1069	31.6377	33.7271	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.5959	73.8786	70.3126	65.4646	62.3171	57.8853	54.1184	58.9449	60.6597	65.6775	71.3434	73.8858	(72)
Total internal gains													
	408.7958	405.6899	390.9346	368.0949	344.9741	323.9393	311.3883	317.6035	330.5076	353.5171	379.1563	398.3017	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9700	11.9672	0.6300	0.7000	0.7700	21.8343	(74)
East	13.8700	22.3142	0.6300	0.7000	0.7700	94.5864	(76)
West	3.7800	22.3142	0.6300	0.7000	0.7700	25.7777	(80)

Solar gains	142.1984	240.7910	404.1225	610.6577	742.9984	817.5966	774.1160	670.0404	509.0928	316.6068	176.7700	115.9994	(83)
Total gains	550.9942	646.4809	795.0571	978.7526	1087.9725	1141.5359	1085.5044	987.6439	839.6004	670.1238	555.9263	514.3011	(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	43.3455	43.6692	43.6692	43.8329	43.8329	44.3313	44.1639	44.5000	44.6700	44.3313	44.5000	43.8329	
alpha	3.8897	3.9113	3.9113	3.9222	3.9222	3.9554	3.9443	3.9667	3.9780	3.9554	3.9667	3.9222	
util living area													
	0.9168	0.8622	0.7318	0.5350	0.3538	0.2021	0.1187	0.1449	0.3309	0.6310	0.8530	0.9299	(86)
MIT	20.1827	20.4187	20.7323	20.9289	20.9881	20.9991	20.9999	20.9998	20.9936	20.8957	20.5462	20.1329	(87)
Th 2	20.0418	20.0482	20.0482	20.0515	20.0515	20.0611	20.0579	20.0643	20.0676	20.0611	20.0643	20.0515	(88)
util rest of house													
	0.9018	0.8402	0.6975	0.4932	0.3104	0.1601	0.0740	0.0965	0.2759	0.5789	0.8258	0.9168	(89)
MIT 2	19.0079	19.3344	19.7429	19.9799	20.0419	20.0607	20.0579	20.0643	20.0636	19.9601	19.5275	18.9468	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	19.7598	20.0283	20.3761	20.5873	20.6475	20.6613	20.6608	20.6631	20.6588	20.5589	20.1795	19.7059	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7598	20.0283	20.3761	20.5873	20.6475	20.6613	20.6608	20.6631	20.6588	20.5589	20.1795	19.7059	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8968	0.8397	0.7097	0.5171	0.3378	0.1869	0.1026	0.1275	0.3109	0.6072	0.8294	0.9114	(94)
Useful gains	494.1546	542.8754	564.2454	506.0729	367.4827	213.3962	111.3356	125.9342	261.0438	406.8754	461.0836	468.7236	(95)
Ext temp.	5.5000	6.1000	7.9000	10.4000	13.5000	16.5000	18.5000	18.2000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	748.6983	725.8745	650.1896	528.9279	371.0997	213.6258	111.3482	125.9654	262.8280	439.3823	602.4239	737.5763	(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													
	189.3805	122.9754	63.9425	16.4556	2.6910	0.0000	0.0000	0.0000	0.0000	24.1851	101.7651	200.0265	(98)
Space heating												721.4217	(98)
Space heating per m2											(98) / (4) =	14.4284	(99)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												721.4217	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	189.3805	122.9754	63.9425	16.4556	2.6910	0.0000	0.0000	0.0000	0.0000	24.1851	101.7651	200.0265	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	189.3805	122.9754	63.9425	16.4556	2.6910	0.0000	0.0000	0.0000	0.0000	24.1851	101.7651	200.0265	(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													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	141.1703	124.0380	129.3485	114.6781	111.4580	98.2658	93.1125	103.9121	104.2735	118.9770	127.4081	137.3439	(219)
Water heating fuel used												1403.9860	(219)
Annual totals kWh/year													
Space heating fuel - main system												721.4217	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)													
mechanical ventilation fans (SFP = 0.7875)												122.4956	(230a)
Total electricity for the above, kWh/year												122.4956	(231)
Electricity for lighting (calculated in Appendix L)												231.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2479.7128	(238)

10a. Fuel costs - using BEDF prices (467)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	721.4217	18.7000	134.9059	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1403.9860	18.7000	262.5454	(247)
Mechanical ventilation fans	122.4956	18.7000	22.9067	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	231.8095	18.7000	43.3484	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	18.7000	0.0000	(252)
Total energy cost			463.7063	(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	721.4217	0.5190	374.4179	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1403.9860	0.5190	728.6688	(264)
Space and water heating			1103.0866	(265)
Pumps and fans	122.4956	0.5190	63.5752	(267)
Energy for lighting	231.8095	0.5190	120.3091	(268)
Energy saving/generation technologies				
PV Unit	-1100.0000	0.5190	-570.9000	(269)
Total kg/year			716.0710	(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	721.4217	3.0700	2214.7645	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1403.9860	3.0700	4310.2371	(264)
Space and water heating			6525.0017	(265)
Pumps and fans	122.4956	3.0700	376.0616	(267)
Energy for lighting	231.8095	3.0700	711.6552	(268)
Energy saving/generation technologies				

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

PV Unit	-1100.0000	3.0700	-3377.0000 (269)
Primary energy kWh/year			4235.7184 (272)
Primary energy kWh/m2/year			84.7144 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 77
Current environmental impact rating: B 87

(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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 77
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 467 TEST (29 Oct 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£464	£464	£0
Space heating	£158	£158	£0
Water heating	£263	£263	£0
Lighting	£43	£43	£0
Total cost of fuels	£464	£464	£0
Total cost of uses	£464	£464	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	85 kWh/m²	85 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Designed)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	163.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	252.45	(P1)
Transmission heat loss coefficient	40.36	(37)
Summer heat loss coefficient	292.81	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.9700	81.1852	0.6300	0.7000	0.9000	173.1309
East	13.8700	117.5071	0.6300	0.7000	0.9000	582.1891
West	3.7800	117.5071	0.6300	0.7000	0.9000	158.6644
total:						913.9844

	Jun	Jul	Aug	
Solar gains	974	914	793	(P3)
Internal gains	324	311	318	
Total summer gains	1298	1225	1110	(P5)
Summer gain/loss ratio	4.43	4.18	3.79	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 163.9)	0.85	0.85	0.85	
Threshold temperature	21.28	22.94	22.44	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

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

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016860	**Issued on Date**	30/11/2020
Assessment Reference	003 - Green	**Prop Type Ref**	
Property	Flat 3:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	77 C	**DER**	20.69	**TER**	32.22
Environmental	87 B	**% DER<TER**	35.80		
CO_2 Emissions (t/year)	0.72	**DFEE**	46.93	**TFEE**	60.92
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.97		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	**Assessor ID**	7869-0001
Client	Carlford Properties		

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	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	32.22	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	20.69	$kgCO_2/m^2$	Pass
	-11.53 (-35.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.92	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.93	$kWh/m^2/yr$	
	-14.0 (-23.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	Pass
Openings	0.88 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Room heaters - Electric Panel, convector or radiant heaters	
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.07 kWh/day Permitted by DBSCG 1.41		Pass
Primary pipework insulated	No primary pipework		

6 Controls

Space heating controls	Programmer and appliance thermostats		Pass
Hot water controls	Cylinderstat		Pass

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	0.63		
Maximum	1.5		Pass
MVHR efficiency	90	%	
Minimum	70	%	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Medium		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	5.97 m², No overhang 13.87 m², No overhang 3.78 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Solid Wall	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Window U-value	0.84	W/m²K
Thermal bridging y-value	0.036	W/m²K
Photovoltaic array	1100.00	kWh/Year

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

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

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016860	**Issued on Date**	30/11/2020
Assessment Reference	003 - Green	**Prop Type Ref**	
Property	Flat 3:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	77 C	**DER**	20.69	**TER**	32.22
Environmental	87 B	**% DER<TER**	35.80		
CO_2 Emissions (t/year)	0.72	**DFEE**	46.93	**TFEE**	60.92
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.97		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	**Assessor ID**	7869-0001
Client	Carlford Properties		

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	27.09 m	50.00 m²	2.55 m

7.0 Living Area	32.00	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	163.86	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
New Wall / Mabsard	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	47.20	23.58
Wall to hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.18	18.00	22.18	20.32

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	30.09

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	27.64

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.13	9.00	50.00	50.00

11.1 Party Floors

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

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	50.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door to Hall	SAP table	Door to Corridor							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	0.84

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door to Hall	Door to Corridor	[2] Wall to hall	North							1.86	
Front Windows	Window	[1] New Wall / Mabsard	West	None	0.00					3.78	
Rear Windows	Window	[1] New Wall / Mabsard	East	None	0.00					13.87	
Side Windows	Window	[1] New Wall / Mabsard	North	None	0.00					5.97	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.73	0.050	No
Table K1 - Approved	E3 Sill	1.80	0.040	No
Table K1 - Approved	E4 Jamb	18.40	0.050	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	27.07	0.000	No
Table K1 - Default	E14 Flat roof	27.09	0.080	No
Table K1 - Approved	E16 Corner (normal)	5.10	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	5.10	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	5.10	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	10.00	0.040	No

Y-value	0.036	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	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 fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat

	recovery
MV Reference Number	500625
Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.63
Duct Type	Rigid
MVHR Efficiency	90.00
Wet Rooms	1

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				0
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	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	SAP table	
Percentage of Heat	100	%
Main Heating	REA	
SAP Code	691	
Efficiency (SAP Table)	100.0	%
Controls	CRC Programmer and appliance thermostats	
Sap Code	2603	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HEI Immersion	
Water Heating	Independent	
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	903	

Immersion Heater	Dual	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder In Heated Space	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	90.00	L
Loss	1.07	kWh/day
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	1100.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None