Energy Assessment

For the proposed development at:

8- 10 George Street, Richmond, London, TW9 1JY

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN
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Contents

1. SUMMARY

It is our opinion that sufficient design works have been carried out at this early stage to demonstrate that the proposal is successfully addressing the requirements of policy 5.2 of the London Plan and the local energy policies of the Borough of Richmond.
The energy hierarchy has been adopted to follow a Be Lean, Be Clean, Be Green methodology. The preferred energy strategy is to reduce energy demand and consequently the amount of conditioning and renewable energy contribution needed. This starts with a fabric first approach to improve thermal elements and controlled fittings. The feasibility of CHP systems and decentralised energy networks has been considered within the Be Clean case.
The final Be Green improvements have additionally explored the adoption and effect of adding renewable energy. The most appropriate renewable energy source has been identified as solar photovoltaic which produce a carbon saving over the baseline emissions of 35% (average) for the new build section of the development and carbon off set payment for the conversion as the feasible roof space has been used for renewables for the new build part of the development.
The calculations provided, draw upon the detailed SAP 2013 assessment. This gives as accurate a guide as possible to the energy usage of the final development in operation.
The Energy Assessment relates to a Planning Application for the creation of two new dwellings at the existing site and conversion of existing commercial units into four flats.

The Energy Assessment sets out to meet the requirements of national and local policies with regard to energy conservation in dwellings, reductions in global climate change gas emissions and the use of renewable technologies to meet energy demand. In particular it meets the requirements of the London Plan and its implementation by the London Borough of Richmond.

The assessment of energy demand, the consequent reductions in that demand, and the choice of suitable renewable technologies follow a hierarchical step-wise process:

The development has been designed to use all electric for space heating, domestic hot water, lighting, and fans to try and future proof the development moving away from gas reducing the NOx emitted into the borough

Proposed Front Elevation

Table 1 shows the summary for the calculations

Table 1 : New Build

Flat	TER CO_2/yr	Lean(DER) CO_2t/y	Percentage Reduction	Clean(DER) CO_2t/y	Percentage Reduction	Be Green (DER) CO_2t/y	Percentage Reduction
2:01	26.10	30.98	-18.69	24.40	6.52	16.68	36.10
3:01	32.22	39.54	-22.70	32.11	0.36	20.69	35.80

Table 2 : Conversion

Unit	CO2 t/yr	SAP Rating	Environmental	Reduction in Co2
1:01	2.69	53 E	58 D	0
1:02	2.97	49 E	54 E	0
1:03	2.68	50 E	55 D	0
1:04	2.68	56 D	60 D	0

The Clean total energy requirements and carbon dioxide emissions have been calculated taking full account of all regulated emissions (space & hot water heating, and electricity for pumps, fans, lights). The Lean calculations was determined by using the orientation and the use of building elements (walls, windows etc.)

2. INTRODUCTION

This Energy Assessment relates to a planning application for a new development comprising of 2 new dwellings above the existing commercial units at 8-10 George Street, Richmond, London TW9 1JY, and a conversion of an existing commercial units into four residential units.

The requirement for new developments to obtain a proportion of their energy needs from on-site renewable energy sources is now a well-established feature of planning policy.

This Energy Assessment sets out the applicable policies on energy and CO_2 emissions, and the methodology for and the results from an energy demand assessment.

It includes an overview of possible renewable energy technologies and identifies the technology most suitable for this development and reasons why other technologies have been excluded.

Finally, it shows that the selected renewable energy technology will reduce the development's predicted carbon dioxide emissions by **35**% relative to the baseline Case for the New build flats, where the photovoltaic is to be installed, and carbon off set payment for the conversion as its not feasible to install renewable energy for the conversions.

For conversions, Local Plan Policy LP22 applies. Conversions, where relevant, are expected to meet BREEAM Domestic Refurbishment 'excellent' rating."

As required by Local Plan LP22, the maximum internal water consumption of 110 litres per person per day will be achieved.

The development has been designed to use all electric for space heating, domestic hot water, lighting, and fans to try and future proof the development moving away from gas reducing the NOx emitted into the borough.

3. PLANNING REQUIREDMENTS

3.1 Planning policy LP22

6.3.12 Major residential developments (10 units or more) should achieve zero carbon standards in line with the London Plan. A zero-carbon home is one where at least 35% of regulated CO2 emissions reductions area chieved on-site, with the remaining emissions (up to 100%) to be offset through a contribution into the Council's Carbon Offset Fund. The Council has adopted the London Plan price of carbon which is £95 per tonne x 30 years equalling £2,8500 per tonne of carbon. Zero carbon standards will apply to major non-residential schemes from 2019. Where development viability is a concern, affordable housing will be prioritised over zero carbon contributions.

6.3.13 All other new residential schemes should achieve a 35% reduction in carbon dioxide emissions. The target of 35% is expressed as minimum improvement over the Target Emission Rate (TER) outlined in the national Building Regulations (2013).

6.3.14 The Council recognises that there may be instances where it is not technically feasible for a development to achieve a 35% reduction in carbon dioxide emissions over Building Regulations (2013). In such cases an applicant will have to demonstrate and set out clearly in the Energy Statement why the carbon dioxide emissions reduction target cannot be met on-site. Any shortfall in on-site reductions can exceptionally be met through a cash-in-lieu contribution to the Council's Carbon Offset Fund, agreed through a Section 106 legal agreement in line with the Planning Obligations SPD.

For conversions, Local Plan Policy LP22 applies. Conversions, where relevant, are expected to meet BREEAM Domestic Refurbishment 'excellent' rating."

3.1.1 KYOTO PROTOCOL

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions .These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012. The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so.

3.1.2 BUILDING REGULATIONS – PART L 2010

This section of the building regulations deals with the conservation of energy in new domestic and commercial buildings; specifically the energy used for space heating/cooling, water heating, cooking, lighting and appliances. The methodology for the assessment of such has been adopted from the Building Research Establishment's Domestic Energy Model energy assessment method for the domestic portion of the building and Simplified Building Energy Model (SBEM) for the commercial units.

This method requires the calculation of a target emissions rate (TER), which assumes standard or typical building components and the calculation of the buildings actual emissions (DER for SAP). It is a requirement that the building's actual emissions will be lower than the target emission rate.

3.1.3 PLANNING POLICY ASSESSMENT 22: RENEWABLE ENERGY (ODPM, 2004)

Planning Policy Assessment covers the consideration of issues relating to renewable energy technologies and their application to new developments. Technical advice and guidance on the various individual renewable technologies and examples of good practice within development plans and developments are also available. Requirements include:

a) Renewable energy developments should be capable of being accommodated throughout England in locations where the technology is viable and environmental, economic, and social impacts can be addressed satisfactorily.
b) The wider environmental and economic benefits of all proposals for renewable energy projects, whatever their scale, are material considerations that should be given significant weight in determining whether proposals should be granted planning permission.
c) Development proposals should demonstrate any environmental, economic and social benefits as well as how any environmental and social impacts have been minimized through careful consideration of location, scale, design and other measures.

3.1.4 THE LONDON PLAN, MAYOR OF LONDON,

This report has been prepared in accompaniment to a planning application for New development comprising of two new flats and four conversions the report seeks to address policy 5.2 of the London Plan as well as LBRUT policies CP1 and CP2 and policies DM H01, DM SDI and DM SD2 of the Development Management Plan. The extract below outlines the approach for producing energy assessments as per 'Energy Planning
Greater London Authority guidance on preparing energy assessments 2018
"On 6 April 2014 the 2013 changes to Part L of the Building Regulations came into effect. Part L 2013 delivers an overall reduction in CO_2emissions for new residential and new non domestic buildings, with the targets for individual buildings being differentiated according to building type. This reduction in CO_2emissions affected the percentage reduction necessary above the Part L 2013 regulations to meet the Mayor's targets in the London Plan.
As outlined in the Sustainable, Design and Construction the Mayor has applied a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations as specified in Policy 5.2 of the London Plan for 2018
Detailed energy statements should be submitted as part of major applications. This should demonstrate the predicted energy and associated carbon dioxide emission savings achieved through the incorporated of energy efficiency measures, decentralised energy and low/zero carbon technologies. This should be demonstrated in line with policy 5.2 of the London Plan, which requires a 35% reduction in CO_2 emissions above 2013 Building Regulations.
Though the requirements are less stringent for the conversion of an existing building, the strategy outlined in this report has aimed to achieve a 35% reduction in CO_2 emissions against a Part L1A. This target has been achieved following the energy hierarchy presented in the London Plan.

4. CALCULATION METHODOLOGY

This Energy Assessment takes a standard hierarchical approach as follows:

1. Lean

A calculation of baseline energy demand, demonstrates the projected annual heating, cooling and electricity demand of the development. The assessment shows the carbon dioxide emissions resulting from the predicted energy use complying with L1A building regulations.

2. Clean

A calculation showing the improvement of the services and fabric over the baseline.

3. Green

Details of renewable energy technologies to be incorporated in the development, demonstrating how much carbon dioxide emissions from expected energy use will be reduced through on-site renewable energy generation.

The starting point was to determine the performance of the “clean” for the dwellings using the orientation and a level of insulation performance and building services equipment consistent with the development achieving compliance with Approved Document L1A : 2013.

4. Carbon off set payment – calculations

The Council recognises that there may be instances where it is not technically feasible for a development to achieve a 35% reduction in carbon dioxide emissions over Building Regulations (2013). In such cases an applicant will have to demonstrate and set out clearly in the Energy Statement why the carbon dioxide emissions reduction target cannot be met on-site. Any shortfall in on-site reductions can exceptionally be met through a cash-in-lieu contribution to the Council's Carbon Offset Fund,

5. ENERGY DEMAND AND EFFICIENCY – Lean – New Build L1A

The total CO_2 emissions has been calculated taking full account of energy demands for space heating and hot water, and electricity for pumps, fans, lights.. The baseline was determined by using the typical orientation and the use of building elements (walls, windows etc.) with U-values and other reference values and in most cases consistent with achieving compliance with Approved Document Part LA: 2013. The tabulated calculations results are in appendix 1.

5.1)) lean calculations

Element	U – Value Element	Element	U – Value Element
Walls	**0.20**	**Wall to Hall**	**0.20**
Door to flats	**1.40**	**Windows (g-value 0.63)**	**0.84**
Flat roof	**0.14**		

Services

- **Accredited construction details applied to table K1**
- **Air pressure test 5.00**
- **Intermittent extract fans**
- **100% Low energy lighting**
- **Spec heating, Electric panel heaters, with programmer, and thermostat**
- **Ventilation – Intermittent extract fans**
- **Domestic hot water – Water cylinder with minimum heat loss**

Results: Show the CO_2 emissions from the baseline (lean) calculations.
Table 2:

Flat	TER CO_2/yr	Lean(DER) CO_2t/y	Percentage Reduction
2:01	26.10	30.98	-18.69
3:01	32.22	39.54	-22.70

5.1. Be Clean -Improved Efficiency and services

The following improvements have been applied to the services over the baseline(lean) calculations reducing the CO_2 emissions:
Domestic .

6.1) Improvements

- **Wall U – values improved to 0.18 W/m2K**
- **Air pressure test to be reduced to 4.00**
- **MVH system installed SFP 0.63 MVHR Efficiency 90%**
- **Independently assessed thermal bridging for lintels (Y = 0.050)**

Table 3 : Clean results

Flat	TER CO_2/yr	Lean(DER) CO_2t/y	Percentage Reduction	Clean(DER) CO_2t/y	Percentage Reduction
2:01	26.10	30.98	-18.69	24.40	6.52
3:01	32.22	39.54	-22.70	32.11	0.36

6. Conversion Baseline – L2B

- 100 % Low energy lighting.
- Ventilation - Intermittent extract fans.
- Internal water use 125ltr. Per person per day.
- Space heating – Electric panel heater with programmer, TRVs, and Room Stat
- Water heating – Water cylinder with minimum heat loss

U - Values: W/m2K requirements

Element	W/m2K to achieve	Element	W/m2k to achieve
Windows & Roof lights (g- value 0.63)	**1.60**	**New Door (default)**	**1.40**
Existing walls – to be upgraded to achieve	**0.30**	**Floor over commercial units to be upgraded to achieve**	**0.25**
Roof Slope- to be upgraded to achieve	**0.18**	**Loft / Void – to be upgraded to achieve**	**0.16**
Flat roof – to be upgraded to achieve	**0.18**	**Wall to hall to achieve**	**0.28**
Wall to void / Dwarf wall – to achieve	**0.28**		

Results

Unit	CO2 t/yr	SAP Rating	Environmental	Reduction in Co2
1:01	2.69	53 E	58 D	0
1:02	2.97	49 E	54 E	0
1:03	2.68	50 E	55 D	0
1:04	2.68	56 D	60 D	0

7. CONSIDERATION OF Renewable and low carbon technologies

Consideration of Heat and power:

Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) or Tri-generation Systems are recognised as a very desirable way of reducing energy wastage and resulting carbon dioxide emissions.
While generally operating on fossil fuel, mainly natural gas, their advantage is that the waste heat normally associated with electricity generation is put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly — typically to above 80% compared to 30-40% for grid electricity. The main effect is to approximately halve the carbon dioxide emissions associated with electricity use on the development for all the electricity produced by the CHP plant. However, space and water heating for the development is provided by mains gas and so a CHP unit would only reduce emissions associated with lighting, fans, pumps and domestic appliances. As such, the reduction in CO_2 would not be that great.
Generally CHP and CCHP are most suited to community heating systems particularly where there is a constant demand for heat throughout the year and therefore they are not considered to be viable on developments of less than approximately 50 units.
However, some systems for individual dwellings have been developed such as the Baxi Ecogen micro CHP. However the technology is new and is still proving its long term reliability.
The installation may be complex and can only be carried out by British Gas & one other supplier and therefore is relatively expensive. For these reasons it is considered that micro CHP installations are not a practical option at the present time for a very small development such as this.

7.1 OVERVIEW OF RENEWABLE ENERGY

Energy from renewable sources has been defined in Article 2 of EU Directive 2010/13/EU '*on the energy performance of buildings*' and includes wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. For the purposes of this energy Assessment and the use of renewable energy on a domestic scale these can be summarised as follows:

_ Bio-fuels — combustion of solid or liquid bio-fuels to produce heat or electricity.
_ Decentralised energy.
_ Heat pumps — extraction of heat from the earth, atmosphere or water bodies.
_ Hydroelectricity — use of water cycle driven flows to generate electricity.
_ Photovoltaic — direct generation of electricity from sunlight.
_ Solar thermal — direct heating of water for space heating or domestic hot water.
_ Wind turbines — use of solar driven air movement to generate electricity.

The technologies and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions, mainly carbon dioxide, and none of the technologies are wholly “zero carbon”. This is because, when the whole life cycle is taken into account some energy has to be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels, the diesel fuel used to transport wood pellets and to power the wood processing machinery for the production of wood fuel pellets.
Finally, due to the dynamic and innovative nature of the renewable energy technology industry even apparently similar products can differ in vital practical details which means that detailed design of installations must be undertaken by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.
The following sections contain a summary of each possibly applicable technology, and a comparison of the advantages and disadvantages of technologies relevant to this development.

7.2 DECENTRALISED ENERGY

In addition to addressing the well understood and widely accepted planning policy requirement to install systems that will deliver a proportion of the development’s energy needs from renewable sources, a further consideration is the availability of decentralised energy. If it is feasible, new developments should incorporate community energy generating schemes so that future developments can be connected or where there are existing networks, the feasibility of connecting the subject development should be investigated. However in this case the development is too small to feasibly construct a new community heating scheme and at present, there is no such network available locally.

7.3 BIO-FUELS

Key planning and design issues regarding the use of bio-fuels include the building space and organisation to accommodate and operate the plant. The equipment would plant space and access and maintenance. Facilities are required for fuel storage and must be provided along with loading access for the fuel to be safely and efficiently delivered and stored. Finally, systems utilising bio fuels, particularly biomass, are rarely available at the small scale that would be appropriate for use in a building where the heat loads are so low.
For these reasons the use of bio-fuels is not considered suitable for this development.

7.4 HEAT PUMPS

Heat pumps collect low temperature heat from renewable sources and “concentrate” it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump can deliver 3 kWh of heat energy for every 1 kWh of input energy i.e. an efficiency of 300%. A heat pump operating in this way would therefore be deemed to have delivered 2 kWh of renewable energy.

7.4.1 Ground source heat pumps

There are two types of ground source heat pump system - a closed loop and open loop system. The first circulates anti-freeze through plastic pipe horizontally or vertically, the second uses ground water. Generally they work best where there is a constant heating or cooling demand or the property is off mains gas. In this case the property has access to mains gas and would not have a constant energy demand. Due to the small scale of the site a vertical closed loop system could be considered. Typically boreholes are around 10-100m deep and it is estimated that 1-2 boreholes might be required.
The viability of a heat pump is dependent on the site ground conditions and geology and this requires a geological desk study and trial boreholes to obtain the necessary information. An environmental impact assessment is generally not required for a closed loop system. There is no visual impact to consider as the system is hidden from view.
Due to the uncertainty regarding ground conditions and the small scale of the development a ground source heat pump system is not considered suitable for this development.

7.5 HYDROELECTRICITY

There is no suitable source of water in the locality which could be utilised as an energy source.

7.6 PHOTOVOLTAIC

Photovoltaic (PV) systems use areas of semiconductor material that produce electricity when exposed to light. They are connected to the building electricity supply via an inverter which converts the output to a form which is compatible with the mains electricity voltage and frequency. This also allows excess electricity to be exported at times when the actual demand from the dwellings is less than that being produced by the PV system. This ensures that all the electricity produced is used and achieves a reduction in carbon dioxide emissions. For all purposes relating to planning, the exported electricity is by convention treated as if it were used on site.
The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1kWp of system expected to produce an average 800 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for

this exercise 6.7m^2 has been used. (The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum)

Because the availability of sunlight, to produce electricity, will generally not align with demand, it is normal for the system to be connected to the electricity grid and excess production exported. The introduction of the feed-in-tariff has improved the economics of solar PV systems.
The installation of renewable technology ensures compliance with the London Plan a total size of approximately 1900 KWh will achieve the reduction required. There are no direct environmental consequences from the installation of PV panels but the installation can have a visual impact that may require consideration.

7.7 SOLAR THERMAL PANELS

Solar thermal panels harness solar energy to heat domestic hot water. They are usually used in conjunction with the main heating system as they can only provide a portion of the demand for hot water, depending on the time of year. Overall, it is estimated that a suitably sized system can provide up to 60% of the annual energy demand for providing hot water These require the installation of a water cylinder in each dwelling. This is not currently planned for as it is proposed to use a combi boiler due to the small size of the dwellings. It is for this reason that solar thermal is not considered entirely suitable for the development.

7.8 WIND TURBINES

Micro wind turbines produce electricity and can be grid-connected in the same way as photovoltaic panels.

Although wind turbines are one of the most cost effective renewable energy technologies, for smaller turbines the capital cost is relatively high compared to the amount of power generated. Adjacent trees and buildings create turbulence and the location affects wind speed and to be effective an average wind speed of no less than 5m/s is required. From the Energy Saving Trust's wind prediction tool, the predicted average wind speed at the development site is 2.4 m/s, significantly less than 5 m/s. In addition noise and vibration from roof mounted turbines can prove unacceptable and wind turbines are less likely to meet with the approval of local residents and planners.

For these reasons wind turbines are not considered suitable for this development.

8. Be Green - Renewable - Conclusion

All possible renewable energy technologies were evaluated in relation to the site, starting with Combined Heat and Power (CHP). Most technologies were excluded because of the small scale of the development and location. One technology was identified as being most suitable for installation; the use of photovoltaic (PV) panels mounted on the roof of the development. It has been calculated that a suitably sized installation to offset 1900 Kwh photovoltaic would contribute to a reduction in carbon dioxide emissions of compared with the TER (target emissions rate)

Photovoltaic Panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required.

The development has been designed to use all electric for space heating, domestic hot water, lighting, and fans to try and future proof the development moving away from gas reducing the NOx emitted into the borough

Table 5 :

Flat	TER CO_2/yr	Lean(DER) CO_2t/y	Percentage Reduction	Clean(DER) CO_2t/y	Percentage Reduction	Be Green (DER) CO_2t/y	Percentage Reduction
2:01	26.10	30.98	-18.69	24.40	6.52	16.68	36.10
3:01	32.22	39.54	-22.70	32.11	0.36	20.69	35.80

Unit	CO2 t/yr	SAP Rating	Environmental	Reduction in Co2
1:01	2.69	53 E	58 D	0
1:02	2.97	49 E	54 E	0
1:03	2.68	50 E	55 D	0
1:04	2.68	56 D	60 D	0

The new build dwellings CO_2 emissions are to be reduced by 35.95 % for this has been achieved through energy efficiency measures, using improved building fabric, increasing the efficiency of the building services and finally the installation of a renewable energy source.

9.10 Carbon off set

Its proposed for the conversion section of the development a carbon off set payment for the 35 % reduction in Co2. It has been calculated the total CO_2 for the conversion as 10.73 t/yr and 35% reduction being 3.77 t/yr . The London plan set this as £95/tonne per year over 30 years which is calculated as £10,744.50

10: Photovoltaic Requirements

Total Photovoltaic = 1900 kWh = approximately 15.90 m2
PV apportioned as follows: Flat 2:01 = 800
Flat 3:01 = 1100

The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1 kWp of system expected to produce an average 800 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for this exercise 6.7m^2 has been used.

The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum.

Appendix 1

SAP Calculations (Green New Build) Flat 2.01

Energy Calculations Ltd

SAP ◆ CODE ◆ SBEM ◆ DESIGN

01754-761035

SAP Report Submission for Building Regulations Compliance

Client: Carlford Properties Limited

Project: Flat 2:01, 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

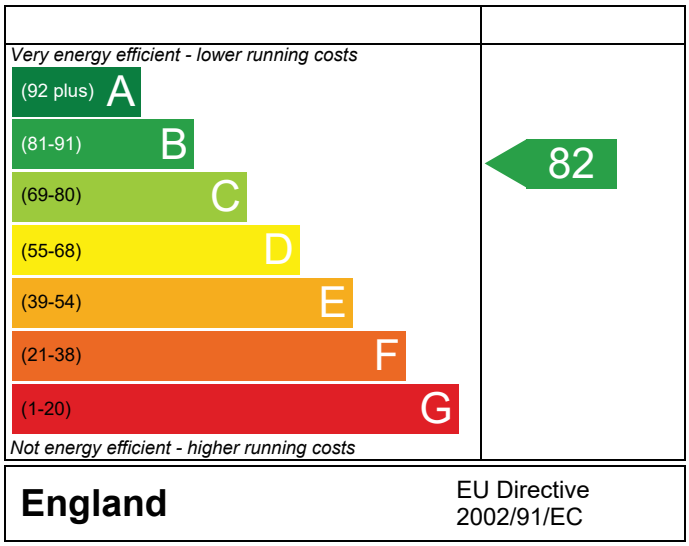
Flat 2:01, 9-10 George Street,
Richmond,
London,
TW9 1JY

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	30/11/2020
Produced by:	Energy Calculations Limited
Total floor area:	53.8 m²
DRRN:	5270-3390-0951

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.

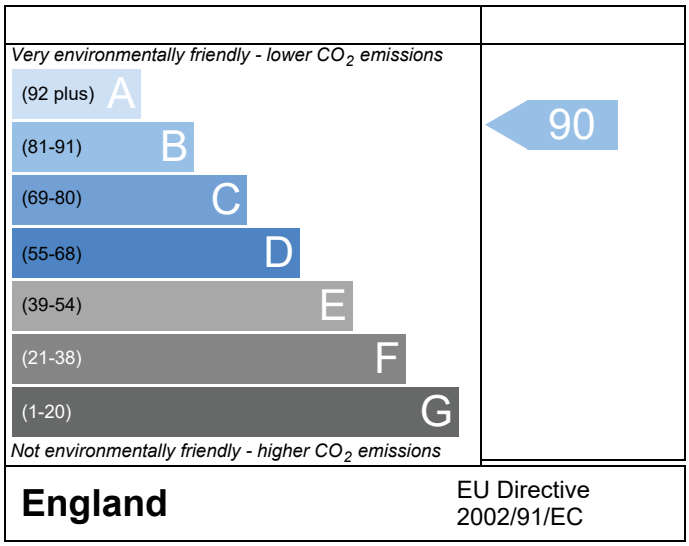
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



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



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	016859	**Issued on Date**	30/11/2020
Assessment Reference	003 - Green	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	82 B	**DER**	16.68	**TER**	26.10
Environmental	90 B	**% DER<TER**	36.10		
CO_2 Emissions (t/year)	0.65	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

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	0.056	9.83	0.55	
External wall	E3 Sill	Table K1 - Approved	0.040	1.80	0.07	
External wall	E4 Jamb	Table K1 - Approved	0.050	16.86	0.84	
External wall	E7 Party floor between dwellings (in blocks of flats)	Independently assessed	0.000	22.25	0.00	
External wall	E14 Flat roof	Table K1 - Default	0.080	4.84	0.39	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	2.55	0.23	
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	10.20	0.61	

Total: **2.24** **W/mK:**

Y-Value: **0.039** **W/m²K:**

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

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016859	**Issued on Date**	30/11/2020
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CO_2 Emissions (t/year)	0.65	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

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

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 54 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) 26.10 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.68 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)42.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (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

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

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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

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

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8 Mechanical ventilation
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: 14.11 m², No overhang
Windows facing West: 3.00 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Window U-value 0.84 W/m²K
Thermal bridging y-value 0.039 W/m²K
Photovoltaic array 800.00 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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(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	0.3151	0.3113	0.3074	0.2880	0.2841	0.2648	0.2648	0.2609	0.2725	0.2841	0.2919	0.2996	(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)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	14.2666	14.0911	13.9157	13.0385	12.8631	11.9859	11.9859	11.8105	12.3368	12.8631	13.2140	13.5648	(38)
Heat transfer coeff	43.5333	43.3579	43.1824	42.3053	42.1298	41.2527	41.2527	41.0773	41.6036	42.1298	42.4807	42.8316	(39)
Average = Sum(39)m / 12 =												42.2614	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8092	0.8059	0.8026	0.7863	0.7831	0.7668	0.7668	0.7635	0.7733	0.7831	0.7896	0.7961	(40)
HLP (average)												0.7855	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0045	12.4387	10.1158	7.6583	5.7247	4.8330	5.2222	6.7881	9.1109	11.5684	13.5021	14.3937	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	298.6596	296.9452	286.8209	270.5970	254.3644	238.5073	228.0637	232.9986	241.2054	257.6052	276.4464	290.3464	(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	14.1100	19.6403	0.6300	0.7000	0.7700	84.6927	(76)
West	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(80)

Solar gains	122.1004	237.9782	393.8584	583.7316	727.6857	751.3026	712.5836	603.1592	460.5485	282.5215	151.9877	100.6286	(83)
Total gains	420.7600	534.9233	680.6793	854.3286	982.0501	989.8099	940.6473	836.1578	701.7539	540.1267	428.4342	390.9751	(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	76.9662	77.2776	77.5915	79.2003	79.5301	81.2212	81.2212	81.5680	80.5362	79.5301	78.8732	78.2271	
alpha	6.1311	6.1518	6.1728	6.2800	6.3020	6.4147	6.4147	6.4379	6.3691	6.3020	6.2582	6.2151	
util living area													
	0.9850	0.9466	0.8222	0.5893	0.3982	0.2667	0.1930	0.2260	0.4083	0.7589	0.9592	0.9896	(86)
MIT	20.3628	20.6089	20.8643	20.9827	20.9985	20.9999	21.0000	21.0000	20.9988	20.9421	20.6325	20.3200	(87)
Th 2	20.2454	20.2482	20.2510	20.2652	20.2680	20.2822	20.2822	20.2851	20.2765	20.2680	20.2624	20.2567	(88)
util rest of house													
	0.9812	0.9352	0.7956	0.5560	0.3671	0.2368	0.1615	0.1909	0.3658	0.7182	0.9484	0.9869	(89)
MIT 2	19.4055	19.7547	20.0948	20.2479	20.2668	20.2822	20.2822	20.2851	20.2757	20.2098	19.8041	19.3528	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.9749	20.2628	20.5525	20.6850	20.7020	20.7091	20.7091	20.7103	20.7058	20.6454	20.2968	19.9281	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9749	20.2628	20.5525	20.6850	20.7020	20.7091	20.7091	20.7103	20.7058	20.6454	20.2968	19.9281	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9796	0.9355	0.8067	0.5752	0.3856	0.2546	0.1802	0.2117	0.3910	0.7397	0.9489	0.9854	(94)
Useful gains	412.1651	500.3982	549.0855	491.3709	378.6735	251.9870	169.5110	177.0484	274.3983	399.5283	406.5519	385.2855	(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													
	682.3803	666.0974	606.8213	498.5661	379.2534	252.0160	169.5133	177.0548	274.8255	423.2096	560.6105	673.6586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	201.0401	111.3498	42.9555	5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496	(98)
Space heating												704.0480	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 13.0864 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												704.0480	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	201.0401	111.3498	42.9555	5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496	(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)													
	201.0401	111.3498	42.9555	5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(219)
Water heating fuel used												1445.8455	(219)
Annual totals kWh/year													
Space heating fuel - main system												704.0480	(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)												131.8053	(230a)
Total electricity for the above, kWh/year												131.8053	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2529.0226	(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	704.0480	0.5190	365.4009	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	0.5190	750.3938	(264)
Space and water heating			1115.7947	(265)
Pumps and fans	131.8053	0.5190	68.4069	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Energy saving/generation technologies				
PV Unit	-800.0000	0.5190	-415.2000	(269)
Total CO2, kg/year			897.3627	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6800	(273)

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

DER		16.6800	ZC1
Total Floor Area	TFA	53.8000	
Assumed number of occupants	N	1.8021	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3024	ZC2
CO2 emissions from cooking, equation (L16)		3.0158	ZC3
Total CO2 emissions		36.9982	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		36.9982	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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3958	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(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	0.3911	0.3834	0.3757	0.3374	0.3297	0.2914	0.2914	0.2837	0.3067	0.3297	0.3451	0.3604	(22b)
Effective ac	0.5765	0.5735	0.5706	0.5569	0.5544	0.5425	0.5425	0.5403	0.5470	0.5544	0.5595	0.5649	(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)			11.6000	1.3258	15.3788			(27)
New Wall	34.5500	11.6000	22.9500	0.1800	4.1310			(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1800	3.6594			(29a)
External Roof 1	1.0000		1.0000	0.1300	0.1300			(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.1592			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7517	(36)
Total fabric heat loss					(33) + (36) =		28.9109	(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	26.0985	25.9641	25.8323	25.2133	25.0975	24.5584	24.5584	24.4586	24.7661	25.0975	25.3318	25.5767	(38)
Heat transfer coeff	55.0094	54.8749	54.7432	54.1242	54.0084	53.4693	53.4693	53.3695	53.6770	54.0084	54.2427	54.4876	(39)
Average = Sum(39)m / 12 =												54.1237	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0225	1.0200	1.0175	1.0060	1.0039	0.9939	0.9939	0.9920	0.9977	1.0039	1.0082	1.0128	(40)
HLP (average)												1.0060	(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	1.8021	(42)
Average daily hot water use (litres/day)	77.0004	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)
Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(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

166.2902	146.6028	154.0454	138.2026	135.5146	121.2030	116.5126	127.6987	127.4256	143.3027	151.3882	162.3269	(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

166.2902	146.6028	154.0454	138.2026	135.5146	121.2030	116.5126	127.6987	127.4256	143.3027	151.3882	162.3269	(64)
							Total per year (kWh/year) = Sum(64)m =				1690.5133	(64)

Heat gains from water heating, kWh/month

74.3103	65.9237	70.2389	64.3577	64.0774	58.7053	57.7593	61.4787	60.7743	66.6670	68.7419	72.9925	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)

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

14.0208	12.4531	10.1276	7.6672	5.7313	4.8386	5.2283	6.7960	9.1215	11.5819	13.5178	14.4105	(67)

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

157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)

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

32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)

-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)

Water heating gains (Table 5)

99.8795	98.1008	94.4072	89.3857	86.1256	81.5352	77.6334	82.6326	84.4088	89.6062	95.4749	98.1082	(72)

Total internal gains

324.0200	322.3037	312.1768	295.9500	279.7151	263.8570	253.4138	258.3506	266.5601	282.9627	301.8062	315.7073	(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	3.0000	10.6334	0.6300	0.7000	0.7700	9.7491	(74)
East	7.0900	19.6403	0.6300	0.7000	0.7700	42.5564	(76)
West	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635	(80)

Solar gains 61.3691	119.6106	197.9577	293.3891	365.7407	377.6101	358.1499	303.1532	231.4766	141.9986	76.3908	50.5771	(83)
Total gains 385.3890	441.9143	510.1344	589.3392	645.4558	641.4671	611.5638	561.5038	498.0367	424.9613	378.1970	366.2843	(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	67.9177	68.0841	68.2480	69.0285	69.1765	69.8739	69.8739	70.0046	69.6036	69.1765	68.8777	68.5681	
alpha	5.5278	5.5389	5.5499	5.6019	5.6118	5.6583	5.6583	5.6670	5.6402	5.6118	5.5918	5.5712	
util living area	0.9952	0.9891	0.9675	0.8895	0.7260	0.5262	0.3836	0.4349	0.7020	0.9396	0.9894	0.9963	(86)
MIT	20.0437	20.2019	20.4629	20.7657	20.9396	20.9917	20.9988	20.9977	20.9627	20.7087	20.3194	20.0145	(87)
Th 2	20.0646	20.0667	20.0687	20.0783	20.0801	20.0885	20.0885	20.0900	20.0852	20.0801	20.0765	20.0727	(88)
util rest of house	0.9937	0.9857	0.9574	0.8594	0.6696	0.4545	0.3047	0.3501	0.6246	0.9156	0.9854	0.9952	(89)
MIT 2	18.7971	19.0279	19.4023	19.8196	20.0265	20.0834	20.0880	20.0891	20.0585	19.7573	19.2072	18.7606	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.5386	19.7262	20.0332	20.3824	20.5696	20.6236	20.6298	20.6295	20.5963	20.3232	19.8688	19.5064	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5386	19.7262	20.0332	20.3824	20.5696	20.6236	20.6298	20.6295	20.5963	20.3232	19.8688	19.5064	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9842	0.9570	0.8701	0.7005	0.4970	0.3517	0.4006	0.6691	0.9228	0.9843	0.9942	(94)
Useful gains	382.5335	434.9157	488.1990	512.7892	452.1116	318.7952	215.0877	224.9550	333.2510	392.1486	372.2613	364.1771	(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	838.2635	813.5853	740.8486	621.4733	479.0333	322.0802	215.4694	225.7285	348.7024	525.1354	692.6121	834.0099	(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	339.0631	254.4660	187.9713	78.2525	20.0297	0.0000	0.0000	0.0000	0.0000	98.9422	230.6526	349.5555	(98)
Space heating												1558.9329	(98)
Space heating per m2											(98) / (4) =	28.9764	(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	1667.3079 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	339.0631	254.4660	187.9713	78.2525	20.0297	0.0000	0.0000	0.0000	0.0000	98.9422	230.6526	349.5555	(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)													
	362.6343	272.1562	201.0388	83.6925	21.4222	0.0000	0.0000	0.0000	0.0000	105.8206	246.6872	373.8562	(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													
	166.2902	146.6028	154.0454	138.2026	135.5146	121.2030	116.5126	127.6987	127.4256	143.3027	151.3882	162.3269	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6757	86.2716	85.3458	83.3632	81.0337	79.8000	79.8000	79.8000	79.8000	83.8491	85.9341	86.8088	(217)
Fuel for water heating, kWh/month													
	191.8533	169.9316	180.4956	165.7837	167.2323	151.8834	146.0057	160.0234	159.6812	170.9055	176.1678	186.9935	(219)
Water heating fuel used												2026.9572	(219)
Annual totals kWh/year													
Space heating fuel - main system												1667.3079	(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)												247.6113	(232)
Total delivered energy for all uses												4016.8765	(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	1667.3079	0.2160	360.1385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2026.9572	0.2160	437.8228	(264)
Space and water heating			797.9613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	247.6113	0.5190	128.5103	(268)
Total CO2, kg/m2/year			965.3965	(272)
Emissions per m2 for space and water heating			14.8320	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.3887	(272b)
Emissions per m2 for pumps and fans			0.7235	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8320 * 1.55) + 2.3887 + 0.7235, rounded to 2 d.p.			26.1000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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) =	0.1458	(8)
Pressure test			Yes	
Measured/design AP50			4.0000	
Infiltration rate			0.3458	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2680	(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	0.3417	0.3350	0.3283	0.2948	0.2881	0.2546	0.2546	0.2479	0.2680	0.2881	0.3015	0.3149	(22b)
Effective ac	0.5584	0.5561	0.5539	0.5434	0.5415	0.5324	0.5324	0.5307	0.5359	0.5415	0.5454	0.5496	(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)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			20.0000	1036.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11544.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.5749	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.2352	(36)
Total fabric heat loss					(33) + (36) =		29.2667	(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	25.2790	25.1764	25.0758	24.6033	24.5150	24.1035	24.1035	24.0273	24.2620	24.5150	24.6938	24.8807	(38)
Heat transfer coeff	54.5457	54.4431	54.3425	53.8701	53.7817	53.3702	53.3702	53.2940	53.5287	53.7817	53.9605	54.1475	(39)
Average = Sum(39)m / 12 =												53.8697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0139	1.0120	1.0101	1.0013	0.9997	0.9920	0.9920	0.9906	0.9950	0.9997	1.0030	1.0065	(40)
HLP (average)												1.0013	(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	1.8021	(42)
Average daily hot water use (litres/day)	77.0004	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)
Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:
Total storage loss

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

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

26.6918	23.3448	24.0897	21.0020	20.1519	17.3896	16.1140	18.4910	18.7119	21.8069	23.8039	25.8495	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)

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

14.0045	12.4387	10.1158	7.6583	5.7247	4.8330	5.2222	6.7881	9.1109	11.5684	13.5021	14.3937	(67)

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

157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)

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

32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)

-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)

Water heating gains (Table 5)

35.8760	34.7393	32.3787	29.1694	27.0859	24.1522	21.6586	24.8536	25.9887	29.3104	33.0610	34.7440	(72)

Total internal gains

257.0002	255.9277	247.1365	232.7249	217.6688	203.4684	194.4329	197.5637	205.1294	219.6535	236.3767	249.3263	(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	14.1100	19.6403	0.6300	0.7000	0.7700	84.6927	(76)
West	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(80)

Solar gains	122.1004	237.9782	393.8584	583.7316	727.6857	751.3026	712.5836	603.1592	460.5485	282.5215	151.9877	100.6286	(83)
Total gains	379.1006	493.9059	640.9949	816.4565	945.3545	954.7710	907.0165	800.7228	665.6779	502.1750	388.3644	349.9549	(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	58.7893	58.9001	59.0091	59.5266	59.6244	60.0841	60.0841	60.1700	59.9062	59.6244	59.4268	59.2217	
alpha	4.9193	4.9267	4.9339	4.9684	4.9750	5.0056	5.0056	5.0113	4.9937	4.9750	4.9618	4.9481	
util living area	0.9921	0.9732	0.9046	0.7272	0.5183	0.3564	0.2587	0.3056	0.5414	0.8741	0.9812	0.9945	(86)
MIT	19.9185	20.1991	20.5788	20.8822	20.9794	20.9974	20.9996	20.9991	20.9818	20.7558	20.2521	19.8624	(87)
Th 2	20.0718	20.0734	20.0749	20.0822	20.0836	20.0900	20.0900	20.0912	20.0875	20.0836	20.0808	20.0780	(88)
util rest of house	0.9900	0.9665	0.8841	0.6868	0.4706	0.3063	0.2053	0.2455	0.4749	0.8390	0.9754	0.9930	(89)
MIT 2	19.0910	19.3679	19.7289	19.9978	20.0714	20.0889	20.0899	20.0909	20.0787	19.9037	19.4289	19.0404	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.5832	19.8623	20.2344	20.5239	20.6115	20.6293	20.6310	20.6311	20.6159	20.4106	19.9185	19.5293	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5832	19.8623	20.2344	20.5239	20.6115	20.6293	20.6310	20.6311	20.6159	20.4106	19.9185	19.5293	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9886	0.9647	0.8880	0.7068	0.4983	0.3361	0.2371	0.2813	0.5139	0.8525	0.9742	0.9919	(94)
Useful gains	374.7757	476.4792	569.1798	577.0455	471.0843	320.8596	215.0118	225.2087	342.0633	428.1168	378.3279	347.1183	(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	833.6319	814.5948	746.3630	626.1781	479.2756	321.7830	215.1340	225.4916	348.7862	527.6281	691.6937	830.0444	(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	341.3890	227.2137	131.8243	35.3755	6.0944	0.0000	0.0000	0.0000	0.0000	74.0364	225.6234	359.2970	(98)
Space heating												1400.8537	(98)
Space heating per m2											(98) / (4) =	26.0382	(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	501.6800	394.9396	405.0345	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9921	0.9966	0.9936	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	497.7246	393.5874	402.4618	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1183.7862	1126.6648	1003.4427	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	493.9644	545.4096	447.1298	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1486.5038 (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	123.4911	136.3524	111.7825	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												371.6259 (107)
Space cooling per m2												6.9075 (108)
Energy for space heating												26.0382 (99)
Energy for space cooling												6.9075 (108)
Total												32.9457 (109)
Dwelling Fabric Energy Efficiency (DFEE)												32.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3958	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(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	0.3911	0.3834	0.3757	0.3374	0.3297	0.2914	0.2914	0.2837	0.3067	0.3297	0.3451	0.3604	(22b)
Effective ac	0.5765	0.5735	0.5706	0.5569	0.5544	0.5425	0.5425	0.5403	0.5470	0.5544	0.5595	0.5649	(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)			11.6000	1.3258	15.3788			(27)
New Wall	34.5500	11.6000	22.9500	0.1800	4.1310			(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1800	3.6594			(29a)
External Roof 1	1.0000		1.0000	0.1300	0.1300			(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.1592			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7517	(36)
Total fabric heat loss					(33) + (36) =		28.9109	(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	26.0985	25.9641	25.8323	25.2133	25.0975	24.5584	24.5584	24.4586	24.7661	25.0975	25.3318	25.5767	(38)
Heat transfer coeff	55.0094	54.8749	54.7432	54.1242	54.0084	53.4693	53.4693	53.3695	53.6770	54.0084	54.2427	54.4876	(39)
Average = Sum(39)m / 12 =												54.1237	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0225	1.0200	1.0175	1.0060	1.0039	0.9939	0.9939	0.9920	0.9977	1.0039	1.0082	1.0128	(40)
HLP (average)												1.0060	(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		1.8021 (42)
Average daily hot water use (litres/day)		77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)
Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6918	23.3448	24.0897	21.0020	20.1519	17.3896	16.1140	18.4910	18.7119	21.8069	23.8039	25.8495	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0208	12.4531	10.1276	7.6672	5.7313	4.8386	5.2283	6.7960	9.1215	11.5819	13.5178	14.4105	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	35.8760	34.7393	32.3787	29.1694	27.0859	24.1522	21.6586	24.8536	25.9887	29.3104	33.0610	34.7440	(72)
Total internal gains													
	257.0165	255.9422	247.1483	232.7338	217.6755	203.4741	194.4390	197.5715	205.1400	219.6669	236.3924	249.3430	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0000	10.6334	0.6300	0.7000	0.7700	9.7491	(74)
East	7.0900	19.6403	0.6300	0.7000	0.7700	42.5564	(76)
West	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635	(80)

Solar gains	61.3691	119.6106	197.9577	293.3891	365.7407	377.6101	358.1499	303.1532	231.4766	141.9986	76.3908	50.5771	(83)
Total gains	318.3856	375.5528	445.1059	526.1229	583.4161	581.0842	552.5889	500.7248	436.6166	361.6655	312.7831	299.9201	(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	67.9177	68.0841	68.2480	69.0285	69.1765	69.8739	69.8739	70.0046	69.6036	69.1765	68.8777	68.5681	
alpha	5.5278	5.5389	5.5499	5.6019	5.6118	5.6583	5.6583	5.6670	5.6402	5.6118	5.5918	5.5712	
util living area													
	0.9981	0.9949	0.9819	0.9245	0.7787	0.5764	0.4238	0.4858	0.7717	0.9682	0.9957	0.9987	(86)
MIT	19.9262	20.0884	20.3619	20.6980	20.9140	20.9870	20.9981	20.9960	20.9400	20.6206	20.2070	19.8973	(87)
Th 2	20.0646	20.0667	20.0687	20.0783	20.0801	20.0885	20.0885	20.0900	20.0852	20.0801	20.0765	20.0727	(88)
util rest of house													
	0.9975	0.9933	0.9758	0.9010	0.7243	0.4997	0.3371	0.3921	0.6962	0.9536	0.9940	0.9982	(89)
MIT 2	19.0824	19.2456	19.5170	19.8436	20.0263	20.0829	20.0880	20.0889	20.0542	19.7804	19.3723	19.0603	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.5843	19.7469	20.0195	20.3518	20.5543	20.6207	20.6293	20.6284	20.5811	20.2802	19.8688	19.5582	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5843	19.7469	20.0195	20.3518	20.5543	20.6207	20.6293	20.6284	20.5811	20.2802	19.8688	19.5582	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9926	0.9754	0.9087	0.7535	0.5451	0.3887	0.4480	0.7390	0.9573	0.9935	0.9979	(94)
Useful gains	317.4613	372.7597	434.1601	478.0876	439.5828	316.7397	214.8053	224.3089	322.6776	346.2185	310.7598	299.2861	(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													
	840.7778	814.7230	740.1004	619.8175	478.2054	321.9204	215.4435	225.6702	347.8836	522.8101	692.6135	836.8287	(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													
	389.3475	296.9994	227.6196	102.0455	28.7352	0.0000	0.0000	0.0000	0.0000	131.3842	274.9347	399.9317	(98)
Space heating												1850.9977	(98)
Space heating per m2											(98) / (4) =	34.4052	(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	502.6116	395.6730	405.6081	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9626	0.9837	0.9734	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.7993	389.2317	394.8009	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	747.0169	712.4069	652.8061	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	189.5167	240.4423	191.9559	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												621.9149	(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   47.3792   60.1106   47.9890    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          155.4787 (107)
Space cooling per m2                                                                                                     2.8899 (108)
Energy for space heating                                                                                                34.4052 (99)
Energy for space cooling                                                                                                 2.8899 (108)
Total                                                                                                                   37.2951 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     42.9 (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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(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	0.1434	0.1356	0.1356	0.1318	0.1318	0.1201	0.1240	0.1163	0.1124	0.1201	0.1163	0.1318	(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	0.2609	0.2531	0.2531	0.2493	0.2493	0.2376	0.2415	0.2338	0.2299	0.2376	0.2338	0.2493	(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)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	11.8105	11.4597	11.4597	11.2842	11.2842	10.7579	10.9334	10.5825	10.4071	10.7579	10.5825	11.2842	(38)
Heat transfer coeff	41.0773	40.7264	40.7264	40.5510	40.5510	40.0247	40.2001	39.8492	39.6738	40.0247	39.8492	40.5510	(39)
Average = Sum(39)m / 12 =												40.3171	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7635	0.7570	0.7570	0.7537	0.7537	0.7440	0.7472	0.7407	0.7374	0.7440	0.7407	0.7537	(40)
HLP (average)												0.7494	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
RHI water heating demand												1446	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	430.6635	427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	14.1100	22.3142	0.6300	0.7000	0.7700	96.2231	(76)
West	3.0000	22.3142	0.6300	0.7000	0.7700	20.4585	(80)

Solar gains	138.5159	234.5422	393.7062	595.1852	724.4903	797.3978	754.9220	653.1849	496.0487	308.4008	172.1866	113.0005	(83)
Total gains	569.1794	661.9454	805.4775	982.7392	1087.4742	1138.0771	1082.3277	987.0713	843.6495	680.3948	571.3593	532.5208	(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	81.5680	82.2708	82.2708	82.6267	82.6267	83.7132	83.3478	84.0817	84.4535	83.7132	84.0817	82.6267	
alpha	6.4379	6.4847	6.4847	6.5084	6.5084	6.5809	6.5565	6.6054	6.6302	6.5809	6.6054	6.5084	
util living area													
	0.9089	0.8259	0.6462	0.4363	0.2796	0.1583	0.0929	0.1130	0.2586	0.5256	0.8063	0.9271	(86)
MIT	20.7543	20.8761	20.9731	20.9977	20.9999	21.0000	21.0000	21.0000	21.0000	20.9946	20.9143	20.7218	(87)
Th 2	20.2851	20.2908	20.2908	20.2936	20.2936	20.3022	20.2993	20.3050	20.3079	20.3022	20.3050	20.2936	(88)
util rest of house													
	0.8919	0.8010	0.6149	0.4075	0.2533	0.1337	0.0668	0.0850	0.2261	0.4861	0.7758	0.9125	(89)
MIT 2	19.9846	20.1468	20.2625	20.2915	20.2935	20.3022	20.2993	20.3050	20.3079	20.2975	20.2107	19.9493	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8959	0.8115	0.6324	0.4245	0.2690	0.1483	0.0823	0.1017	0.2454	0.5094	0.7904	0.9151	(94)
Useful gains	509.9242	537.1821	509.3875	417.2185	292.4796	168.7929	89.0866	100.3560	207.0640	346.5991	451.6143	487.2888	(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													
	613.7923	589.7414	520.6928	418.1431	292.5211	168.7934	89.0866	100.3561	207.0781	348.7014	487.3240	604.5654	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	236.2342 (98)
RHI space heating demand	236 (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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(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	0.3151	0.3113	0.3074	0.2880	0.2841	0.2648	0.2648	0.2609	0.2725	0.2841	0.2919	0.2996	(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)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	14.2666	14.0911	13.9157	13.0385	12.8631	11.9859	11.9859	11.8105	12.3368	12.8631	13.2140	13.5648	(38)
Heat transfer coeff	43.5333	43.3579	43.1824	42.3053	42.1298	41.2527	41.2527	41.0773	41.6036	42.1298	42.4807	42.8316	(39)
Average = Sum(39)m / 12 =												42.2614	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8092	0.8059	0.8026	0.7863	0.7831	0.7668	0.7668	0.7635	0.7733	0.7831	0.7896	0.7961	(40)
HLP (average)												0.7855	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	430.6635	427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	14.1100	19.6403	0.6300	0.7000	0.7700	84.6927	(76)
West	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(80)

Solar gains	122.1004	237.9782	393.8584	583.7316	727.6857	751.3026	712.5836	603.1592	460.5485	282.5215	151.9877	100.6286	(83)
Total gains	552.7639	665.3813	805.6298	971.2856	1090.6696	1091.9818	1039.9892	937.0456	808.1493	654.5154	551.1604	520.1489	(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	76.9662	77.2776	77.5915	79.2003	79.5301	81.2212	81.2212	81.5680	80.5362	79.5301	78.8732	78.2271	
alpha	6.1311	6.1518	6.1728	6.2800	6.3020	6.4147	6.4147	6.4379	6.3691	6.3020	6.2582	6.2151	
util living area													
	0.9480	0.8799	0.7335	0.5225	0.3589	0.2418	0.1745	0.2016	0.3549	0.6508	0.8901	0.9592	(86)
MIT	20.5862	20.7704	20.9281	20.9910	20.9992	21.0000	21.0000	21.0000	20.9995	20.9750	20.7955	20.5490	(87)
Th 2	20.2454	20.2482	20.2510	20.2652	20.2680	20.2822	20.2822	20.2851	20.2765	20.2680	20.2624	20.2567	(88)
util rest of house													
	0.9372	0.8602	0.7039	0.4920	0.3308	0.2147	0.1461	0.1703	0.3178	0.6101	0.8683	0.9504	(89)
MIT 2	19.7196	19.9701	20.1711	20.2563	20.2673	20.2822	20.2822	20.2851	20.2762	20.2440	20.0209	19.6778	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	20.2350	20.4461	20.6214	20.6933	20.7026	20.7091	20.7091	20.7103	20.7064	20.6788	20.4816	20.1960	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2350	20.4461	20.6214	20.6933	20.7026	20.7091	20.7091	20.7103	20.7064	20.6788	20.4816	20.1960	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9371	0.8657	0.7188	0.5098	0.3475	0.2308	0.1630	0.1889	0.3399	0.6332	0.8752	0.9496	(94)
Useful gains	517.9720	576.0058	579.0590	495.1921	378.9616	252.0014	169.5122	177.0520	274.6609	414.4286	482.3655	493.9573	(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													
	693.7051	674.0454	609.7948	498.9200	379.2798	252.0173	169.5134	177.0551	274.8494	424.6184	568.4602	685.1322	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	130.7454	65.8827	22.8674	2.6841	0.2367	0.0000	0.0000	0.0000	0.0000	7.5812	61.9882	142.2342	(98)
Space heating												434.2199	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 8.0710 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	434.2199 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	130.7454	65.8827	22.8674	2.6841	0.2367	0.0000	0.0000	0.0000	0.0000	7.5812	61.9882	142.2342	(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)													
	130.7454	65.8827	22.8674	2.6841	0.2367	0.0000	0.0000	0.0000	0.0000	7.5812	61.9882	142.2342	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(219)
Water heating fuel used												1445.8455	(219)

Annual totals kWh/year	
Space heating fuel - main system	434.2199 (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)	131.8053 (230a)
Total electricity for the above, kWh/year	131.8053 (231)
Electricity for lighting (calculated in Appendix L)	247.3239 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
Total delivered energy for all uses	2259.1945 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	434.2199	13.1900	57.2736	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1445.8455	13.1900	190.7070	(247)
Mechanical ventilation fans	131.8053	13.1900	17.3851	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.3239	13.1900	32.6220	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			297.9878	(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] =	1.2667 (257)
SAP value		82.3288
SAP rating (Section 12)		82 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	434.2199	0.5190	225.3601	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	0.5190	750.3938	(264)
Space and water heating			975.7539	(265)
Pumps and fans	131.8053	0.5190	68.4069	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Energy saving/generation technologies				
PV Unit	-800.0000	0.5190	-415.2000	(269)
Total kg/year			757.3220	(272)
CO2 emissions per m2			14.0800	(273)
EI value			89.7286	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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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


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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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(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	0.1434	0.1356	0.1356	0.1318	0.1318	0.1201	0.1240	0.1163	0.1124	0.1201	0.1163	0.1318	(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	0.2609	0.2531	0.2531	0.2493	0.2493	0.2376	0.2415	0.2338	0.2299	0.2376	0.2338	0.2493	(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)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	11.8105	11.4597	11.4597	11.2842	11.2842	10.7579	10.9334	10.5825	10.4071	10.7579	10.5825	11.2842	(38)
Heat transfer coeff	41.0773	40.7264	40.7264	40.5510	40.5510	40.0247	40.2001	39.8492	39.6738	40.0247	39.8492	40.5510	(39)
Average = Sum(39)m / 12 =												40.3171	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7635	0.7570	0.7570	0.7537	0.7537	0.7440	0.7472	0.7407	0.7374	0.7440	0.7407	0.7537	(40)
HLP (average)												0.7494	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

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

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
									Total per year (kWh/year) = Sum(64)m =			1445.8455	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	430.6635	427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	11.9672	0.6300	0.7000	0.7700	21.8343	(74)
East	14.1100	22.3142	0.6300	0.7000	0.7700	96.2231	(76)
West	3.0000	22.3142	0.6300	0.7000	0.7700	20.4585	(80)

Solar gains	138.5159	234.5422	393.7062	595.1852	724.4903	797.3978	754.9220	653.1849	496.0487	308.4008	172.1866	113.0005	(83)
Total gains	569.1794	661.9454	805.4775	982.7392	1087.4742	1138.0771	1082.3277	987.0713	843.6495	680.3948	571.3593	532.5208	(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	81.5680	82.2708	82.2708	82.6267	82.6267	83.7132	83.3478	84.0817	84.4535	83.7132	84.0817	82.6267	
alpha	6.4379	6.4847	6.4847	6.5084	6.5084	6.5809	6.5565	6.6054	6.6302	6.5809	6.6054	6.5084	
util living area													
	0.9089	0.8259	0.6462	0.4363	0.2796	0.1583	0.0929	0.1130	0.2586	0.5256	0.8063	0.9271	(86)
MIT	20.7543	20.8761	20.9731	20.9977	20.9999	21.0000	21.0000	21.0000	21.0000	20.9946	20.9143	20.7218	(87)
Th 2	20.2851	20.2908	20.2908	20.2936	20.2936	20.3022	20.2993	20.3050	20.3079	20.3022	20.3050	20.2936	(88)
util rest of house													
	0.8919	0.8010	0.6149	0.4075	0.2533	0.1337	0.0668	0.0850	0.2261	0.4861	0.7758	0.9125	(89)
MIT 2	19.9846	20.1468	20.2625	20.2915	20.2935	20.3022	20.2993	20.3050	20.3079	20.2975	20.2107	19.9493	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8959	0.8115	0.6324	0.4245	0.2690	0.1483	0.0823	0.1017	0.2454	0.5094	0.7904	0.9151	(94)
Useful gains	509.9242	537.1821	509.3875	417.2185	292.4796	168.7929	89.0866	100.3560	207.0640	346.5991	451.6143	487.2888	(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													
	613.7923	589.7414	520.6928	418.1431	292.5211	168.7934	89.0866	100.3561	207.0781	348.7014	487.3240	604.5654	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(98)
Space heating												236.2342	(98)

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

Space heating per m2 (98) / (4) = 4.3910 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												236.2342	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(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)													
	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(219)
Water heating fuel used												1445.8455	(219)
Annual totals kWh/year													
Space heating fuel - main system												236.2342	(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)												131.8053	(230a)
Total electricity for the above, kWh/year												131.8053	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2061.2089	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	236.2342	18.7000	44.1758	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1445.8455	18.7000	270.3731	(247)
Mechanical ventilation fans	131.8053	18.7000	24.6476	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.3239	18.7000	46.2496	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	18.7000	0.0000	(252)
Total energy cost			385.4461	(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	236.2342	0.5190	122.6056	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	0.5190	750.3938	(264)
Space and water heating			872.9994	(265)
Pumps and fans	131.8053	0.5190	68.4069	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Energy saving/generation technologies				
PV Unit	-800.0000	0.5190	-415.2000	(269)
Total kg/year			654.5674	(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	236.2342	3.0700	725.2391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	3.0700	4438.7457	(264)
Space and water heating			5163.9848	(265)
Pumps and fans	131.8053	3.0700	404.6422	(267)
Energy for lighting	247.3239	3.0700	759.2842	(268)

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

Energy saving/generation technologies			
PV Unit	-800.0000	3.0700	-2456.0000 (269)
Primary energy kWh/year			3871.9113 (272)
Primary energy kWh/m2/year			71.9686 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 82
Current environmental impact rating: B 90

(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: B 82
Potential environmental impact rating: B 90

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	£385	£385	£0
Space heating	£69	£69	£0
Water heating	£270	£270	£0
Lighting	£46	£46	£0
Total cost of fuels	£385	£385	£0
Total cost of uses	£385	£385	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	72 kWh/m²	72 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	MidTerrace 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	224.2 (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	271.64	(P1)
Transmission heat loss coefficient	29.27	(37)
Summer heat loss coefficient	300.90	(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	14.1100	117.5071	0.6300	0.7000	0.9000	592.2630
West	3.0000	117.5071	0.6300	0.7000	0.9000	125.9241
total:						891.3180

	Jun	Jul	Aug	
Solar gains	950	891	773	(P3)
Internal gains	341	327	334	
Total summer gains	1290	1219	1106	(P5)
Summer gain/loss ratio	4.29	4.05	3.68	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 224.2)	0.43	0.43	0.43	
Threshold temperature	20.72	22.38	21.91	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
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	016859	**Issued on Date**	30/11/2020
Assessment Reference	003 - Green	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	82 B	**DER**	16.68	**TER**	26.10
Environmental	90 B	**% DER<TER**	36.10		
CO_2 Emissions (t/year)	0.65	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

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)	26.10	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	16.68	$kgCO_2/m^2$	Pass
	-9.42 (-36.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.89	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	32.95	$kWh/m^2/yr$	
	-10.0 (-23.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.14 (max. 0.20)	0.14 (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	5.97 m², No overhang
Windows facing East	14.11 m², No overhang
Windows facing West	3.00 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	0.039	W/m²K
Photovoltaic array	800.00	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	016859	**Issued on Date**	30/11/2020
Assessment Reference	003 - Green	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	82 B	**DER**	16.68	**TER**	26.10
Environmental	90 B	**% DER<TER**	36.10		
CO_2 Emissions (t/year)	0.65	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

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, Mid-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	22.25 m	53.80 m²	2.55 m

7.0 Living Area	32.00	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	224.2	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
New Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	34.55	11.47
Wall to hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.18	18.00	22.19	20.33

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	45.54

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	0.14	9.00	1.00	1.00

10.1 Party Ceilings

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 Ceilings 1	Timber I-joists, carpeted	20.00	51.80

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	52.80

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	West	None	0.00					3.00	
Rear Windows	Window	[1] New Wall	East	None	0.00					14.11	
Side Windows	Window	[1] New Wall	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)	9.83	0.056	No
Table K1 - Approved	E3 Sill	1.80	0.040	No
Table K1 - Approved	E4 Jamb	16.86	0.050	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	22.25	0.000	No
Table K1 - Default	E14 Flat roof	4.84	0.080	No
Table K1 - Approved	E16 Corner (normal)	2.55	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	10.20	0.060	No

Y-value	0.039	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	800.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Appendix 2

SAP Calculations (conversion) Flat 1.01

Energy Calculations Ltd

SAP ◆ CODE ◆ SBEM ◆ DESIGN

01754-761035

SAP Report Submission for Building Regulations Compliance

Client: Carlford Properties Limited

Project: Flat 1:01, 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

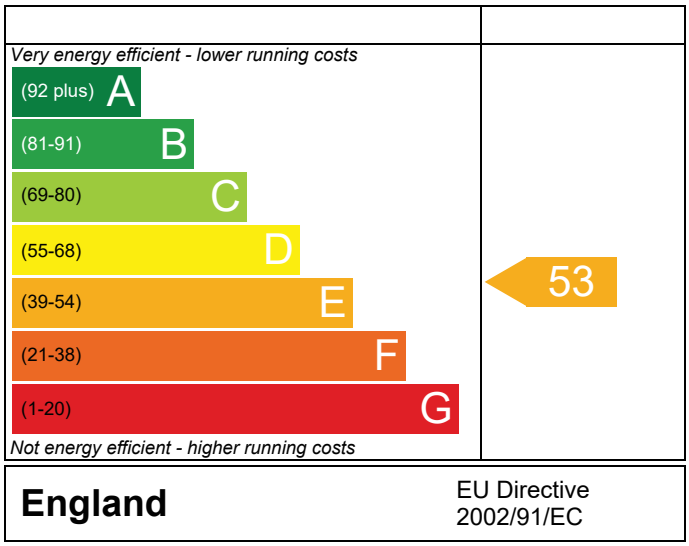
Flat 1:01, 9-10 George Street,
Richmond,
London,
TW9 1JY

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	30/11/2020
Produced by:	Energy Calculations Limited
Total floor area:	59.03 m²
DRRN:	9270-0193-0975

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.

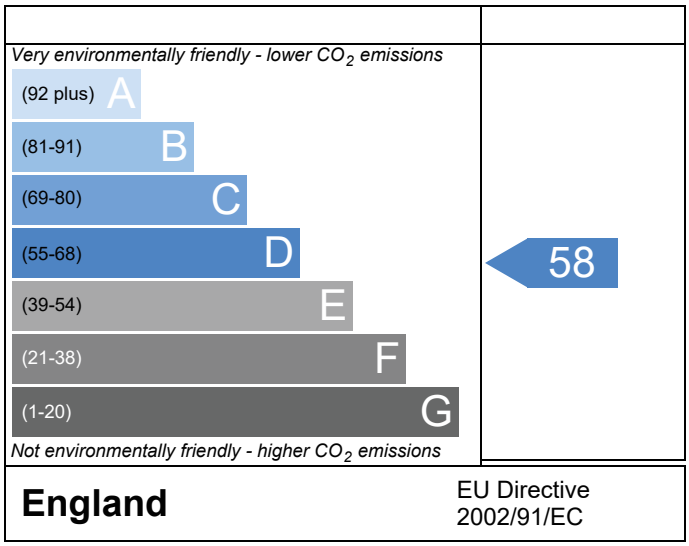
Energy Efficiency Rating



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.

FULL SAP CALCULATION PRINTOUT
Calculation Type: Conversion (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016861	**Issued on Date**	30/11/2020
Assessment Reference	001	**Prop Type Ref**	
Property	Flat 1:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	53 E	**DER**	N/A	**TER**	N/A
Environmental	58 D	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	2.69	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

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

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (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	47.0000	(1b)	x 2.5500	(2b) =	119.8500	(1b) - (3b)
First floor	12.0300	(1c)	x 2.3300	(2c) =	28.0299	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		147.8799	(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) =	0.1352	(8)
Pressure test			No	
Measured/design AP50			15.0000	
Infiltration rate			0.8852	(18)
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.6861	(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	0.6346	0.6003	0.6003	0.5832	0.5832	0.5317	0.5489	0.5145	0.4974	0.5317	0.5145	0.5832	(22b)
Effective ac	0.7014	0.6802	0.6802	0.6700	0.6700	0.6414	0.6506	0.6324	0.6237	0.6414	0.6324	0.6700	(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 = 1.60)			11.4500	1.5038	17.2180			(27)
Heat Loss Floor 1			47.0000	0.1250	5.8750	20.0000	940.0000	(28b)
Existing wall	31.7700	11.4500	20.3200	0.3000	6.0960	190.0000	3860.8000	(29a)
Dwarf Wall	10.8700		10.8700	0.2800	3.0436	9.0000	97.8300	(29a)
Wall to Void	15.2000		15.2000	0.2800	4.2560	9.0000	136.8000	(29a)
Wall to hall	20.1200	1.8600	18.2600	0.2745	5.0119	190.0000	3469.4000	(29a)
Roof Slope	4.6600		4.6600	0.1800	0.8388	9.0000	41.9400	(30)
Roof plane	4.3000		4.3000	0.1600	0.6880	9.0000	38.7000	(30)
Roof Void	33.9200		33.9200	0.1600	5.4272	9.0000	305.2800	(30)
Flat roof	6.1200		6.1200	0.1800	1.1016	9.0000	55.0800	(30)
Total net area of external elements Aum(A, m2)			173.9600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.1601			(33)
Party Wall 1			36.7500	0.0000	0.0000	180.0000	6615.0000	(32)
Internal Wall 1			40.8500			9.0000	367.6500	(32c)
Internal Floor 1			12.0300			18.0000	216.5400	(32d)
Internal Ceiling 1			12.0300			9.0000	108.2700	(32e)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16253.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 275.3395 (35)
Thermal bridges (Default value 0.150 * total exposed area) 26.0940 (36)
Total fabric heat loss (33) + (36) = 78.2541 (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	34.2269	33.1932	33.1932	32.6979	32.6979	31.2982	31.7505	30.8604	30.4369	31.2982	30.8604	32.6979	(38)
Heat transfer coeff	112.4810	111.4474	111.4474	110.9521	110.9521	109.5524	110.0046	109.1145	108.6910	109.5524	109.1145	110.9521	(39)

Average = Sum(39)m / 12 = 110.3551 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9055	1.8880	1.8880	1.8796	1.8796	1.8559	1.8635	1.8485	1.8413	1.8559	1.8485	1.8796	(40)

HLP (average) 1.8695 (40)

Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9541 (42)
Average daily hot water use (litres/day) 80.6094 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.6703	85.4460	82.2216	78.9972	75.7728	72.5484	72.5484	75.7728	78.9972	82.2216	85.4460	88.6703	(44)
Energy conte	131.4955	115.0068	118.6767	103.4653	99.2774	85.6688	79.3848	91.0952	92.1831	107.4306	117.2689	127.3464	(45)
Energy content (annual)										Total = Sum(45)m =		1268.2995	(45)
Distribution loss (46)m = 0.15 x (45)m	19.7243	17.2510	17.8015	15.5198	14.8916	12.8503	11.9077	13.6643	13.8275	16.1146	17.5903	19.1020	(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	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(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	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(64)
								Total per year (kWh/year) = Sum(64)m =				1502.6295	(64)
RHI water heating demand												1503	(64)
Heat gains from water heating, kWh/month	59.6439	52.6206	55.3816	49.8102	48.9313	43.8929	42.3170	46.2107	46.0589	51.6423	54.3999	58.2643	(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	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.4004	34.1069	27.7376	20.9991	15.6971	13.2522	14.3194	18.6129	24.9822	31.7207	37.0227	39.4676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	254.4688	257.1094	250.4552	236.2892	218.4071	201.6005	190.3727	187.7321	194.3863	208.5523	226.4344	243.2410	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	(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)	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	(71)
Water heating gains (Table 5)	80.1665	78.3044	74.4377	69.1808	65.7679	60.9623	56.8777	62.1112	63.9707	69.4116	75.5554	78.3122	(72)
Total internal gains	460.7958	457.2808	440.3906	414.2293	387.6323	363.5752	349.3300	356.2164	371.0994	397.4448	426.7726	448.7810	(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	
East	6.0700	22.3142	0.6300	0.7000	0.7700	41.3943	(76)
West	5.3800	22.3142	0.6300	0.7000	0.7700	36.6889	(80)

Solar gains	78.0832	132.4978	220.8647	328.0745	392.4398	428.2894	406.9836	357.3993	276.5837	173.9967	97.1854	63.5882	(83)
Total gains	538.8790	589.7786	661.2553	742.3038	780.0721	791.8646	756.3136	713.6157	647.6831	571.4415	523.9580	512.3691	(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	40.1384	40.5106	40.5106	40.6915	40.6915	41.2114	41.0419	41.3767	41.5380	41.2114	41.3767	40.6915

CALCULATION OF HEAT DEMAND 09 Jan 2014

alpha	3.6759	3.7007	3.7007	3.7128	3.7128	3.7474	3.7361	3.7584	3.7692	3.7474	3.7584	3.7128	
util living area	0.9907	0.9859	0.9701	0.9246	0.8125	0.5781	0.3583	0.4179	0.7575	0.9411	0.9833	0.9921	(86)
MIT	19.4197	19.5864	19.9278	20.3576	20.7399	20.9536	20.9947	20.9903	20.8586	20.4101	19.8672	19.4111	(87)
Th 2	19.3971	19.4091	19.4091	19.4148	19.4148	19.4311	19.4259	19.4363	19.4412	19.4311	19.4363	19.4148	(88)
util rest of house	0.9868	0.9799	0.9563	0.8871	0.7151	0.3972	0.1346	0.1887	0.6066	0.9028	0.9748	0.9888	(89)
MIT 2	17.4235	17.6721	18.1614	18.7584	19.2258	19.4185	19.4258	19.4359	19.3727	18.8562	18.0978	17.4222	(90)
Living area fraction									fLA = Living area / (4) =			0.4720	(91)
MIT	18.3656	18.5756	18.9951	19.5131	19.9404	20.1430	20.1662	20.1695	20.0740	19.5896	18.9329	18.3609	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3656	18.5756	18.9951	19.5131	19.9404	20.1430	20.1662	20.1695	20.0740	19.5896	18.9329	18.3609	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9755	0.9516	0.8900	0.7520	0.4841	0.2414	0.2988	0.6757	0.9077	0.9709	0.9856	(94)
Useful gains	529.8327	575.3092	629.2223	660.6204	586.5994	383.3041	182.5976	213.2473	437.6700	518.7216	508.7068	504.9840	(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	1447.1363	1390.3703	1236.5212	1011.1224	714.5709	399.1011	183.2948	214.9034	497.1542	831.4559	1149.2949	1426.9457	(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	682.4739	547.7211	451.8304	252.3614	95.2108	0.0000	0.0000	0.0000	0.0000	232.6743	461.2235	685.9396	(98)
Space heating												3409.4348	(98)
RHI space heating demand												3409	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (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	47.0000 (1b)	x	2.5500 (2b)	=	119.8500	(1b) - (3b)
First floor	12.0300 (1c)	x	2.3300 (2c)	=	28.0299	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	147.8799	(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) =	0.1352	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8852	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.6861	(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	0.8747	0.8576	0.8404	0.7547	0.7375	0.6518	0.6518	0.6346	0.6861	0.7375	0.7718	0.8061	(22b)
Effective ac	0.8826	0.8677	0.8532	0.7848	0.7720	0.7124	0.7124	0.7014	0.7353	0.7720	0.7979	0.8249	(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 = 1.60)			11.4500	1.5038	17.2180			(27)
Heat Loss Floor 1			47.0000	0.1250	5.8750	20.0000	940.0000	(28b)
Existing wall	31.7700	11.4500	20.3200	0.3000	6.0960	190.0000	3860.8000	(29a)
Dwarf Wall	10.8700		10.8700	0.2800	3.0436	9.0000	97.8300	(29a)
Wall to Void	15.2000		15.2000	0.2800	4.2560	9.0000	136.8000	(29a)
Wall to hall	20.1200	1.8600	18.2600	0.2745	5.0119	190.0000	3469.4000	(29a)
Roof Slope	4.6600		4.6600	0.1800	0.8388	9.0000	41.9400	(30)
Roof plane	4.3000		4.3000	0.1600	0.6880	9.0000	38.7000	(30)
Roof Void	33.9200		33.9200	0.1600	5.4272	9.0000	305.2800	(30)
Flat roof	6.1200		6.1200	0.1800	1.1016	9.0000	55.0800	(30)
Total net area of external elements Aum(A, m2)			173.9600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.1601			(33)
Party Wall 1			36.7500	0.0000	0.0000	180.0000	6615.0000	(32)
Internal Wall 1			40.8500			9.0000	367.6500	(32c)
Internal Floor 1			12.0300			18.0000	216.5400	(32d)
Internal Ceiling 1			12.0300			18.0000	216.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16361.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		277.1736 (35)
Thermal bridges (Default value 0.150 * total exposed area)		26.0940 (36)
Total fabric heat loss	(33) + (36) =	78.2541 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0702	42.3452	41.6346	38.2968	37.6723	34.7652	34.7652	34.2269	35.8850	37.6723	38.9356	40.2564	(38)
Heat transfer coeff	121.3243	120.5993	119.8887	116.5509	115.9264	113.0194	113.0194	112.4810	114.1391	115.9264	117.1898	118.5105	(39)
Average = Sum(39)m / 12 =												116.5479	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0553	2.0430	2.0310	1.9744	1.9639	1.9146	1.9146	1.9055	1.9336	1.9639	1.9853	2.0076	(40)
HLP (average)												1.9744	(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	1.9541 (42)
Average daily hot water use (litres/day)	80.6094 (43)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	88.6703	85.4460	82.2216	78.9972	75.7728	72.5484	72.5484	75.7728	78.9972	82.2216	85.4460	88.6703	(44)
Energy conte	131.4955	115.0068	118.6767	103.4653	99.2774	85.6688	79.3848	91.0952	92.1831	107.4306	117.2689	127.3464	(45)
Energy content (annual)										Total = Sum(45)m =		1268.2995	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7243	17.2510	17.8015	15.5198	14.8916	12.8503	11.9077	13.6643	13.8275	16.1146	17.5903	19.1020	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(64)
								Total per year (kWh/year) = Sum(64)m =				1502.6295	(64)
Heat gains from water heating, kWh/month													
	59.6439	52.6206	55.3816	49.8102	48.9313	43.8929	42.3170	46.2107	46.0589	51.6423	54.3999	58.2643	(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	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.4004	34.1069	27.7376	20.9991	15.6971	13.2522	14.3194	18.6129	24.9822	31.7207	37.0227	39.4676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	254.4688	257.1094	250.4552	236.2892	218.4071	201.6005	190.3727	187.7321	194.3863	208.5523	226.4344	243.2410	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	(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)													
	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	(71)
Water heating gains (Table 5)													
	80.1665	78.3044	74.4377	69.1808	65.7679	60.9623	56.8777	62.1112	63.9707	69.4116	75.5554	78.3122	(72)
Total internal gains													
	460.7958	457.2808	440.3906	414.2293	387.6323	363.5752	349.3300	356.2164	371.0994	397.4448	426.7726	448.7810	(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	
East	6.0700	19.6403	0.6300	0.7000	0.7700	36.4341	(76)
West	5.3800	19.6403	0.6300	0.7000	0.7700	32.2925	(80)

Solar gains	68.7266	134.4437	221.4097	322.9128	395.7418	405.1121	385.6833	331.2962	257.5086	159.5288	85.6939	56.5174	(83)
Total gains	529.5224	591.7246	661.8003	737.1421	783.3741	768.6873	735.0133	687.5126	628.6080	556.9736	512.4666	505.2983	(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	37.4606	37.6858	37.9091	38.9948	39.2048	40.2133	40.2133	40.4057	39.8188	39.2048	38.7822	38.3500	
alpha	3.4974	3.5124	3.5273	3.5997	3.6137	3.6809	3.6809	3.6937	3.6546	3.6137	3.5855	3.5567	
util living area	0.9932	0.9892	0.9792	0.9513	0.8882	0.7618	0.6147	0.6641	0.8637	0.9660	0.9891	0.9943	(86)
MIT	19.0918	19.2718	19.6082	20.0874	20.5071	20.8212	20.9409	20.9209	20.6833	20.1394	19.5581	19.0934	(87)
Th 2	19.2967	19.3048	19.3128	19.3504	19.3575	19.3909	19.3909	19.3971	19.3780	19.3575	19.3432	19.3283	(88)
util rest of house	0.9905	0.9849	0.9701	0.9281	0.8293	0.6333	0.4180	0.4717	0.7682	0.9450	0.9838	0.9920	(89)
MIT 2	16.8842	17.1503	17.6412	18.3440	18.9081	19.2869	19.3754	19.3727	19.1512	18.4344	17.5916	16.9052	(90)
Living area fraction									fLA = Living area / (4) =			0.4720	(91)
MIT	17.9261	18.1515	18.5696	19.1669	19.6628	20.0110	20.1143	20.1034	19.8743	19.2391	18.5197	17.9380	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9261	18.1515	18.5696	19.1669	19.6628	20.0110	20.1143	20.1034	19.8743	19.2391	18.5197	17.9380	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9872	0.9806	0.9646	0.9248	0.8425	0.6889	0.5131	0.5644	0.8033	0.9429	0.9800	0.9892	(94)
Useful gains	522.7682	580.2259	638.3775	681.6832	659.9790	529.5672	377.1102	388.0529	504.9832	525.1861	502.2185	499.8405	(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	1653.1814	1598.1274	1447.0042	1196.6109	923.0969	611.5493	397.1791	416.5618	659.0720	1001.5022	1338.2757	1628.0939	(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													

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	841.0275	684.0298	601.6183	370.7480	195.7597	0.0000	0.0000	0.0000	0.0000	354.3791	601.9611	839.4206 (98)
Space heating												4488.9441 (98)
Space heating per m2											(98) / (4) =	76.0451 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4488.9441	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	841.0275	684.0298	601.6183	370.7480	195.7597	0.0000	0.0000	0.0000	0.0000	354.3791	601.9611	839.4206	(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)													
	841.0275	684.0298	601.6183	370.7480	195.7597	0.0000	0.0000	0.0000	0.0000	354.3791	601.9611	839.4206	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(219)
Water heating fuel used												1502.6295	(219)
Annual totals kWh/year													
Space heating fuel - main system												4488.9441	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												271.2651	(232)
Total delivered energy for all uses												6262.8387	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4488.9441	13.1900	592.0917	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1502.6295	13.1900	198.1968	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	271.2651	13.1900	35.7799	(250)
Additional standing charges			0.0000	(251)
Total energy cost			826.0684	(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] =	3.3351	(257)
SAP value		53.4756	
SAP rating (Section 12)		53	(258)
SAP band		E	

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	4488.9441	0.5190	2329.7620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6295	0.5190	779.8647	(264)
Space and water heating			3109.6267	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	271.2651	0.5190	140.7866	(268)
Total kg/year			3250.4133	(272)
CO2 emissions per m2			55.0600	(273)
EI value			57.9959	
EI rating			58	(274)
EI band			D	

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

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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 Conversion (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	47.0000 (1b)	x	2.5500 (2b)	=	119.8500	(1b) - (3b)
First floor	12.0300 (1c)	x	2.3300 (2c)	=	28.0299	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	147.8799	(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) =	0.1352	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8852	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.6861	(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	0.6346	0.6003	0.6003	0.5832	0.5832	0.5317	0.5489	0.5145	0.4974	0.5317	0.5145	0.5832	(22b)
Effective ac	0.7014	0.6802	0.6802	0.6700	0.6700	0.6414	0.6506	0.6324	0.6237	0.6414	0.6324	0.6700	(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 = 1.60)			11.4500	1.5038	17.2180			(27)
Heat Loss Floor 1			47.0000	0.1250	5.8750	20.0000	940.0000	(28b)
Existing wall	31.7700	11.4500	20.3200	0.3000	6.0960	190.0000	3860.8000	(29a)
Dwarf Wall	10.8700		10.8700	0.2800	3.0436	9.0000	97.8300	(29a)
Wall to Void	15.2000		15.2000	0.2800	4.2560	9.0000	136.8000	(29a)
Wall to hall	20.1200	1.8600	18.2600	0.2745	5.0119	190.0000	3469.4000	(29a)
Roof Slope	4.6600		4.6600	0.1800	0.8388	9.0000	41.9400	(30)
Roof plane	4.3000		4.3000	0.1600	0.6880	9.0000	38.7000	(30)
Roof Void	33.9200		33.9200	0.1600	5.4272	9.0000	305.2800	(30)
Flat roof	6.1200		6.1200	0.1800	1.1016	9.0000	55.0800	(30)
Total net area of external elements Aum(A, m2)			173.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1601			(33)
Party Wall 1			36.7500	0.0000	0.0000	180.0000	6615.0000	(32)
Internal Wall 1			40.8500			9.0000	367.6500	(32c)
Internal Floor 1			12.0300			18.0000	216.5400	(32d)
Internal Ceiling 1			12.0300			18.0000	216.5400	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16361.5600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							277.1736	(35)
Thermal bridges (Default value 0.150 * total exposed area)							26.0940	(36)
Total fabric heat loss					(33) + (36) =		78.2541	(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	34.2269	33.1932	33.1932	32.6979	32.6979	31.2982	31.7505	30.8604	30.4369	31.2982	30.8604	32.6979	(38)
Heat transfer coeff	112.4810	111.4474	111.4474	110.9521	110.9521	109.5524	110.0046	109.1145	108.6910	109.5524	109.1145	110.9521	(39)
Average = Sum(39)m / 12 =												110.3551	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9055	1.8880	1.8880	1.8796	1.8796	1.8559	1.8635	1.8485	1.8413	1.8559	1.8485	1.8796	(40)
HLP (average)												1.8695	(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	1.9541	(42)
Average daily hot water use (litres/day)	80.6094	(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	88.6703	85.4460	82.2216	78.9972	75.7728	72.5484	72.5484	75.7728	78.9972	82.2216	85.4460	88.6703	(44)
Energy conte	131.4955	115.0068	118.6767	103.4653	99.2774	85.6688	79.3848	91.0952	92.1831	107.4306	117.2689	127.3464	(45)
Energy content (annual)										Total = Sum(45)m =		1268.2995	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7243	17.2510	17.8015	15.5198	14.8916	12.8503	11.9077	13.6643	13.8275	16.1146	17.5903	19.1020	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(64)
								Total per year (kWh/year) = Sum(64)m =				1502.6295	(64)
Heat gains from water heating, kWh/month													
	59.6439	52.6206	55.3816	49.8102	48.9313	43.8929	42.3170	46.2107	46.0589	51.6423	54.3999	58.2643	(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	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.4004	34.1069	27.7376	20.9991	15.6971	13.2522	14.3194	18.6129	24.9822	31.7207	37.0227	39.4676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	254.4688	257.1094	250.4552	236.2892	218.4071	201.6005	190.3727	187.7321	194.3863	208.5523	226.4344	243.2410	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786	(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)													
	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	(71)
Water heating gains (Table 5)													
	80.1665	78.3044	74.4377	69.1808	65.7679	60.9623	56.8777	62.1112	63.9707	69.4116	75.5554	78.3122	(72)
Total internal gains													
	460.7958	457.2808	440.3906	414.2293	387.6323	363.5752	349.3300	356.2164	371.0994	397.4448	426.7726	448.7810	(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	
East	6.0700	22.3142	0.6300	0.7000	0.7700	41.3943	(76)
West	5.3800	22.3142	0.6300	0.7000	0.7700	36.6889	(80)

Solar gains	78.0832	132.4978	220.8647	328.0745	392.4398	428.2894	406.9836	357.3993	276.5837	173.9967	97.1854	63.5882	(83)
Total gains	538.8790	589.7786	661.2553	742.3038	780.0721	791.8646	756.3136	713.6157	647.6831	571.4415	523.9580	512.3691	(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	40.4057	40.7805	40.7805	40.9625	40.9625	41.4859	41.3153	41.6524	41.8147	41.4859	41.6524	40.9625	
alpha	3.6937	3.7187	3.7187	3.7308	3.7308	3.7657	3.7544	3.7768	3.7876	3.7657	3.7768	3.7308	
util living area	0.9909	0.9862	0.9705	0.9253	0.8133	0.5785	0.3584	0.4180	0.7583	0.9418	0.9836	0.9923	(86)
MIT	19.4273	19.5934	19.9333	20.3613	20.7419	20.9543	20.9948	20.9905	20.8600	20.4134	19.8729	19.4188	(87)
Th 2	19.3971	19.4091	19.4091	19.4148	19.4148	19.4311	19.4259	19.4363	19.4412	19.4311	19.4363	19.4148	(88)
util rest of house	0.9871	0.9802	0.9569	0.8879	0.7158	0.3974	0.1346	0.1887	0.6071	0.9035	0.9752	0.9890	(89)
MIT 2	17.4331	17.6807	18.1681	18.7626	19.2277	19.4187	19.4258	19.4359	19.3736	18.8598	18.1046	17.4319	(90)
Living area fraction									fLA = Living area / (4) =			0.4720	(91)
MIT	18.3743	18.5834	19.0012	19.5172	19.9424	20.1435	20.1663	20.1696	20.0751	19.5930	18.9392	18.3697	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3743	18.5834	19.0012	19.5172	19.9424	20.1435	20.1663	20.1696	20.0751	19.5930	18.9392	18.3697	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9835	0.9759	0.9522	0.8909	0.7529	0.4844	0.2415	0.2989	0.6765	0.9086	0.9714	0.9859	(94)
Useful gains	530.0110	575.5620	629.6497	661.2982	587.2992	383.5511	182.6218	213.2941	438.1461	519.2147	508.9577	505.1363	(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													
	1448.1120	1391.2423	1237.1980	1011.5679	714.7943	399.1511	183.3013	214.9143	497.2757	831.8337	1149.9756	1427.9159	(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													

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

	683.0671	548.1372	452.0159	252.1942	94.8563	0.0000	0.0000	0.0000	0.0000	232.5886	461.5329	686.5480 (98)
Space heating												3410.9403 (98)
Space heating per m2											(98) / (4) =	57.7832 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3410.9403	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	683.0671	548.1372	452.0159	252.1942	94.8563	0.0000	0.0000	0.0000	0.0000	232.5886	461.5329	686.5480	(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)													
	683.0671	548.1372	452.0159	252.1942	94.8563	0.0000	0.0000	0.0000	0.0000	232.5886	461.5329	686.5480	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(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													
	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(219)
Water heating fuel used												1502.6295	(219)
Annual totals kWh/year													
Space heating fuel - main system												3410.9403	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												271.2651	(232)
Total delivered energy for all uses												5184.8349	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3410.9403	18.7000	637.8458	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1502.6295	18.7000	280.9917	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	271.2651	18.7000	50.7266	(250)
Additional standing charges			0.0000	(251)
Total energy cost			969.5641	(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	3410.9403	0.5190	1770.2780	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6295	0.5190	779.8647	(264)
Space and water heating			2550.1427	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	271.2651	0.5190	140.7866	(268)
Total kg/year			2690.9293	(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	3410.9403	3.0700	10471.5866	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6295	3.0700	4613.0727	(264)
Space and water heating			15084.6593	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	271.2651	3.0700	832.7838	(268)
Primary energy kWh/year			15917.4431	(272)
Primary energy kWh/m2/year			269.6501	(273)

SAP 2012 EPC IMPROVEMENTS

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

Current energy efficiency rating: E 53
Current environmental impact rating: D 58

(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: E 53
Potential environmental impact rating: D 58

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	£970	£970	£0
Space heating	£638	£638	£0
Water heating	£281	£281	£0
Lighting	£51	£51	£0
Total cost of fuels	£970	£970	£0
Total cost of uses	£970	£970	£0
Delivered energy	88 kWh/m²	88 kWh/m²	0 kWh/m²
Carbon dioxide emissions	2.7 tonnes	2.7 tonnes	0.0 tonnes
CO2 emissions per m²	46 kg/m²	46 kg/m²	0 kg/m²
Primary energy	270 kWh/m²	270 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

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

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-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR Conversion (As Designed)   (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
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No improvements selected / applicable
```

SUMMARY FOR INPUT DATA
Calculation Type: Conversion (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016861	**Issued on Date**	30/11/2020
Assessment Reference	001	**Prop Type Ref**	
Property	Flat 1:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	53 E	**DER**	N/A	**TER**	N/A
Environmental	58 D	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	2.69	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

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: Conversion (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.35 m	47.00 m²	2.55 m
1st Storey:	11.10 m	12.03 m²	2.33 m

7.0 Living Area	27.86	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	277.17	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Existing wall	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.30	190.00	31.77	20.32
Dwarf Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.28	9.00	10.87	10.87
Wall to Void	Timber Frame	Timber framed wall (one layer of plasterboard)	0.28	9.00	15.20	15.20
Wall to hall	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.30	190.00	20.12	18.26

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	36.75

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	40.85

10.0 External Roofs

SUMMARY FOR INPUT DATA
Calculation Type: Conversion (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Roof Slope	External Slope Roof	Plasterboard, insulated slope	0.18	9.00	4.66	4.66
Roof plane	External Plane Roof	Plasterboard, insulated at ceiling level	0.16	9.00	4.30	4.30
Roof Void	External Plane Roof	Plasterboard, insulated at ceiling level	0.16	9.00	33.92	33.92
Flat roof	External Flat Roof	Plasterboard, insulated flat roof	0.18	9.00	6.12	6.12

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	12.03

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.25	20.00	47.00

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	12.03

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	1.60

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	[4] Wall to hall	West							1.86	
Front Windows	Window	[1] Existing wall	West	None	0.00					5.38	
Rear Windows	Window	[1] Existing wall	East	None	0.00					6.07	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	
17.0 Thermal Bridging	Default	
Y-value	0.150	W/m²K
18.0 Pressure Testing	No	

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	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0

Number of intermittent fans	2	
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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Appendix 3

Water Calculation – Flat 2.01

Part G Compliance Report

PROJECT DETAILS

Project Reference:
Client:
Property: Flay 2 : 01
Water Lane
Thurnham ME14 3LU

Local Authority:
Agent:

Assessor:	Energy Calculations Limited
Address:	7 Marine Avenue, Skegness
Contact:	01754 -761035
Software:	G-Calc 2015 version 3.0.2
Prepared on:	02-Dec-20

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 1 bed dwelling, as designed, achieves a water consumption of 109.9 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings					
Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	4	1.46	0.00	5.84
	Part flush vol.	2.6	2.96	0.00	7.7
WC(multiple fittings)	Average effective Flush vol. (litres)	0	4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (bath also present)	Flow rate (litres/min)	9	4.37	0.00	39.33
Bath only	Capacity to overflow (litres)		0.50	0.00	0
Shower only	Flow rate (litres/minute)		5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	5	0.44	10.36	12.56
Washing Machine	litres/kg dry load	8.17	2.1	0.0	17.16
Dishwasher	litres/place setting	1.25	3.6	0.0	4.5
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0

Total calculated use (litres/person/day)	115.27
Contribution from greywater (litres/person/day)	-
Contribution from rainwater (litres/person/day)	-
Normalisation factor	0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)	**104.9**
External water use	5.0
Total Water Consumption. (36(1)) (litres/person/day)	**109.9**

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	Taps	5 litres/min	1
Baths	Bath	170 litres to overflow	1
Dishwashers		1.25 litres/place	1
Washing Machines		8.17 litres/kg	1
Showers	Showers	9 litres/min	1
WC's	WC	4 / 2.6 litres flush vols.	1
Kitchen/Utility taps	Taps	5 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer ().
The completed table should be returned to the assessor: Energy Calculations Limited (Contact: 01754 -761035).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

Project ref: - Flay 2 : 01

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: ..... Signature: ..... Date: .....

------End of Report------