Energy and Sustainability Statement

Kingsley House, Crowsley Road, Shiplake, RG9 3LU

PR9657
Date: 10/05/2022

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Executive summary

ERS Consultants Ltd has been appointed to prepare an Energy & Sustainability Statement for the site at Kingsley House, Crowsley Road, Shiplake, RG9 3LU

The proposal is for the conversion of a building containing 4 flats to a building containing 6 flats which specifically are, 2 x 1-bedroom, 2 x 2-bedroom and 2 x 3-bedroom properties. This report will be focusing on implementing careful design and sustainability measures so that the project creates attractive residential units which will address the current housing need within the area

Proposed schedules of accommodation are as follows:

- 2 x 1-bedroom units
- 2 x 2-bedroom units
- 2 x 3-bedroom units

Total combined internal floor area for the habitable development: 945m²
(Drawings can be found in the appendix of this report)

This energy and sustainability report outlines the key measures to be incorporated in the design, in regards to sustainability, carbon emissions, renewable energy and environmental impact of the considered development in accordance and with guidance from the following documents and policies:

- South Oxfordshire District Council Policy DES10
- The National Planning Policy Framework (NPPF) July 2019

In line with South Oxfordshire's District Council Policy DES10, the development would need to achieve a 40% reduction in regulated CO_2 emissions against a Building Regulations (Part L 2013) compliant scheme.

In addition to the passive design and energy efficiency measures, this energy and sustainability statement will demonstrate that the low-noise, highly efficient Air Source Heat Pump will provide an increased carbon emissions reduction compared to the energy efficiency and passive measures alone.
A dynamic energy simulation has been undertaken to establish the energy consumption and carbon emissions of the proposed dwellings.

The methodology used to determine the expected operational CO_2 emissions for the development is in accordance with the National Planning Policy Framework (NPPF) three-step Energy Hierarchy and the CO_2 savings achieved for each step are outlined below:

Baseline – (CO2 emissions Part L 2013 of the Building Regulation)

Initially in the energy assessment, it must be established that the properties regulated CO_2 emissions comply with Part L 2013 of the Building Regulations using the approved compliance software SAP.

For the proposed development, the regulated baseline CO_2 emissions are **23.37tCO_2/year.**

Be Lean – Use less energy

The second step addresses reduction in energy demand, through the adoption of passive and active design measures with emphasis on a fabric first approach.

Emphasis will be put on the building's fabric performance in order to reduce energy consumption. By doing this, there will be less losses through the fabric, thus reducing the demand in heating and cooling. Fabric first measures include insulating the building beyond the minimum standards of the current Approved Document Part L 2013.

The proposed space conditioning and hot water system in the development consists of a highly efficient Air Source Heat Pump, serving as the main space and water heating.

With the addition of the lean fabric improvements the energy regulated CO_2 emissions are shown to reduce by **29.46%** from the baseline to **16.49tCO2/year** for the proposed development.

Be Clean – Supply energy efficiently

At this stage, a feasibility study is carried out to determine if a Combined Heat and Power (CHP) can be installed in the development. For this project, the installation of a CHP alongside an Air Source Heat Pump is not deemed as being suitable or feasible.

Because of the fact that a CHP is not going to be installed, the energy regulated CO_2 emissions is shown to remain the same as in the above step to **29.46%** from the baseline to **16.49tCO_2/year** for the proposed development.

Be Green – Use renewable energy

In the Be Green stage, renewable energy technologies and specifically solar PV panels are going to be installed in order the required reduction of 40% compared to the baseline to be achieved according to Policy DES10.

Therefore, the CO_2 emissions for the whole development are reduced to **40.69%** reduction from the baseline to **13.86 tCO_2/year.**

Energy & carbon demand summary

Table 1 Energy and Carbon Reductions

	Energy Consumption (kWh/Year)	Energy Savings from Baseline (%)	CO_2 Emissions (tCO_2/Year)	CO_2 Emissions Savings from Baseline (%)
Baseline	101,387		23.37	
Be Lean	31,763	68.67%	16.49	29.46%
Be Clean	31,763	00.00%	16.49	00.00%
Be Green	26,703	04.99%	13.86	11.24%
Total Reduction		**73.66%**		**40.69%**

Table 1: Breakdown of energy consumption and CO_2 emissions for the baseline and the proposed schemes after 'Lean' measures are implemented.

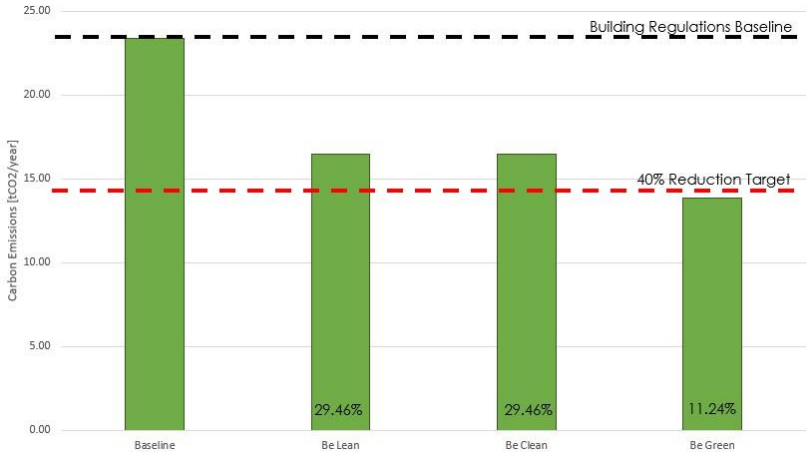


Fig.1 CO_2 Reduction

Table 1, the provisional baseline annual energy consumption of the development has been estimated to be **101,387kWh/year** and the resulting annual carbon dioxide emissions are **23.37 tCO_2/year**.

The incorporation of energy saving measures and renewable energy sources in the site, following the South Oxfordshire local plan guidance, would reduce the energy requirement and CO_2 emissions to **26,703kWh/year** and **13.86 tCO_2/year**, respectively.

The total reduction with "Be Lean", "Be Clean" and "Be Green" measures would result in a total of **40.69%** reduction from the Part L 2013 Building regulations baseline as shown in Figure 1, thus achieving the required target.

Table 2. Proposed Specifications

Proposed Specifications			
Fabric	U-Value (W/m^2K)	Walls	0.30 (External Wall) 0.30 (Basement Wall)
		Floors	0.25 (Ground Floor) 0.25 (Basement Floor)
		Roof	0.16 (Pitched, insulated @ joist)
		Windows / Rooflights	1.60 Double glazed units, Low-E Soft Coat;
		Doors	1.80 Solid or Minimally Glazed
Air permeability	Q (m^3/m^2h)	N/A	
Space Heating	Air Source Heat Pump	Air Source Heat Pump to Radiators; Mitsubishi Ecodan 8.5kW PUZ-WM85VAA; OR Mitsubishi Ecodan 14.0kW PUZ-HWM140YHA; Model only indication, to be sized and installed by qualified professionals;	
Controls	Time and Temperature Zone Control;		
Water Heating	From main heating; 150-litre domestic hot water cylinder (1 Bedroom Flats); OR 200-litre domestic hot water cylinder; (2 and 3 Bedroom Flats)		
Thermal Bridging	N/A;		
Lighting Systems	Lighting type	100% LED Lighting, throughout;	
Renewables	Photovoltaic Panels	6.00kW of solar PV panels installed in Southwest orientation;	
This specification is a recommendation but may change during the construction stage, to meet site constraints, any worsening of the u-values must ensure the required 40% reduction in Carbon is met before completion;			

Introduction

Site & proposal

The site is located at Kingsley House, Crowsley Road, Shiplake, RG9 3LU. The total development measures internally, approximately 945.00m^2 in area and will consist of 2 x 1-bedroom, 2 x 2-bedroom and 2 x 3-bedroom properties.

The approximate site location of the proposed development is shown in the site plan Figure.2.

Fig.2 Site Plan

Policy context

This energy and sustainability statement will seek to respond to the energy policies that apply to this development. The most relevant applicable energy policies in the context of the proposed development are presented below.

- South Oxfordshire District Council Policy DES10
- The National Planning Policy Framework (NPPF) July 2019

All the aforementioned polices focus on zero carbon targets for residential developments with a minimum 40% on site reduction beyond Part L 2013.

Calculation methodology

The sections below present the methodology followed in determining carbon emissions reduction savings for the proposed scheme.

The methodology employed by the energy and sustainability statement is in line with the GLA's Guidance on preparing energy assessments.

The baseline CO_2 emissions are first established, i.e., the emissions of a scheme that is compliant with Part L 2013 of the Building Regulations.

The approved software used to model and calculate the energy performance and carbon emissions is Design SAP 2012 version 4.14r19 by Elmhurst Energy Systems Ltd.

The TER which is used as the baseline figure for the carbon reductions for each non-domestic element is multiplied by its floor area to establish the total emissions.

Similarly, the DER is calculated in the same method to determine the energy performance and CO_2 emissions of the proposed scheme for each of the steps of the Energy Hierarchy.

Baseline:

The development's baseline uses the notional fabric specification and the heating system in the baseline model which is a gas boiler. In order to get an accurate carbon reduction, we look at the development target emission rate fuel factor of gas, to coincide with proposed heating systems to the development.

Be Lean: use less energy

The demand for energy is reduced through a range of passive and active energy efficiency measures; as part of this step the development's fabric u-values, thermal bridging, air tightness and glazing have been improved to a high standard; Also, a highly efficient, low-noise Air Source Heat Pump is installed in the development.

Be Clean: supply energy efficiently

At this stage, because the installation of a CHP system has not deemed feasible, the percentage % improvement compared to the baseline will remain the same.

Be Green: use renewable energy

In the Be Green stage, renewable energy technologies and specifically solar PV panels are going to be installed in order the required reduction of 40% compared to the baseline to be achieved according to Policy DES10.

The Conclusion at the end of the report summarizes the energy strategy and associated carbon savings for the proposed development.

The carbon emissions factors used in all calculations in this document are those used for Part L of the Building Regulations. The relevant factors are reproduced in Table 3 below.

Table 3 Carbon Emission Factors for selected fuel type

Fuel	CO_2 emission factor ($kgCO_2/kWh$)
Mains Gas	0.216 kgCo2/kWh
Bulk LPG	0.241 kgCo2/kWh
Heating Oil	0.298 kgCo2/kWh
Wood Pellets	0.039 kgCo2/kWh
Grid Electricity	0.519 kgCo2/kWh

* Table extracted from the document SAP 2012 version 9.92 (October 2013), Table 12: Fuel prices, emission factors and primary energy factors, Page 225. This can be found in the appendix of the report.

The emission factors and primary energy factors in Table 12 are for a 3-year projection 2013-2015. Factors for a 15-year projection, which may be relevant to consideration of longer-term impacts, are given on www.bre.co.uk/sap2012

Be Lean – Use less energy

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water, and lighting. Measures to reduce the risk of overheating will also be put in place.

At the Be Lean stage, the saving in regulated carbon emissions from the baseline is **29.46%** for the development, resulting in a total production of **16.49 tCO_2/year.**

Passive design measures

Building materials

The key issues to be addressed in the selection of materials and equipment are:

- Use of materials and equipment from sustainable sources
- Minimization of in-use environmental impacts
- Minimization of embodied environmental impacts
- Use of materials and equipment with high recycled content

Enhanced U-values

The heat loss of different building fabric elements is dependent upon their U-value. A building with low U-Values provide better levels of insulation and reduced heating demand during the cooler months. The proposed development will incorporate high levels of insulation and high-performance glazing beyond Part L 2013 targets and notional building specifications, to reduce the demand for space conditioning (heating and/or cooling). Table 4 demonstrates the improved performance of the proposed development's fabric beyond the Building Regulations requirements.

Table 4 Proposed fabric U-Values

Domestic (U-Values in W/m²k)		
Element	**Part L 2013 Building Regulation**	**Proposed**
Wall	0.30	0.30 (External Walls) 0.30 (Basement Walls)
Floor	0.25	0.25 (Ground Floor) 0.25 (Basement Floor)
Roof	0.20	0.16 (Pitched, insulated @ joist)
Windows	1.60	1.60
Doors	1.80	1.80
These u-values are recommended but may change during the construction stage, to meet site constraints, any worsening of the u-values must ensure the required 40% reduction in Carbon is met before completion;		

Air tightness improvement

Heat loss may also occur due to air infiltration and exfiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration.

An Air Pressure test is not currently required and SAP default value has been used for the purpose of this report **(15.00m³/m².h at 50Pa)**.

Reducing the need for artificial lighting

The development has been designed to maximise daylight in all habitable spaces as a way of improving the health and wellbeing of its occupants.

All of the habitable areas will benefit from large areas of glazing to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.

Materials and Waste

A site waste management plan that provides details of waste minimisation, sorting, reuse and recycling procedures is required for all levels in the planning guidance. Sustainable waste management should follow the hierarchy described in *BS 5906: Waste management in buildings. Code of practice*. This outlines the following principles in decreasing order of desirability:

- Reuse land and buildings wherever feasible and consistent with maintaining and enhancing local character and distinctiveness.
- Reuse and recycle materials that arise through demolition and refurbishment, including the reuse of excavated soil and hardcore within the site.
- Prioritise the use of materials and construction techniques that have smaller ecological and carbon footprints, help to sustain or create good air quality, and improve resilience to a changing climate where appropriate.
- Incorporate green roofs and/or walls into the structure of building, where feasible, to improve water management in the built environment, provide space for biodiversity and aid resilience and adaptation to climate change.
- Consider the lifecycle of the building and public spaces, including how they can be easily adapted and modified to meet changing social and economic needs and how materials can be recycled at the end of their lifetime.
- Space is provided and appropriately designed to foster greater levels of recycling of domestic and commercial waste.

Active design measures

High efficiency & low energy lighting

Where artificial lighting will be needed it will be low energy lighting without compensating for luminance, and will accommodate LED.

Water

Proposals for new residential development are to meet the higher water efficiency standard within Building Regulations Part G2 of water consumption target of 110 litres per person per day. The Building Regulations regulation requirement, 110 litres/ person is recommended for a new development within the Oxford area. This will be achieved by applying various water efficiency and reclamation / recycling measures.

Appendix of this report shows a model water calculation has been provided as a guide on how should achieve this standard.

Water Efficiency Measures

The following measures will be used to reduce the quantity of water demand to satisfy end users:

- Dual or low flush WCs
- Spray or aerating taps
- Water efficient appliances
- Low flow showers
- Smaller size bath

Water Reclamation / Recycling Measures

- Rainwater collection

Water collected from roofs or hard surfaces such as car parks can be harvested for storage and use for non-potable uses such as watering gardens and WC flushing.

Controls and Monitoring

Advanced lighting and space conditioning controls will be incorporated, specifically:

- For areas of infrequent use, occupant sensors will be fitted for lighting, whereas day lit areas will incorporate daylight sensors where appropriate;
- Heating and cooling systems controls will comprise time and temperature controls, both centrally for the whole building, and locally for each space;
- Smart metering to be installed on the new dwellings for adequate monitoring;

Overheating Risk analysis

The potential risk of overheating was assessed via the Part L Building Regulation compliance tool SAP. All domestic areas have been found to pass Criterion 3 'Limiting Solar Gains' of Part L. The SAP output(s) for all domestic areas can be found in Appendix – SAP Results.

Be Lean CO_2 emissions & savings

By means of energy efficiency measures alone, regulated CO_2 emissions are shown to reduce by **29.46% (to 16.49tCO_2/year)** from the baseline for the development.

Be Clean – Supply energy efficiently

On that stage, the regulated CO2 emissions are shown to remain **29.46% (to 16.49tCO2/year)** from the baseline for the development.

Combined Heat and Power (CHP)

The presence of a year-round base hot water generation heat load in residential units is favourable to CHP. To date, there are readily available micro gas fired CHP units (such as EC power) on the market. At this stage gas fired CHP will be provisionally incorporated into the development's LZC strategy, however, the carbon reductions due to CHP are extremely sensitive to the system design, unit selection and running time.
CHP (Combined Heat & Power) is a great technology to use, however the system itself needs to run on a 24-hour basis. The heat generated would be exceeding the demand and needs for this site, and would require to have an outlet area which can profit from this excess; however, this development does not have a space that benefit from this, therefore this option has considered not feasible for this development.

Be Green – Use renewable energy

Renewable technologies feasibility study

Methods of generating on-site renewable energy (Green) were assessed, once Lean and Clean measures were considered. However, the CO_2 emission reduction levels to achieve compliance were achieved on the previous (Be Lean) stage.

This section provides an overview of the technologies which can be considered, a brief assessment of their feasibility and a proposed mixture of suitable technologies.

The development will benefit from an energy efficient building fabric which will reduce their energy consumption.

A range of renewable technologies were subsequently considered including:

- Biomass;
- Ground/water source heat pumps;
- Wind energy;
- Photovoltaic panels, and,
- Solar thermal panels.

In determining the appropriate renewable technology for the site, the following factors were considered:

- CO_2 savings achieved;
- Site constraints;
- Financial benefit
- Any potential visual impacts

Demand profiles

Keeping in mind that the space heating energy demand changes according to the season. While hot water energy demand will provide a significant base load throughout the year.

Electrical demand is likely to be moderate throughout the year. Lighting loads will be highest during the evening but will continue at reduced levels throughout the night and during the day.

Feasibility

At this early stage in the design, it is possible only to outline the likely feasibility of specific technologies. Further descriptions of the LZC technologies below are included in Appendix A.

Table 5. Renewable and Low Zero Carbon Technologies

Renewable Technology	Comments	Lifetime (Years)	Maintenance	Impact on External Appearance	Site Feasibility	Adopted for Site
BIOMASS	Burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20	High	High	3	☐
PV	PV panels would generate significant carbon savings, whilst having minimal impact on the appearance of the building and no adverse impact on the amenity of neighboring buildings.	25	Low	Med	9	☐
Solar Thermal	Solar thermal array mounted on the roof would conflict with the savings made if a CHP unit were to be installed.	25	Low	Med	4	☐
Heat Pump	The installation of ground loops requires significant space, which is not available at the proposed dwellings, so an air source heat pump is recommended to be installed	20	Med	Low	5	☒
Wind	Due to insufficient open area for installation of a stand-alone wind turbine and planning issues this option has not considered in the development.	25	Med	High	3	☐

Feasibility of alternative solutions

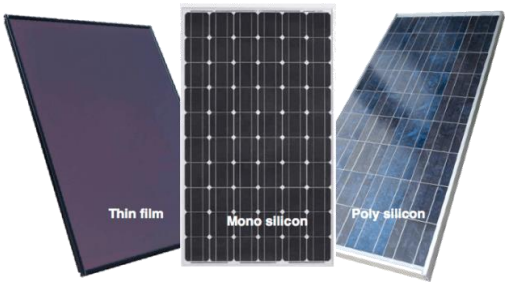


Fig 3. Photovoltaic Panels

Four types of solar cells are available on the market at present and these are mono-crystalline, polycrystalline, thin film and hybrid panels as seen in figure 3. Although mono-crystalline and hybrid cells are the most expensive, they are also the most efficient with an efficiency rate of 12-20%. Poly-crystalline cells are cheaper but they are less efficient (9-15%). Thin film cells are only 5-8% efficient but can be produced as thin and flexible sheets.

1.00 kWp (Kilo Watt Peak) of PV panels can produce approximately 850 kWh/ year of electricity in this region, reducing the grid energy requirement and CO_2 emissions.

Photovoltaic Panel is considered a suitable technology for this development as the development provides an extent of roof space for the installation of PV panels. In addition to this the PV arrays are relatively easy to install when compared to other renewable systems and provide a significant amount of CO_2 savings.

The PV shall comprise of 6.00 kWp of South Western facing arrays; Table 13 summarizes the technical data for the proposed PV array. In total, the PV installation would produce a further regulated CO_2 savings of 11.24% for the development.

Table 13. Proposed PV Specifications

Photovoltaic Panels	
Module Efficiency	15%
Panel Orientation	South-Western;
Tilt	45°
Array Area (approximately)	Approximate Total 36.00m^2
Total power to be installed	6.00 KWp
Energy Generation	5,157.84 KWh/yr
Total CO_2 savings	**2,676.92 KgCO_2/yr**

Be Green CO_2 emissions & savings

The incorporation of renewable technologies will further reduce CO2 emissions by a further **40.69% (13,86tCO2/year)** for the development compared to the baseline.

Flood zone risk assessment for planning

The Environment Agency has developed a flood risk map for planning to identify the relative risk of flooding for proposed development planning locations. Flood zones assume that no defenses are present and so where these do exist, they are only indicative of the potential for flooding.

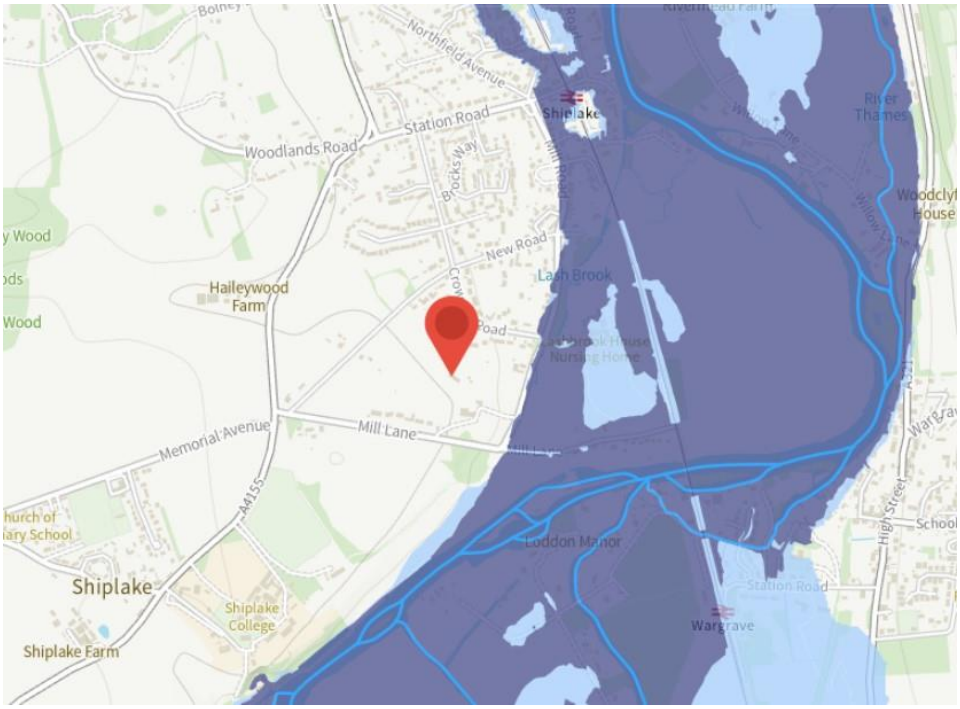


Fig.5 Environment Agency Flood Zone Interactive Map

The whole of the development lies within flood zone 1 of the Environment Agency's flood risk map as seen in Figure. 5, the land located within flood zone 1 is at low risk of flooding having an associated annual probability of flooding of less than 1 in 1000 (0.1%).

Study approach

In accordance with Planning Practice Guidance for Flood Risk document, land within flood zone 1 is suitable for all uses. Assessment of this site has been based upon the Environment Agency's flood interactive map, the topographical site survey and the architect's proposed development layout.

Flood vulnerability

Based on the Environment Agencies flood map, the development site is located within Flood Zone 1 and in accordance with Planning Practice Guidance for Flood Risk neither a sequential or exception test is required.

Post-Occupancy Monitoring

With regards to the continued monitoring of the 'as-built' performance of the buildings, Policy DES10 does not prescribe a one-size-fits-all approach, leaving applicants the flexibility to decide to how this could take place. As the council is keen to continue post construction testing, to verify the performance of the building, the as-built SAP calculations must fall in line with what is specified in the energy statement, and that the reduction in carbon emissions is still met.

This is beneficial as consistent monitoring and verification can lead to energy and monetary savings being made by the developer and owner/occupier of the property. This information could also be shared by the developer to prove that a high standard of home construction and design is present in their work, and that green systems and measures are used effectively.

Along with as-built SAPs that prove the as-built dwelling is built to the specification within this energy statement, the installation of smart metering (for example) would allow regular monitoring of energy usage.

Conclusion

Following the implementation of the three-step Energy Hierarchy, the regulated CO_2 savings for the site are estimated at **40.69%** for the development, against a Part L 2013 compliance scheme.

Overall, the proposed development has been designed to meet energy policies set out by the South Oxfordshire plan requirements, which demonstrates the client and the design team's commitment to enhancing sustainability of the scheme.

Table 7 summarises the implementation of the Energy Hierarchy for the proposed scheme and detail the CO_2 emissions and savings against the baseline scheme for each step of the hierarchy as well as the savings achieved through the carbon offset. In addition to the above, a total site average is calculated which meets the 40% Carbon reduction over a Part L1A 2013 baseline, requirements as set by South Oxfordshire Local Plan DES10.

Table 7. CO_2 emissions after each step of the Energy Hierarchy for the proposed development

	CO_2 Emissions (tCO2/yr)	**CO_2 Emissions Savings per Step (%)**
Baseline	23.37	
Be Lean	16.49	29.46%
Be Clean	16.49	00.00%
Be Green	13.86	11.24%
Total Site Reduction achieved		**40.69%**

Based on the results and outline figures, the proposed development, will satisfy the relevant policies for sustainable design and construction requirements of energy consumption and carbon emissions.

The energy demand and carbon emissions, could be reduced by introducing a combination of passive design measures and energy efficient systems. Based on the calculations and results achieved when those measures were applied, the development achieved a total site reduction of **40.69%** in regulated CO_2 emissions. This is from the baseline according to the 2013 Regulations (Figure 1).

The new houses will be designed with a high level of insulation and low air permeability to reduce heat loss as much as is practically possible. Also, the use of low energy lighting and A – Rated White goods are essential for the reduction of energy

consumption. Moreover, the control strategy must be carefully designed to ensure the most economically viable operation of all equipment throughout the development.

In order to achieve the required reduction of carbon emissions, several options were considered, however the best option in regards to the site location and the development size, was the selection of highly efficient Air Source Heat Pump to serve as the main heating system. The highly efficient Air Source Heat Pump with solar PV panels were enough in order to achieve the 40% reduction of the CO2 emissions without installing any on-site renewable energy sources.

The fabric specification and U-values in this report are recommended but may change during the construction stage to meet the site constraints. Any worsening of the U-values must ensure the required 40% reduction in carbon emissions is met before completion.

The proposed development site is not in close proximity to an existing heat network, meaning this was not a viable solution to improve the heating system in the development at present. CHP (Combined Heat & Power) is an efficient system to use for a new development. However, due to the low energy demands of the development and the lack of additional space required for this technology, it would not be a feasible or sensible solution.

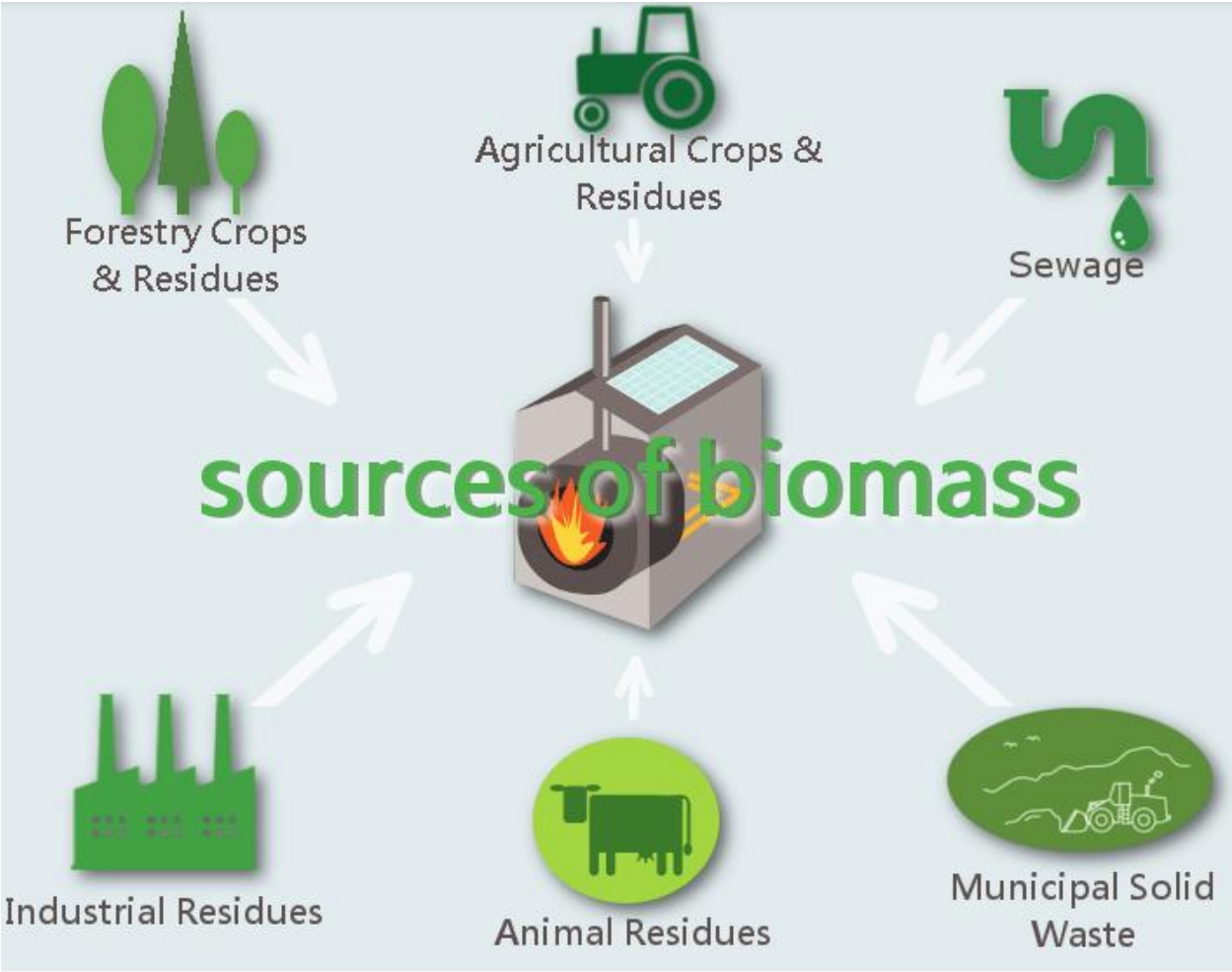
The baseline annual energy consumption of the development has been calculated to be **101,387 kWh/yr** and **23.37 tCO_2/yr**. By incorporating highly efficient Air Source Heat Pump and solar PV panels, the total CO_2 emissions will be reduced to **13.86 tCO_2/yr**, which is equivalent to a **40.69%** reduction over Building Regulation Part L1 2013.

Appendix A - Low or Zero Carbon Energy Sources

Biomass As a fuel

Biomass is a renewable energy source, generated from burning wood, plants and other organic matter, such as manure or household waste. It releases CO2 when burned, but considerably less than fossil fuels. We consider biomass a renewable energy source, if the plants or other organic materials being burned are replaced.

Biomass is known for its versatility, given it can be used to generate heat, electricity, be used in combined heat and power units and be used as liquid fuel. In domestic settings, it tends to be found in the form of wood-fuelled heating systems.



Geothermal Energy:

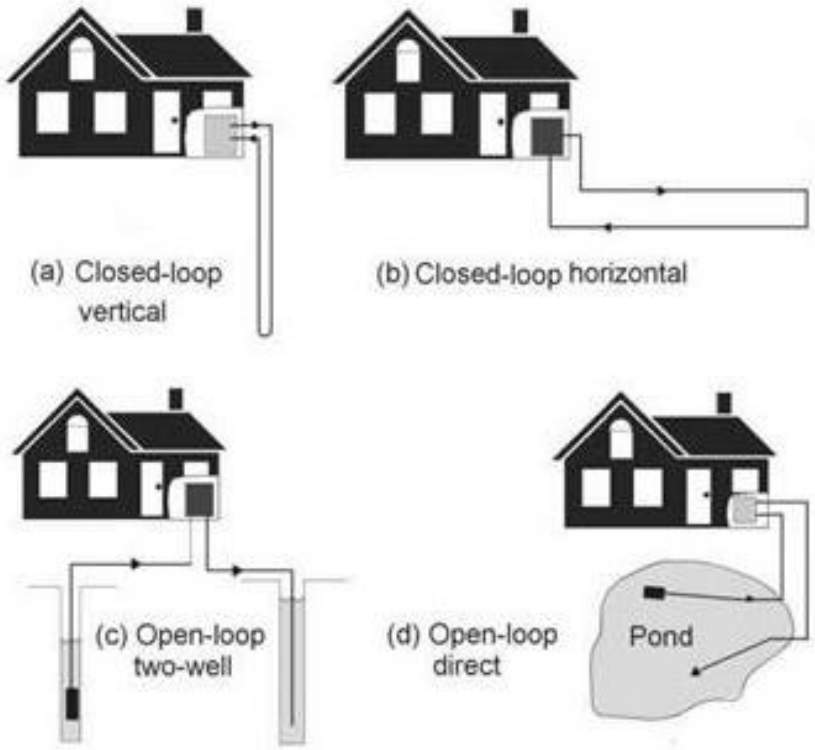
Geothermal energy technologies use the heat energy stored in ground; either for direct-use applications: such as using the grounds' heat to defrost a driveway or the indirect use with additional equipment such as a geothermal heat pump. Most

commercial installations couple a heat pump with the ground to upgrade the low-grade heat from the ground or ground water to a higher-grade heat, where it can be used for heating purposes.

The suitability of a ground source system depends heavily on the type of earth coupling heat exchange system used:

Ground source earth coupling options

The right choice of appropriate heat exchanger depends on several factors such as: size of space heating/hot water system, available site area for the heat exchangers, and local ground conditions. Due to the specialist nature of this technology, we recommend that a specialist is employed to size the heat exchangers based on a desk-top study of the site's geological conditions – this normally being required in advance of any other contractor appointment.



Vertical Closed Loop System

A frequently used and simple ground source heat exchanger, for a small to medium size project, is a closed loop vertical system. The system comprises of vertically drilled boreholes, usually up to 100 m deep, into which are inserted two polyethylene pipes with a U-shape connector at the base of the hole – effectively providing a flow down to the bottom of the hole and return back up to the surface. All the flow and return loops

are connected together across the site - completing the entire heat exchange loop. Water is pumped around the loop and is then circulated around the heat pump to achieve the required heat exchange. The distance between boreholes is dependent on ground conditions but is typically a minimum of a 6mx6m grid, to prevent overlapping of the heat exchange process between loops.

Horizontal Closed Loop System

Horizontal closed loop heat exchangers are usually applied to small projects such as individual houses, which usually require a relatively low heat output. Consisting of horizontal trenches 1.5-2m deep, with either straight pipes or 'slinky' coiled pipes, these require significant excavation work and significant site area to achieve appreciable outputs as such are not normally suited to medium to large projects.

Vertical Open Boreholes System

A further option is a vertical open borehole system. The system involves the abstraction and discharge of natural ground water using boreholes; into which pumps are inserted, connected to collapsible pipework. Each borehole pump abstracts ground water, circulates it around the heat pump and then discharges the water back to the ground via an absorbing well, some distance from the original abstraction borehole. The system is capable of providing very high rates of heat exchange for a relatively small number of boreholes, which makes it very efficient in terms of site area required. However, this depends greatly on the availability of ground water, which in turn varies according to location. A major downside of this system is that the extraction of water from deep boreholes via pumps consumes a lot of energy, as the water has to be physically lifted to the surface by the pump – this in effect reduces the carbon emissions saved by this system as a whole.

Ground source heat exchange options in summary:

Vertical loop system - closed boreholes

- moderate heat capacity
- relatively low installation cost

Vertical open system - open boreholes

- high heat capacity
- high running energy
- high installation cost

Horizontal loop system – straight pipes

- low capacity,
- high installation cost
- extensive ground excavation work

Horizontal coiled loop system – 'slinky' pipes

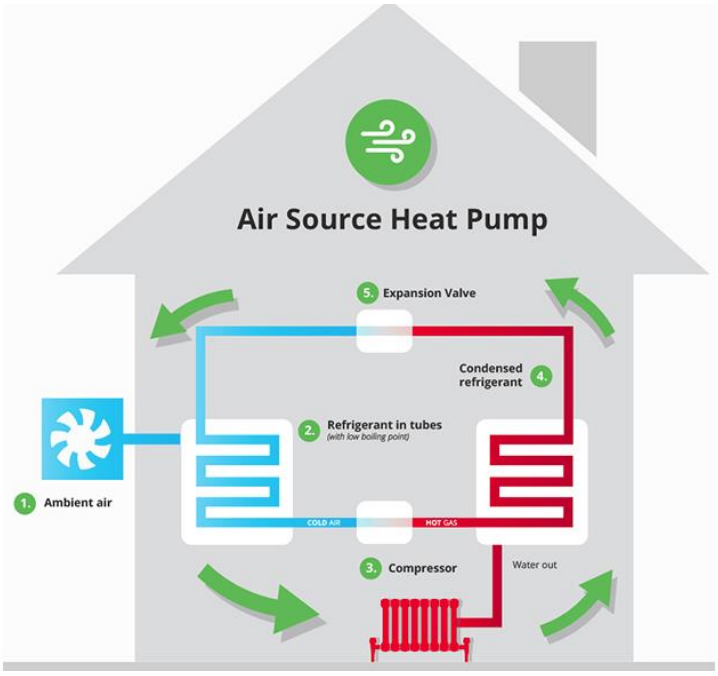
- good capacity
- low installation cost
- extensive ground excavation work

Air Source Heat Pumps

Heat pumps are basically refrigeration units which work in reverse – instead of cooling being produced and heat rejected, the unit produces heat and rejects cooling. Conventional heat pumps use air as the medium to reject this 'coolth' to atmosphere. Ground source units use the ground as a means of improving the unit efficiency because the ground is a constant 11-13 °C at depths of 50m down – this suits the heat pump much better during the coldest weather than the extremes of air temperature. Reversible heat pumps can also be used for cooling; however, this is not being considered further for this project.

A heat pump consumes electrical power to drive the compressor and other ancillary elements. The ratio between total energy input and heat energy output of the heat pump is a measure of its efficiency – usually referred to as 'Coefficient of Performance' - COP. A ground source heat pump has a higher COP than an air cooled heat pump – this additional energy effectively being the grounds' natural contribution to the system.

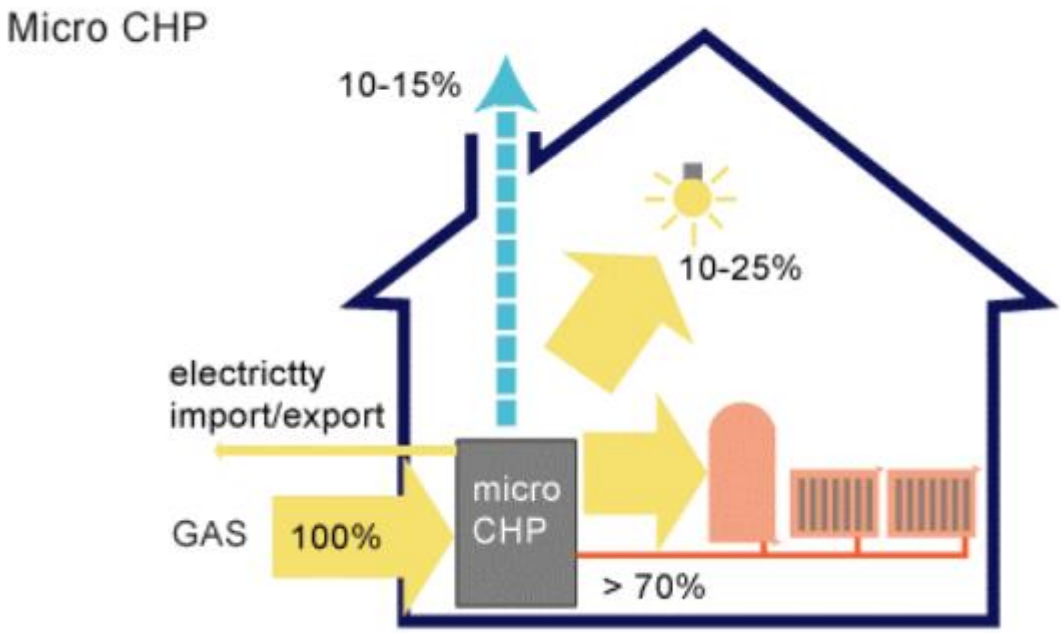
The heat produced by a heat pump is usually used to either provide space heating say to underfloor heating or radiators or the heat is used to generate domestic hot water via a storage vessel.



CHP

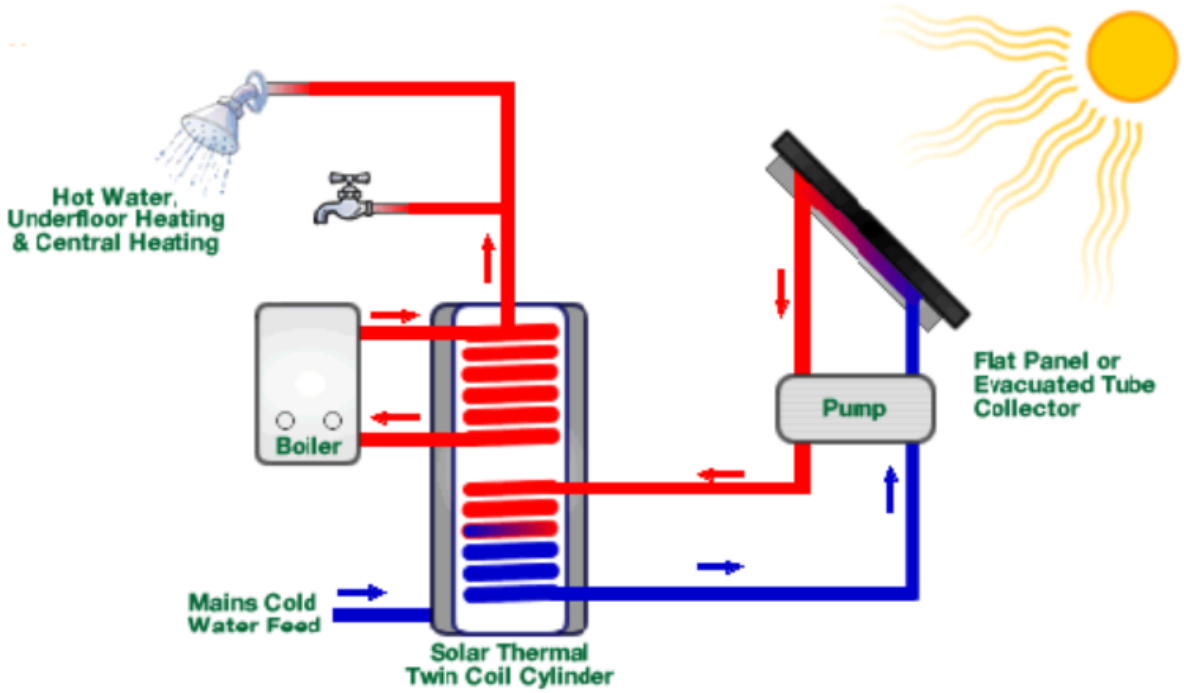
Combined heat and power (CHP) is a process involving simultaneous generation of heat and electricity, where the heat generated in the process in harnessed via heat recovery equipment. CHP at the large commercial size is now fairly common in premises which have a simultaneous demand for heating and electricity for long periods, such as hospitals, recreational centers and hotels. In addition, small CHP systems are now becoming available for individual houses, group residential units and small non-domestic premises. Compared with using centrally generated electricity supplied via the grid, CHP can offer a more efficient and economic method of supplying energy demand, if installed and operated appropriately, owing to the utilization of heat which is normally rejected to the atmosphere from central generating stations, and by reducing network distribution losses due to local generation and use.

Heat generated will be used for space and water heating, and additional heat storage may be used to lengthen use periods, to assist in warm-up and to improve overall energy efficiency. For overall good energy efficiency, as with all CHP, usage must be heat demand led. Thus, a sophisticated control system is required and users should be made aware of efficient operating practices.



Solar thermal collectors

Solar thermal collectors (flat plate or evacuated tubes) convert solar thermal energy into heat for hot water generation. These are usually located on a roof oriented south facing in an ideal slope of 45 degree. Solar collectors properly sized and designed provide approx 50% of annual hot water demand.



Photovoltaic

Photovoltaic modules convert sunlight directly into DC electricity and can be integrated into buildings. Photovoltaics (PVs) are distinct from other renewable energy technologies since they have no moving parts to be maintained and are silent. PV systems can be incorporated into buildings in various ways: on sloped roofs and flat roofs, in façades, atria and shading devices. Modules can be mounted using frames or they can be fully incorporated into the actual building fabric; for example, PV roof tiles are now available which can be fitted in place of standard tiles.

Currently, a PV system will cost between £1500 and £2500 per kWp, and frequently part of this cost can be offset owing to the displacement of a conventional cladding material. Costs have fallen significantly since the first systems were installed (1980s) and are predicted to fall further still.

While single crystal silicon remains the most efficient flat plate technology (15–16% conversion efficiency); it also has the least potential for cost reduction. PV cells made from poly-crystalline silicon have become popular as they are less expensive to produce, although they have a slightly lower efficiency.

Thin film modules are constructed by depositing extremely thin layers of photosensitive materials on a low-cost backing such as glass, stainless steel or plastic. As much less semiconductor material is required as for crystalline silicon cells, material costs are potentially much lower. Efficiencies are much lower, around 4–5%, although this can be boosted to 8–10% by depositing two or three layers of thin film material. Thin film production also requires less handling as the films are produced as large, complete modules and not as individual cells that have to be mounted in frames and wired together. Hence, there is the potential for significant cost reductions with volume production.

Since PVs generate DC output, an inverter and other equipment is needed to deliver the power to a building or the grid in an acceptable AC form. The cost of the inverter and these 'Balance Of System' (BOS) components can approach 30% of the total cost of a PV system. Hence, simplification and cost reductions in these components over the coming years will also be necessary to make PV systems affordable.

Wind energy

Wind power is the most successful and fastest spreading renewable energy technology in the UK with a number of individual and group installations of varying size, capacity and location. Traditionally, turbines are installed in non-urban areas with a strong trend for large offshore wind farms. In parallel with the design and development of ever-bigger machines, which are deemed to be more efficient and cost-effective, it is being increasingly recognized that smaller devices installed at the point of use, i.e. urban settings, can play an important role in reducing carbon emissions if they become mainstream.

At present there is a wide range of available off-the-shelf wind products, many manufactured in the UK and EU with proven good performance and durability. The dominant type is horizontal axis wind turbines (HAWT), which are typically ground mounted. Vertical axis wind turbines (VAWT) have limited market presence and there is a trade-off between lower efficiency and potentially higher resistance to extreme conditions. Capacity ranges from 500W to more than 1.5MW, but, for practical purposes and in built-up areas in particular, machines of more than 1kW and below 500kW are likely to be considered.
Wind technology is also currently one of the most cost-effective renewable energy technologies, which is attributable to the large scale of installations reducing the unit output cost. Individual building or community wind projects, although smaller, have the advantage of feeding electricity directly into the building's electricity circuit, thus sparing costly distribution network development and avoiding distribution losses. The downside is the still high capital cost per kW installed for smaller turbines, plus location constraints, such as visual intrusion and noise. The wind regime in urban areas is also a concern owing to higher wind turbulence which reduces the potential electricity output.

In most cases, wind turbines are connected to the electricity grid and all generated energy is used regardless of the building demand fluctuations. The output largely depends on the wind speed and the correlation between the two is a cube function. This means that in short periods of above-average wind speeds the generation increases exponentially. As a result, it is difficult to make precise calculations of the annual output of a turbine, but average figures can provide useful guidance to designers and architects. In reasonably windy areas (average wind speed of 6m/s) the expected output from 1kW installed is about 2500kWh annually.

The cost per kW installed varies considerably by manufacturer and size of machine with an indicative bracket of £2,500–£5,000. With a lifespan of more than 20 years, wind turbines can save money if design and planning are carried out in a robust way.

Building-integrated wind turbines are starting to be a reality in the UK, but potential projects may face difficulties with obtaining planning permission. There are a few examples now of permitted development rights for certain rooftop turbines in some local councils. A number of horizontal axis devices specifically designed for building integration are now available commercially, having design and reliability parameters relevant to the urban context. Building-mounted vertical axis devices are under development. At present, turbines installed near buildings, as well as community installations for groups of buildings, should be regarded as the larger wind energy source related to buildings, when they contribute to the carbon emissions from these premises using 'private wire' networks. However, the contribution of several building-

integrated turbines in a development is likely to become significant in the next few years.

Appendix B-Fuel prices and emission factors

Table 12: Fuel prices, emission factors and primary energy factors

Fuel	Standing charge, £ [a]	Unit price p/kWh	Emissions kg CO_2 per kWh [b]	Primary energy factor	Fuel code
Gas:					
mains gas	120	3.48	0.216	1.22	1
bulk LPG	70	7.60	0.241	1.09	2
bottled LPG		10.30	0.241	1.09	3
LPG subject to Special Condition 18 [c]	120	3.48	0.241	1.09	9
biogas (including anaerobic digestion)	70	7.60	0.098	1.10	7
Oil:					
heating oil		5.44	0.298	1.10	4
biodiesel from any biomass source [d]		7.64	0.123	1.06	71
biodiesel from vegetable oil only [e]		7.64	0.083	1.01	73
appliances able to use mineral oil or biodiesel		5.44	0.298	1.10	74
B30K [f]		6.10	0.245	1.09	75
bioethanol from any biomass source		47.0	0.140	1.08	76
Solid fuel: [g]					
house coal		3.67	0.394	1.00	11
anthracite		3.64	0.394	1.00	15
manufactured smokeless fuel		4.61	0.433	1.21	12
wood logs		4.23	0.019	1.04	20
wood pellets (in bags for secondary heating)		5.81	0.039	1.26	22
wood pellets (bulk supply for main heating)		5.26	0.039	1.26	23
wood chips		3.07	0.016	1.12	21
dual fuel appliance (mineral and wood)		3.99	0.226	1.02	10
Electricity: [a]					
standard tariff	54	13.19	0.519	3.07	30
7-hour tariff (high rate) [h]	24	15.29	0.519	3.07	32
7-hour tariff (low rate) [h]		5.50	0.519	3.07	31
10-hour tariff (high rate) [h]	23	14.68	0.519	3.07	34
10-hour tariff (low rate) [h]		7.50	0.519	3.07	33
18-hour tariff (high rate) [h]	40	13.67	0.519	3.07	38
18-hour tariff (low rate) [h]		7.41	0.519	3.07	40
24-hour heating tariff	70	6.61	0.519	3.07	35
electricity sold to grid		13.19 [i]	0.519	3.07	36
electricity displaced from grid			0.519 [i]	3.07 [i]	37
electricity, any tariff [j]					39
Community heating schemes: [k]	120 [l]				
heat from boilers – mains gas		4.24	0.216	1.22	51
heat from boilers – LPG		4.24	0.241	1.09	52
heat from boilers – oil		4.24	0.331 [m]	1.10	53
heat from boilers that can use mineral oil or biodiesel		4.24	0.331	1.10	56
heat from boilers using biodiesel from any biomass source		4.24	0.123	1.06	57
heat from boilers using biodiesel from vegetable oil only		4.24	0.083	1.01	58
heat from boilers – B30D [f]		4.24	0.269	1.09	55
heat from boilers – coal		4.24	0.380 [n]	1.00	54
heat from electric heat pump		4.24	0.519	3.07	41
heat from boilers – waste combustion		4.24	0.047	1.23	42
heat from boilers – biomass		4.24	0.031 [o]	1.01	43
heat from boilers – biogas (landfill or sewage gas)		4.24	0.098	1.10	44
waste heat from power station		2.97	0.058 [p]	1.34	45
geothermal heat source		2.97	0.041	1.24	46
heat from CHP		2.97	as above [q]	as above [q]	48
electricity generated by CHP			0.519 [i]	3.07 [i]	49
electricity for pumping in distribution network			0.519	3.07	50

Appendix C, D, E and F

This appendix contains the following reports used in producing the content of this Energy and Sustainability Statement.

*Appendix C-*Flood risk map for planning to show the location of the site with regards to the relevant flood zone areas.

Appendix D- Floor plan and elevations used to produce SAP Calculation for this development.

Appendix E- SAP calculation reports for the development used to base the calculations on this report.

Appendix F- Sample water efficiency calculations to demonstrate how the required target suggested could be achieved.

Flood map for planning

Your reference	Location (easting/northing)	Created
FL	**477317/178975**	**10 May 2022 9:51**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms

Environment Agency

Flood map for planning

Your reference
FL

Location (easting/northing)
477317/178975

Scale
1:2500

Created
10 May 2022 9:51

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

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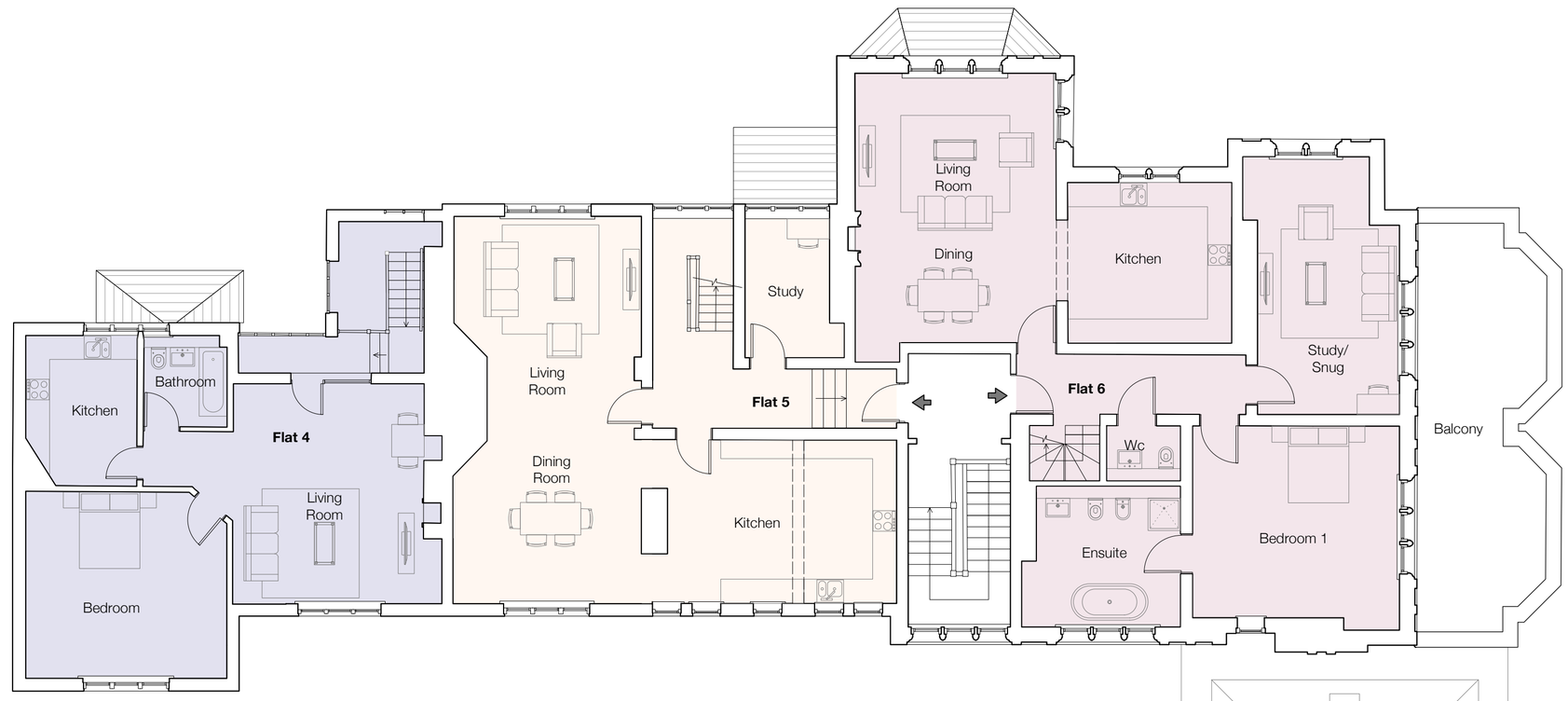
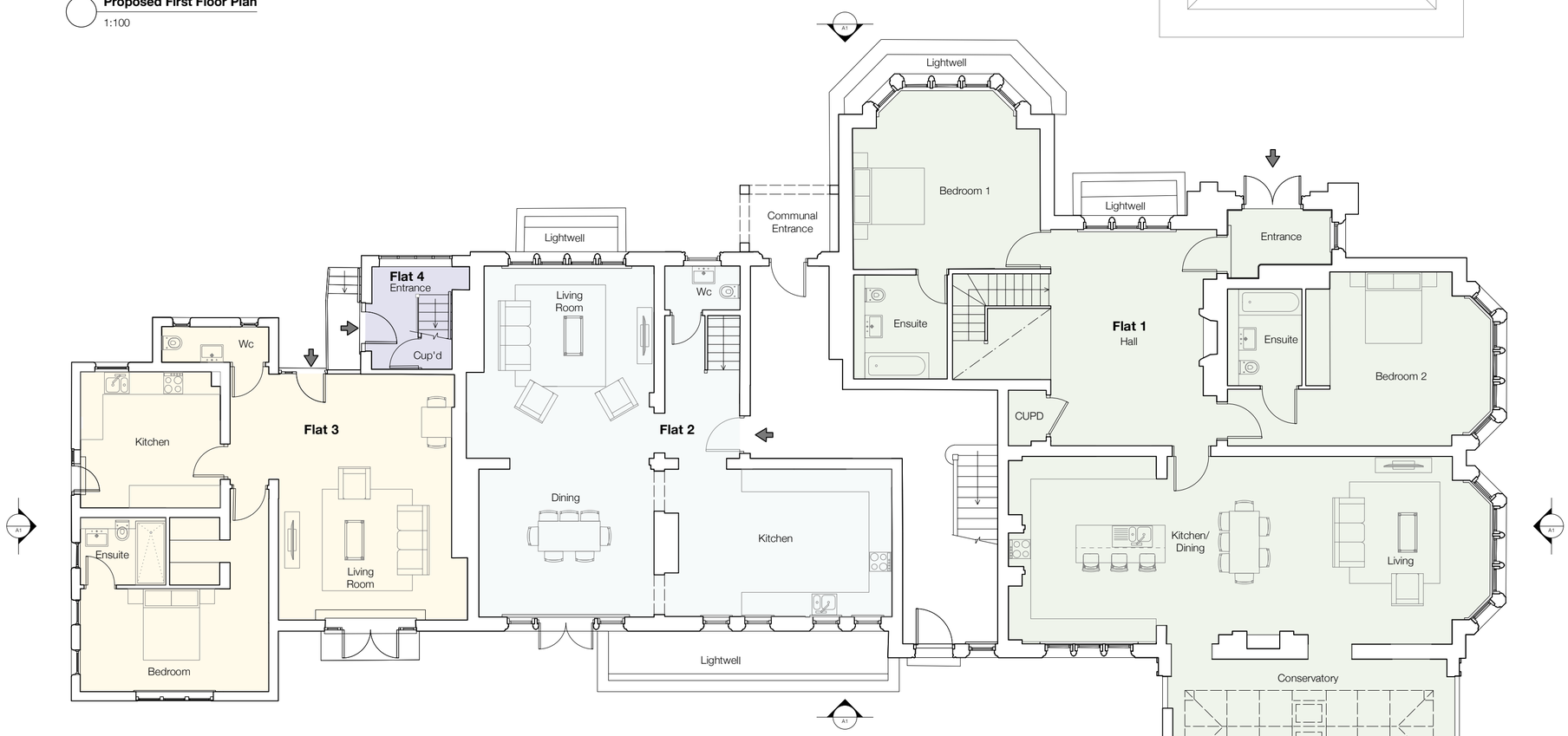
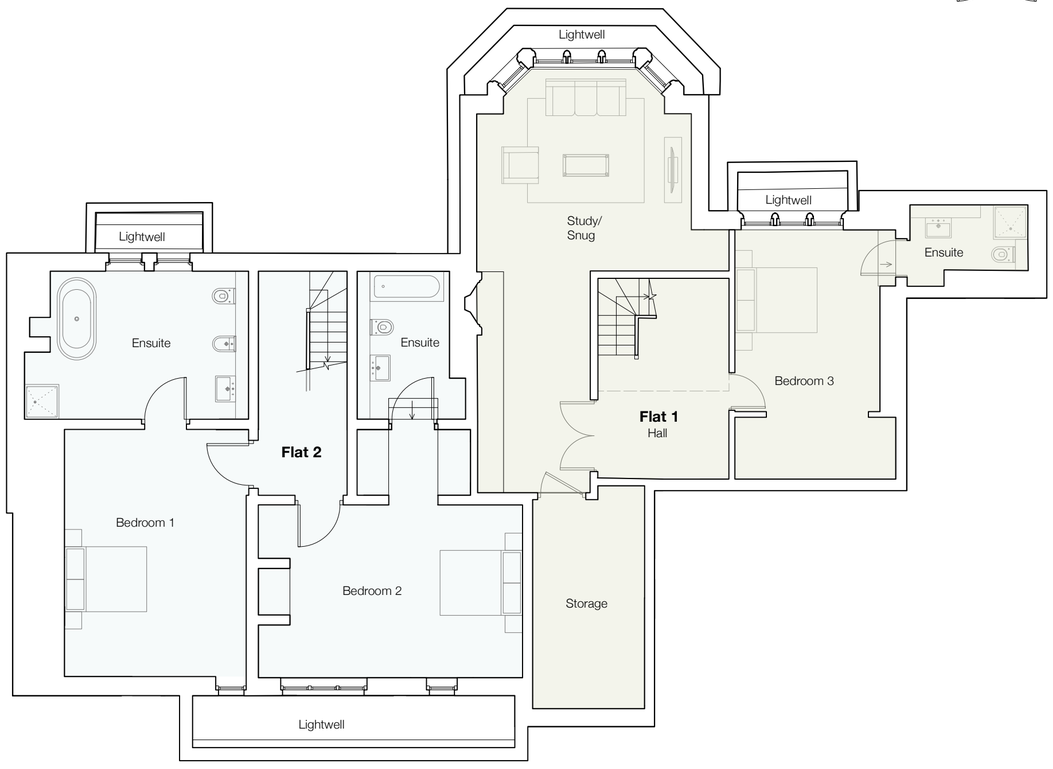
Proposed Second Floor Plan
1:100



Proposed First Floor Plan
1:100



Proposed Ground Floor Plan
1:100



Proposed Basement Floor Plan
1:100

Flat 1 - 271m²
Flat 2 - 185m²
Flat 3 - 74m²
Flat 4 - 78m²
Flat 5 - 153m²
Flat 6 - 184m²
Total - 945m²

N

0 5m

Rev	Date	Note
B	03/05/22	Issue to client
A	19/04/22	Issue for comment

Drawn by: *Checked by:* *Project Ref:* PSA65

Drawing No. PA-05

Rev. No. B

PRELIMINARY

Client
Mr & Mrs Stewart

Project Title
Kingsley House
Crowsley Road
Shiplake
RG9 3LU

Drawing Title
Proposed Plans

PAULSOUTHOUSEARCHITECTS
103, Walton Street
Oxford OX2 6EB
Telephone: 01865 686108
studio@paulsouthouse.co.uk

1:100 @ A1

Proposed North East Elevation
1:100

Proposed South West Elevation
1:100

Proposed South East Elevation
1:100

Proposed North West Elevation
1:100

North East Elevation

North West Elevation

South East Elevation

South West Elevation

Kingsley House

0 5m

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

Design SAP
elmhurst energy

Property Reference	Fl02-Kingsley House	**Issued on Date**	10/05/2022
Assessment Reference	001-BASELINE	**Prop Type Ref**	PR9657
Property	Flat 02-Kingsley House, Crowsley Road, Shiplake, RG9 3LU		

SAP Rating	78 C	**DER**	N/A	**TER**	N/A
Environmental	75 C	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	4.00	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Iraj Maghounaki, ERS Consultants Ltd, Tel: 01865 378 885, info@erscltd.co.uk	**Assessor ID**	v571-0001
Client			

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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		463.6144	(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							4 * 10 =		40.0000	(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) =		40.0000 / (5) =	0.0863	(8)
Pressure test			No	
Measured/design AP50			15.0000	
Infiltration rate			0.8363	(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) =	0.6481	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.7453	0.7129	0.7129	0.6481	0.6643	0.5671	0.5671	0.5671	0.5995	0.6643	0.6481	0.6967	(22b)
Effective ac	0.7778	0.7541	0.7541	0.7100	0.7207	0.6608	0.6608	0.6608	0.6797	0.7207	0.7100	0.7427	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss (33) + (36) =	152.5289	(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

CALCULATION OF HEAT DEMAND 09 Jan 2014

(38)m	118.9918	115.3769	115.3769	108.6290	110.2557	101.0979	101.0979	101.0979	103.9899	110.2557	108.6290	113.6296	(38)
Heat transfer coeff													
	271.5206	267.9057	267.9057	261.1579	262.7846	253.6268	253.6268	253.6268	256.5187	262.7846	261.1579	266.1585	(39)
Average = Sum(39)m / 12 =												261.5645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5253	1.5050	1.5050	1.4671	1.4762	1.4248	1.4248	1.4248	1.4410	1.4762	1.4671	1.4952	(40)
HLP (average)												1.4694	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9732	(42)
Average daily hot water use (litres/day)												110.3299	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m													
	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)
Water storage loss:													
Store volume												200.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115	(51)
Volume factor from Table 2a												0.8434	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0519	(55)
Total storage loss													
	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(56)
If cylinder contains dedicated solar storage													
	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
								Total per year (kWh/year) = Sum(64)m =				2393.7520	(64)
RHI water heating demand												2394	(64)
Heat gains from water heating, kWh/month													
	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509	(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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	105.8750	94.0373	76.4762	57.8974	43.2790	36.5380	39.4806	51.3183	68.8793	87.4581	102.0766	108.8176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)													
	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)
Water heating gains (Table 5)													
	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)
Total internal gains													
	886.5015	877.5302	841.0310	786.2069	730.2464	682.4626	656.7896	670.3753	704.1272	759.2034	818.9015	863.8812	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	13.3543	0.6300	0.7000	0.7700	37.6700	(75)
Southwest	12.8700	41.8189	0.6300	0.7000	0.7700	164.4838	(79)

Solar gains	202.1538	322.1473	463.8756	638.3318	740.4877	799.8262	754.2039	671.9948	550.8440	385.9549	242.3639	171.2181	(83)
Total gains	1088.6553	1199.6776	1304.9065	1424.5387	1470.7340	1482.2887	1410.9935	1342.3702	1254.9712	1145.1582	1061.2655	1035.0992	(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	81.9505	83.0563	83.0563	85.2023	84.6749	87.7323	87.7323	87.7323	86.7432	84.6749	85.2023	83.6015	
alpha	6.4634	6.5371	6.5371	6.6802	6.6450	6.8488	6.8488	6.8488	6.7829	6.6450	6.6802	6.5734	
util living area													
	0.9999	0.9998	0.9994	0.9970	0.9835	0.8838	0.7106	0.7534	0.9674	0.9980	0.9998	0.9999	(86)
MIT	19.9395	20.0320	20.2144	20.4733	20.7135	20.9336	20.9883	20.9831	20.8340	20.5205	20.2062	19.9471	(87)

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Th 2	19.6686	19.6837	19.6837	19.7123	19.7054	19.7444	19.7444	19.7444	19.7320	19.7054	19.7123	19.6911	(88)
util rest of house	0.9999	0.9997	0.9990	0.9943	0.9642	0.7663	0.5087	0.5518	0.9184	0.9956	0.9996	0.9999	(89)
MIT 2	18.7202	18.8253	19.0076	19.2893	19.5162	19.7232	19.7433	19.7425	19.6486	19.3311	19.0234	18.7466	(90)
Living area fraction									fLA = Living area / (4) =			0.3854	(91)
MIT	19.1902	19.2904	19.4728	19.7456	19.9777	20.1897	20.2231	20.2207	20.1055	19.7896	19.4793	19.2093	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0402	19.1404	19.3228	19.5956	19.8277	20.0397	20.0731	20.0707	19.9555	19.6396	19.3293	19.0593	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9996	0.9988	0.9939	0.9668	0.7997	0.5651	0.6090	0.9306	0.9954	0.9996	0.9999	(94)
Useful gains	1088.4723	1199.2503	1303.3190	1415.8433	1421.8689	1185.3773	797.3107	817.5220	1167.8583	1139.8527	1060.7910	1034.9753	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W	3975.1082	3815.0849	3381.7127	2741.0127	2056.9872	1278.2134	804.7939	829.5252	1476.3904	2322.8984	3167.6641	3901.7098	(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	2147.6571	1757.8409	1546.3249	954.1220	472.5280	0.0000	0.0000	0.0000	0.0000	880.1860	1516.9486	2132.8504	(98)
Space heating												11408.4579	(98)
RHI space heating demand												11408	(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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	463.6144	(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							4 * 10	=	40.0000	(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) =	40.0000	/ (5) =	0.0863	(8)
Pressure test			No	
Measured/design AP50			15.0000	
Infiltration rate			0.8363	(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) =		0.6481	(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	0.8263	0.8101	0.7939	0.7129	0.6967	0.6157	0.6157	0.5995	0.6481	0.6967	0.7291	0.7615	(22b)
Effective ac	0.8414	0.8282	0.8152	0.7541	0.7427	0.6895	0.6895	0.6797	0.7100	0.7427	0.7658	0.7900	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss (33) + (36) =	152.5289	(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	128.7320	126.7036	124.7154	115.3769	113.6296	105.4961	105.4961	103.9899	108.6290	113.6296	117.1642	120.8595	(38)
Heat transfer coeff	281.2608	279.2325	277.2443	267.9057	266.1585	258.0249	258.0249	256.5187	261.1579	266.1585	269.6931	273.3883	(39)
Average = Sum(39)m / 12 =												267.8974	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5800	1.5686	1.5575	1.5050	1.4952	1.4495	1.4495	1.4410	1.4671	1.4952	1.5150	1.5358	(40)
HLP (average)												1.5050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9732 (42)
Average daily hot water use (litres/day)	110.3299 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:
Store volume 200.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8434 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 1.0519 (55)
Total storage loss

32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(56)

If cylinder contains dedicated solar storage

32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(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

235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(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

235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)

Total per year (kWh/year) = Sum(64)m = 2393.7520 (64)

Heat gains from water heating, kWh/month

104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509	(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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)

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

105.8750	94.0373	76.4762	57.8974	43.2790	36.5380	39.4806	51.3183	68.8793	87.4581	102.0766	108.8176	(67)

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

521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)

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

55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)

-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)

Water heating gains (Table 5)

140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)

Total internal gains

886.5015	877.5302	841.0310	786.2069	730.2464	682.4626	656.7896	670.3753	704.1272	759.2034	818.9015	863.8812	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	11.2829	0.6300	0.7000	0.7700	31.8270	(75)
Southwest	12.8700	36.7938	0.6300	0.7000	0.7700	144.7189	(79)

Solar gains	176.5460	311.2947	454.0072	609.6036	725.7672	739.4156	705.0115	615.4594	507.4361	351.6181	213.3866	149.8408	(83)
Total gains	1063.0475	1188.8249	1295.0382	1395.8105	1456.0135	1421.8782	1361.8011	1285.8347	1211.5633	1110.8215	1032.2881	1013.7220	(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	79.1125	79.6872	80.2586	83.0563	83.6015	86.2368	86.2368	86.7432	85.2023	83.6015	82.5058	81.3906	
alpha	6.2742	6.3125	6.3506	6.5371	6.5734	6.7491	6.7491	6.7829	6.6802	6.5734	6.5004	6.4260	
util living area	0.9999	0.9998	0.9995	0.9977	0.9872	0.9262	0.7799	0.8312	0.9757	0.9985	0.9998	1.0000	(86)
MIT	19.8793	19.9789	20.1574	20.4252	20.6770	20.8954	20.9771	20.9652	20.8065	20.4837	20.1564	19.8910	(87)
Th 2	19.6280	19.6364	19.6447	19.6837	19.6911	19.7256	19.7256	19.7320	19.7123	19.6911	19.6762	19.6608	(88)
util rest of house	0.9999	0.9997	0.9991	0.9955	0.9723	0.8373	0.5851	0.6502	0.9368	0.9968	0.9997	0.9999	(89)
MIT 2	18.6263	18.7328	18.9181	19.2176	19.4698	19.6843	19.7225	19.7261	19.6090	19.2827	18.9434	18.6651	(90)
Living area fraction									fLA = Living area / (4) =			0.3854	(91)
MIT	19.1092	19.2131	19.3957	19.6830	19.9351	20.1511	20.2061	20.2037	20.0706	19.7456	19.4109	19.1376	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9592	19.0631	19.2457	19.5330	19.7851	20.0011	20.0561	20.0537	19.9206	19.5956	19.2609	18.9876	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9996	0.9989	0.9952	0.9738	0.8620	0.6414	0.7036	0.9459	0.9965	0.9996	0.9999	(94)
Useful gains	1062.8876	1188.4035	1293.6392	1389.0629	1417.9256	1225.7249	873.3921	904.7188	1146.0653	1106.9868	1031.9024	1013.6173	(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	4123.0619	3954.7979	3533.6842	2848.6496	2151.9108	1393.6233	891.7563	937.2435	1520.0889	2394.2543	3279.7195	4042.7599	(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	2276.7697	1859.0171	1666.5935	1050.9024	546.0850	0.0000	0.0000	0.0000	0.0000	957.7270	1618.4283	2253.6821	(98)
Space heating												12229.2050	(98)
Space heating per m2											(98) / (4) =	68.6995	(99)

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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 %)												83.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												14733.9820	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2276.7697	1859.0171	1666.5935	1050.9024	546.0850	0.0000	0.0000	0.0000	0.0000	957.7270	1618.4283	2253.6821	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	2743.0960	2239.7796	2007.9439	1266.1474	657.9337	0.0000	0.0000	0.0000	0.0000	1153.8880	1949.9136	2715.2797	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
Efficiency of water heater												83.0000	(216)
(217)m	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	(217)
Fuel for water heating, kWh/month													
	284.1547	250.4500	263.0161	235.7604	231.0259	206.4135	198.2223	217.5332	217.1558	244.4708	258.5231	277.3127	(219)
Water heating fuel used												2884.0386	(219)
Annual totals kWh/year													
Space heating fuel - main system												14733.9820	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												39.0000	(230c)
Total electricity for the above, kWh/year												39.0000	(231)
Electricity for lighting (calculated in Appendix L)												747.9144	(232)
Total delivered energy for all uses												18404.9349	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	14733.9820	3.4800	512.7426	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2884.0386	3.4800	100.3645	(247)
Pumps and fans for heating	39.0000	13.1900	5.1441	(249)
Energy for lighting	747.9144	13.1900	98.6499	(250)
Additional standing charges			120.0000	(251)
Total energy cost			836.9011	(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] =	1.5762	(257)
SAP value		78.0126	
SAP rating (Section 12)		78	(258)
SAP band		C	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	14733.9820	0.2160	3182.5401	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2884.0386	0.2160	622.9523	(264)
Space and water heating			3805.4924	(265)
Pumps and fans	39.0000	0.5190	20.2410	(267)
Energy for lighting	747.9144	0.5190	388.1676	(268)
Total kg/year			4213.9010	(272)
CO2 emissions per m2			23.6700	(273)
EI value			74.6799	
EI rating			75	(274)
EI band			C	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8800 = 3.955, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8800 = 0.2455, stars = 4
Water heating energy efficiency	3.48 / 0.8800 = 3.955, stars = 4
Water heating environmental impact	0.216 / 0.8800 = 0.2455, stars = 4

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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	463.6144	(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							4 * 10 =	40.0000	(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) =	40.0000 / (5) =	0.0863	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8363	(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) =	0.6481	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.7453	0.7129	0.7129	0.6481	0.6643	0.5671	0.5671	0.5671	0.5995	0.6643	0.6481	0.6967	(22b)
Effective ac	0.7778	0.7541	0.7541	0.7100	0.7207	0.6608	0.6608	0.6608	0.6797	0.7207	0.7100	0.7427	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss	(33) + (36) = 152.5289	(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	118.9918	115.3769	115.3769	108.6290	110.2557	101.0979	101.0979	101.0979	103.9899	110.2557	108.6290	113.6296	(38)
Heat transfer coeff	271.5206	267.9057	267.9057	261.1579	262.7846	253.6268	253.6268	253.6268	256.5187	262.7846	261.1579	266.1585	(39)
Average = Sum(39)m / 12 =												261.5645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5253	1.5050	1.5050	1.4671	1.4762	1.4248	1.4248	1.4248	1.4410	1.4762	1.4671	1.4952	(40)
HLP (average)												1.4694	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9732 (42)
Average daily hot water use (litres/day)	110.3299 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)

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

Water storage loss:
Store volume 200.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8434 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 1.0519 (55)
Total storage loss

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (56)

If cylinder contains dedicated solar storage

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (64)

Total per year (kWh/year) = Sum(64)m = 2393.7520 (64)

Heat gains from water heating, kWh/month

	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509 (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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)

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

	105.8750	94.0373	76.4762	57.8974	43.2790	36.5380	39.4806	51.3183	68.8793	87.4581	102.0766	108.8176	(67)

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

	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)

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

	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)

	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)

Water heating gains (Table 5)

	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)

Total internal gains

	886.5015	877.5302	841.0310	786.2069	730.2464	682.4626	656.7896	670.3753	704.1272	759.2034	818.9015	863.8812	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	13.3543	0.6300	0.7000	0.7700	37.6700	(75)
Southwest	12.8700	41.8189	0.6300	0.7000	0.7700	164.4838	(79)

Solar gains	202.1538	322.1473	463.8756	638.3318	740.4877	799.8262	754.2039	671.9948	550.8440	385.9549	242.3639	171.2181 (83)
Total gains	1088.6553	1199.6776	1304.9065	1424.5387	1470.7340	1482.2887	1410.9935	1342.3702	1254.9712	1145.1582	1061.2655	1035.0992 (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	81.9505	83.0563	83.0563	85.2023	84.6749	87.7323	87.7323	87.7323	86.7432	84.6749	85.2023	83.6015	
alpha	6.4634	6.5371	6.5371	6.6802	6.6450	6.8488	6.8488	6.8488	6.7829	6.6450	6.6802	6.5734	
util living area	0.9999	0.9998	0.9994	0.9970	0.9835	0.8838	0.7106	0.7534	0.9674	0.9980	0.9998	0.9999	(86)
MIT	19.9395	20.0320	20.2144	20.4733	20.7135	20.9336	20.9883	20.9831	20.8340	20.5205	20.2062	19.9471	(87)
Th 2	19.6686	19.6837	19.6837	19.7123	19.7054	19.7444	19.7444	19.7444	19.7320	19.7054	19.7123	19.6911	(88)
util rest of house	0.9999	0.9997	0.9990	0.9943	0.9642	0.7663	0.5087	0.5518	0.9184	0.9956	0.9996	0.9999	(89)
MIT 2	18.7202	18.8253	19.0076	19.2893	19.5162	19.7232	19.7433	19.7425	19.6486	19.3311	19.0234	18.7466	(90)
Living area fraction									fLA = Living area / (4) =			0.3854	(91)
MIT	19.1902	19.2904	19.4728	19.7456	19.9777	20.1897	20.2231	20.2207	20.1055	19.7896	19.4793	19.2093	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0402	19.1404	19.3228	19.5956	19.8277	20.0397	20.0731	20.0707	19.9555	19.6396	19.3293	19.0593	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9996	0.9988	0.9939	0.9668	0.7997	0.5651	0.6090	0.9306	0.9954	0.9996	0.9999	(94)
Useful gains	1088.4723	1199.2503	1303.3190	1415.8433	1421.8689	1185.3773	797.3107	817.5220	1167.8583	1139.8527	1060.7910	1034.9753	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W	3975.1082	3815.0849	3381.7127	2741.0127	2056.9872	1278.2134	804.7939	829.5252	1476.3904	2322.8984	3167.6641	3901.7098	(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	2147.6571	1757.8409	1546.3249	954.1220	472.5280	0.0000	0.0000	0.0000	0.0000	880.1860	1516.9486	2132.8504	(98)

Space heating 11408.4579 (98)
Space heating per m2 (98) / (4) = 64.0889 (99)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	13745.1301	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2147.6571	1757.8409	1546.3249	954.1220	472.5280	0.0000	0.0000	0.0000	0.0000	880.1860	1516.9486	2132.8504	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	2587.5387	2117.8806	1863.0420	1149.5446	569.3108	0.0000	0.0000	0.0000	0.0000	1060.4650	1827.6490	2569.6993	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
Efficiency of water heater												83.0000	(216)
(217)m	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	(217)
Fuel for water heating, kWh/month													
	284.1547	250.4500	263.0161	235.7604	231.0259	206.4135	198.2223	217.5332	217.1558	244.4708	258.5231	277.3127	(219)
Water heating fuel used												2884.0386	(219)
Annual totals kWh/year													
Space heating fuel - main system												13745.1301	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												39.0000	(230c)
Total electricity for the above, kWh/year												39.0000	(231)
Electricity for lighting (calculated in Appendix L)												747.9144	(232)
Total delivered energy for all uses												17416.0830	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13745.1301	3.6300	498.9482	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2884.0386	3.6300	104.6906	(247)
Pumps and fans for heating	39.0000	19.4400	7.5816	(249)
Energy for lighting	747.9144	19.4400	145.3946	(250)
Additional standing charges			95.0000	(251)
Total energy cost			851.6150	(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	13745.1301	0.2160	2968.9481	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2884.0386	0.2160	622.9523	(264)
Space and water heating			3591.9004	(265)
Pumps and fans	39.0000	0.5190	20.2410	(267)
Energy for lighting	747.9144	0.5190	388.1676	(268)
Total kg/year			4000.3090	(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	13745.1301	1.2200	16769.0587	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2884.0386	1.2200	3518.5271	(264)
Space and water heating			20287.5857	(265)
Pumps and fans	39.0000	3.0700	119.7300	(267)
Energy for lighting	747.9144	3.0700	2296.0972	(268)
Primary energy kWh/year			22703.4129	(272)
Primary energy kWh/m2/year			127.5401	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	C 78
Current environmental impact rating:	C 75

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

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: C 78
Potential environmental impact rating: C 75

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
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	£153	£153	£0
Mains gas	£699	£699	£0
Space heating	£602	£602	£0
Water heating	£105	£105	£0
Lighting	£145	£145	£0
Total cost of fuels	£852	£852	£0
Total cost of uses	£852	£852	£0
Delivered energy	98 kWh/m²	98 kWh/m²	0 kWh/m²
Carbon dioxide emissions	4.0 tonnes	4.0 tonnes	0.0 tonnes
CO2 emissions per m²	22 kg/m²	22 kg/m²	0 kg/m²
Primary energy	128 kWh/m²	128 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

Design SAP
elmhurst energy

Property Reference	Fl02-Kingsley House	**Issued on Date**	10/05/2022
Assessment Reference	002-BE LEAN	**Prop Type Ref**	PR9657
Property	Flat 02-Kingsley House, Crowsley Road, Shiplake, RG9 3LU		

SAP Rating	79 C	**DER**	N/A	**TER**	N/A
Environmental	82 B	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	2.93	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Iraj Maghounaki, ERS Consultants Ltd, Tel: 01865 378 885, info@erscltd.co.uk	**Assessor ID**	v571-0001
Client			

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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		463.6144	(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							4 * 10 =	40.0000	(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) =		40.0000 / (5) =	0.0863	(8)
Pressure test			No	
Measured/design AP50			15.0000	
Infiltration rate			0.8363	(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) =	0.6481	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.7453	0.7129	0.7129	0.6481	0.6643	0.5671	0.5671	0.5671	0.5995	0.6643	0.6481	0.6967	(22b)
Effective ac	0.7778	0.7541	0.7541	0.7100	0.7207	0.6608	0.6608	0.6608	0.6797	0.7207	0.7100	0.7427	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss (33) + (36) =	152.5289	(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

CALCULATION OF HEAT DEMAND 09 Jan 2014

(38)m	118.9918	115.3769	115.3769	108.6290	110.2557	101.0979	101.0979	101.0979	103.9899	110.2557	108.6290	113.6296	(38)
Heat transfer coeff													
	271.5206	267.9057	267.9057	261.1579	262.7846	253.6268	253.6268	253.6268	256.5187	262.7846	261.1579	266.1585	(39)
Average = Sum(39)m / 12 =												261.5645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5253	1.5050	1.5050	1.4671	1.4762	1.4248	1.4248	1.4248	1.4410	1.4762	1.4671	1.4952	(40)
HLP (average)												1.4694	(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												2.9732	(42)
Average daily hot water use (litres/day)												110.3299	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m													
	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)
Water storage loss:													
Store volume												200.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115	(51)
Volume factor from Table 2a												0.8434	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0519	(55)
Total storage loss													
	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(56)
If cylinder contains dedicated solar storage													
	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
								Total per year (kWh/year) = Sum(64)m =				2393.7520	(64)
RHI water heating demand												2394	(64)
Heat gains from water heating, kWh/month													
	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509	(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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	85.8446	76.2464	62.0078	46.9439	35.0911	29.6254	32.0113	41.6095	55.8481	70.9120	82.7648	88.2305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)													
	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)
Water heating gains (Table 5)													
	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)
Total internal gains													
	863.4711	856.7394	823.5625	772.2533	719.0585	672.5500	646.3203	657.6665	688.0960	739.6572	796.5898	840.2941	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	13.3543	0.6300	0.7000	0.7700	37.6700	(75)
Southwest	12.8700	41.8189	0.6300	0.7000	0.7700	164.4838	(79)

Solar gains	202.1538	322.1473	463.8756	638.3318	740.4877	799.8262	754.2039	671.9948	550.8440	385.9549	242.3639	171.2181	(83)
Total gains	1065.6249	1178.8867	1287.4380	1410.5851	1459.5461	1472.3761	1400.5242	1329.6613	1238.9400	1125.6121	1038.9537	1011.5121	(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	81.9505	83.0563	83.0563	85.2023	84.6749	87.7323	87.7323	87.7323	86.7432	84.6749	85.2023	83.6015	
alpha	6.4634	6.5371	6.5371	6.6802	6.6450	6.8488	6.8488	6.8488	6.7829	6.6450	6.6802	6.5734	
util living area													
	0.9999	0.9998	0.9995	0.9972	0.9841	0.8865	0.7149	0.7588	0.9694	0.9982	0.9998	1.0000	(86)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	

CALCULATION OF HEAT DEMAND 09 Jan 2014

Tweekend	20.3098	20.3700	20.4887	20.6567	20.8128	20.9561	20.9922	20.9886	20.8901	20.6862	20.4824	20.3146	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9348	20.0255	20.2108	20.4640	20.7111	20.9326	20.9879	20.9824	20.8283	20.5156	20.1917	19.9422	(87)
Th 2	19.6686	19.6837	19.6837	19.7123	19.7054	19.7444	19.7444	19.7444	19.7320	19.7054	19.7123	19.6911	(88)
util rest of house													
	0.9999	0.9997	0.9990	0.9946	0.9655	0.7701	0.5124	0.5568	0.9225	0.9960	0.9997	0.9999	(89)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
Tweekend	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
MIT 2	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	(90)
Living area fraction									fLA = Living area / (4) =			0.4386	(91)
MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9997	0.9989	0.9945	0.9710	0.8245	0.6052	0.6507	0.9427	0.9961	0.9996	0.9999	(94)
Useful gains	1065.4650	1178.5064	1286.0134	1402.8478	1417.1757	1213.9850	847.5284	865.2144	1167.9141	1121.2065	1038.5508	1011.4054	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	3964.1292	3810.3014	3390.2395	2765.8586	2099.2869	1330.9464	859.5083	884.0835	1524.1878	2351.4461	3173.1932	3890.8828	(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													
	2156.6062	1768.5663	1565.5443	981.3677	507.4907	0.0000	0.0000	0.0000	0.0000	915.2983	1536.9425	2142.3312	(98)
Space heating												11574.1472	(98)
RHI space heating demand												11574	(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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	463.6144	(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							4 * 10	=	40.0000	(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) =	40.0000	/ (5) =	0.0863	(8)
Pressure test			No	
Measured/design AP50			15.0000	
Infiltration rate			0.8363	(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) =		0.6481	(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	0.8263	0.8101	0.7939	0.7129	0.6967	0.6157	0.6157	0.5995	0.6481	0.6967	0.7291	0.7615	(22b)
Effective ac	0.8414	0.8282	0.8152	0.7541	0.7427	0.6895	0.6895	0.6797	0.7100	0.7427	0.7658	0.7900	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss (33) + (36) =	152.5289	(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	128.7320	126.7036	124.7154	115.3769	113.6296	105.4961	105.4961	103.9899	108.6290	113.6296	117.1642	120.8595	(38)
Heat transfer coeff	281.2608	279.2325	277.2443	267.9057	266.1585	258.0249	258.0249	256.5187	261.1579	266.1585	269.6931	273.3883	(39)
Average = Sum(39)m / 12 =												267.8974	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5800	1.5686	1.5575	1.5050	1.4952	1.4495	1.4495	1.4410	1.4671	1.4952	1.5150	1.5358	(40)
HLP (average)												1.5050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9732 (42)
Average daily hot water use (litres/day)	110.3299 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:
Store volume 200.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8434 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 1.0519 (55)
Total storage loss

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (56)

If cylinder contains dedicated solar storage

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (64)

Total per year (kWh/year) = Sum(64)m = 2393.7520 (64)

Heat gains from water heating, kWh/month

	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509 (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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)

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

	85.8446	76.2464	62.0078	46.9439	35.0911	29.6254	32.0113	41.6095	55.8481	70.9120	82.7648	88.2305	(67)

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

	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)

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

	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)

	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)

Water heating gains (Table 5)

	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)

Total internal gains

	863.4711	856.7394	823.5625	772.2533	719.0585	672.5500	646.3203	657.6665	688.0960	739.6572	796.5898	840.2941	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	11.2829	0.6300	0.7000	0.7700	31.8270	(75)
Southwest	12.8700	36.7938	0.6300	0.7000	0.7700	144.7189	(79)

Solar gains	176.5460	311.2947	454.0072	609.6036	725.7672	739.4156	705.0115	615.4594	507.4361	351.6181	213.3866	149.8408	(83)
Total gains	1040.0171	1168.0341	1277.5697	1381.8569	1444.8256	1411.9656	1351.3318	1273.1258	1195.5321	1091.2754	1009.9763	990.1349	(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	79.1125	79.6872	80.2586	83.0563	83.6015	86.2368	86.2368	86.7432	85.2023	83.6015	82.5058	81.3906	
alpha	6.2742	6.3125	6.3506	6.5371	6.5734	6.7491	6.7491	6.7829	6.6802	6.5734	6.5004	6.4260	
util living area													
	0.9999	0.9999	0.9995	0.9978	0.9877	0.9283	0.7842	0.8361	0.9773	0.9987	0.9999	1.0000	(86)
Tweekday	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	
Tweekend	20.2709	20.3357	20.4518	20.6256	20.7891	20.9311	20.9847	20.9766	20.8721	20.6624	20.4502	20.2783	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8747	19.9725	20.1539	20.4154	20.6745	20.8942	20.9764	20.9639	20.8004	20.4789	20.1414	19.8862	(87)
Th 2	19.6280	19.6364	19.6447	19.6837	19.6911	19.7256	19.7256	19.7320	19.7123	19.6911	19.6762	19.6608	(88)
util rest of house													
	0.9999	0.9997	0.9992	0.9958	0.9733	0.8407	0.5893	0.6559	0.9402	0.9971	0.9997	0.9999	(89)
Tweekday	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	
Tweekend	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	
MIT 2	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	(90)
Living area fraction									fLA = Living area / (4) =			0.4386	(91)
MIT	18.9068	19.0356	19.2662	19.6179	19.9381	20.2034	20.2716	20.2673	20.1019	19.6959	19.2721	18.9350	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9068	19.0356	19.2662	19.6179	19.9381	20.2034	20.2716	20.2673	20.1019	19.6959	19.2721	18.9350	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9999	0.9997	0.9990	0.9956	0.9770	0.8810	0.6807	0.7422	0.9556	0.9971	0.9997	0.9999	(94)
Useful gains	1039.8768	1167.6566	1276.3056	1375.8202	1411.6588	1243.9850	919.8440	944.9485	1142.4468	1088.0840	1009.6475	990.0443	(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													
	4108.3079	3947.1241	3539.3616	2871.4000	2192.6343	1445.8087	947.3686	992.0318	1567.4341	2420.9609	3282.7250	4028.3863	(97)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													
	2282.9128	1867.8022	1683.7136	1076.8174	581.0458	0.0000	0.0000	0.0000	0.0000	991.6604	1636.6158	2260.5265	(98)
Space heating												12381.0945	(98)
Space heating per m2											(98) / (4) =	69.5528	(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 %)												280.1973	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												4418.7055	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2282.9128	1867.8022	1683.7136	1076.8174	581.0458	0.0000	0.0000	0.0000	0.0000	991.6604	1636.6158	2260.5265	(98)
Space heating efficiency (main heating system 1)													
	280.1973	280.1973	280.1973	280.1973	280.1973	0.0000	0.0000	0.0000	0.0000	280.1973	280.1973	280.1973	(210)
Space heating fuel (main heating system)													
	814.7518	666.6024	600.9028	384.3068	207.3702	0.0000	0.0000	0.0000	0.0000	353.9150	584.0940	806.7623	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
Efficiency of water heater												267.1400	(216)
(217)m	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	(217)
Fuel for water heating, kWh/month													
	88.2865	77.8145	81.7187	73.2504	71.7794	64.1324	61.5874	67.5872	67.4700	75.9567	80.3227	86.1606	(219)
Water heating fuel used												896.0665	(219)
Annual totals kWh/year													
Space heating fuel - main system												4418.7055	(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)												606.4171	(232)
Total delivered energy for all uses												5921.1890	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4418.7055	13.1900	582.8273	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	896.0665	13.1900	118.1912	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	606.4171	13.1900	79.9864	(250)
Additional standing charges			0.0000	(251)
Total energy cost			781.0048	(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] =	1.4709	(257)
SAP value		79.4812	
SAP rating (Section 12)		79	(258)
SAP band		C	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4418.7055	0.5190	2293.3081	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	896.0665	0.5190	465.0585	(264)
Space and water heating			2758.3667	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	606.4171	0.5190	314.7305	(268)
Total kg/year			3073.0971	(272)
CO2 emissions per m2			17.2600	(273)
EI value			81.5347	
EI rating			82	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency 13.19 × (1 + 0.29 × 0.00) / 2.8020 = 4.707, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 2.8020 = 0.1852, stars = 5
Water heating energy efficiency	13.19 / 2.6714 = 4.937, stars = 4
Water heating environmental impact	0.519 / 2.6714 = 0.1943, stars = 5

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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	463.6144	(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							4 * 10 =	40.0000	(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) =	40.0000 / (5) =	0.0863	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8363	(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) =	0.6481	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.7453	0.7129	0.7129	0.6481	0.6643	0.5671	0.5671	0.5671	0.5995	0.6643	0.6481	0.6967	(22b)
Effective ac	0.7778	0.7541	0.7541	0.7100	0.7207	0.6608	0.6608	0.6608	0.6797	0.7207	0.7100	0.7427	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss	(33) + (36) = 152.5289	(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	118.9918	115.3769	115.3769	108.6290	110.2557	101.0979	101.0979	101.0979	103.9899	110.2557	108.6290	113.6296	(38)
Heat transfer coeff	271.5206	267.9057	267.9057	261.1579	262.7846	253.6268	253.6268	253.6268	256.5187	262.7846	261.1579	266.1585	(39)
Average = Sum(39)m / 12 =												261.5645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5253	1.5050	1.5050	1.4671	1.4762	1.4248	1.4248	1.4248	1.4410	1.4762	1.4671	1.4952	(40)
HLP (average)												1.4694	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9732 (42)
Average daily hot water use (litres/day)	110.3299 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)

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

Water storage loss:
Store volume 200.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8434 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 1.0519 (55)
Total storage loss

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (56)

If cylinder contains dedicated solar storage

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (64)

Total per year (kWh/year) = Sum(64)m = 2393.7520 (64)

Heat gains from water heating, kWh/month

	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509 (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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)

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

	85.8446	76.2464	62.0078	46.9439	35.0911	29.6254	32.0113	41.6095	55.8481	70.9120	82.7648	88.2305 (67)

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

	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156 (68)

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

	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124 (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)

	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279 (71)

Water heating gains (Table 5)

	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717 (72)

Total internal gains

	863.4711	856.7394	823.5625	772.2533	719.0585	672.5500	646.3203	657.6665	688.0960	739.6572	796.5898	840.2941 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	13.3543	0.6300	0.7000	0.7700	37.6700	(75)
Southwest	12.8700	41.8189	0.6300	0.7000	0.7700	164.4838	(79)

Solar gains	202.1538	322.1473	463.8756	638.3318	740.4877	799.8262	754.2039	671.9948	550.8440	385.9549	242.3639	171.2181 (83)
Total gains	1065.6249	1178.8867	1287.4380	1410.5851	1459.5461	1472.3761	1400.5242	1329.6613	1238.9400	1125.6121	1038.9537	1011.5121 (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	81.9505	83.0563	83.0563	85.2023	84.6749	87.7323	87.7323	87.7323	86.7432	84.6749	85.2023	83.6015	
alpha	6.4634	6.5371	6.5371	6.6802	6.6450	6.8488	6.8488	6.8488	6.7829	6.6450	6.6802	6.5734	
util living area													
	0.9999	0.9998	0.9995	0.9972	0.9841	0.8865	0.7149	0.7588	0.9694	0.9982	0.9998	1.0000	(86)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
Tweekend	20.3098	20.3700	20.4887	20.6567	20.8128	20.9561	20.9922	20.9886	20.8901	20.6862	20.4824	20.3146	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9348	20.0255	20.2108	20.4640	20.7111	20.9326	20.9879	20.9824	20.8283	20.5156	20.1917	19.9422	(87)
Th 2	19.6686	19.6837	19.6837	19.7123	19.7054	19.7444	19.7444	19.7444	19.7320	19.7054	19.7123	19.6911	(88)
util rest of house													
	0.9999	0.9997	0.9990	0.9946	0.9655	0.7701	0.5124	0.5568	0.9225	0.9960	0.9997	0.9999	(89)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
Tweekend	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
MIT 2	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	(90)
Living area fraction									fLA = Living area / (4) =			0.4386	(91)
MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9997	0.9989	0.9945	0.9710	0.8245	0.6052	0.6507	0.9427	0.9961	0.9996	0.9999	(94)
Useful gains	1065.4650	1178.5064	1286.0134	1402.8478	1417.1757	1213.9850	847.5284	865.2144	1167.9141	1121.2065	1038.5508	1011.4054	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	3964.1292	3810.3014	3390.2395	2765.8586	2099.2869	1330.9464	859.5083	884.0835	1524.1878	2351.4461	3173.1932	3890.8828	(97)

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

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													
	2156.6062	1768.5663	1565.5443	981.3677	507.4907	0.0000	0.0000	0.0000	0.0000	915.2983	1536.9425	2142.3312	(98)
Space heating												11574.1472	(98)
Space heating per m2											(98) / (4) =	65.0196	(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 %)												279.7378	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												4137.4983	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2156.6062	1768.5663	1565.5443	981.3677	507.4907	0.0000	0.0000	0.0000	0.0000	915.2983	1536.9425	2142.3312	(98)
Space heating efficiency (main heating system 1)													
	279.7378	279.7378	279.7378	279.7378	279.7378	0.0000	0.0000	0.0000	0.0000	279.7378	279.7378	279.7378	(210)
Space heating fuel (main heating system)													
	770.9384	632.2228	559.6470	350.8170	181.4166	0.0000	0.0000	0.0000	0.0000	327.1986	549.4225	765.8354	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
Efficiency of water heater												267.1400	(216)
(217)m	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	(217)
Fuel for water heating, kWh/month													
	88.2865	77.8145	81.7187	73.2504	71.7794	64.1324	61.5874	67.5872	67.4700	75.9567	80.3227	86.1606	(219)
Water heating fuel used												896.0665	(219)
Annual totals kWh/year													
Space heating fuel - main system												4137.4983	(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)												606.4171	(232)
Total delivered energy for all uses												5639.9819	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4137.4983	19.4400	804.3297	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	896.0665	19.4400	174.1953	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	606.4171	19.4400	117.8875	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1096.4125	(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	4137.4983	0.5190	2147.3616	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	896.0665	0.5190	465.0585	(264)
Space and water heating			2612.4201	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	606.4171	0.5190	314.7305	(268)
Total kg/year			2927.1506	(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	4137.4983	3.0700	12702.1198	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	896.0665	3.0700	2750.9241	(264)
Space and water heating			15453.0440	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	606.4171	3.0700	1861.7004	(268)
Primary energy kWh/year			17314.7444	(272)
Primary energy kWh/m2/year			97.2684	(273)

SAP 2012 EPC IMPROVEMENTS

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

Current energy efficiency rating: C 79
Current environmental impact rating: B 82

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: C 79
Potential environmental impact rating: B 82

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
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	£1096	£1096	£0
Space heating	£804	£804	£0
Water heating	£174	£174	£0
Lighting	£118	£118	£0
Total cost of fuels	£1096	£1096	£0
Total cost of uses	£1096	£1096	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	2.9 tonnes	2.9 tonnes	0.0 tonnes
CO2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	97 kWh/m²	97 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
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FULL SAP CALCULATION PRINTOUT
Calculation Type: Conversion (As Designed)

Design SAP
elmhurst energy

Property Reference	Fl02-Kingsley House	**Issued on Date**	10/05/2022
Assessment Reference	003-BE GREEN	**Prop Type Ref**	PR9657
Property	Flat 02-Kingsley House, Crowsley Road, Shiplake, RG9 3LU		

SAP Rating	83 B	**DER**	N/A	**TER**	N/A
Environmental	85 B	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	2.39	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Iraj Maghounaki, ERS Consultants Ltd, Tel: 01865 378 885, info@erscltd.co.uk	**Assessor ID**	v571-0001
Client			

CALCULATION OF HEAT DEMAND 09 Jan 2014

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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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		463.6144	(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							4 * 10 =		40.0000	(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) =	40.0000 / (5) =	0.0863	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8363	(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) =	0.6481	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.7453	0.7129	0.7129	0.6481	0.6643	0.5671	0.5671	0.5671	0.5995	0.6643	0.6481	0.6967	(22b)
Effective ac	0.7778	0.7541	0.7541	0.7100	0.7207	0.6608	0.6608	0.6608	0.6797	0.7207	0.7100	0.7427	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss (33) + (36) =	152.5289	(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

CALCULATION OF HEAT DEMAND 09 Jan 2014

(38)m	118.9918	115.3769	115.3769	108.6290	110.2557	101.0979	101.0979	101.0979	103.9899	110.2557	108.6290	113.6296	(38)
Heat transfer coeff													
	271.5206	267.9057	267.9057	261.1579	262.7846	253.6268	253.6268	253.6268	256.5187	262.7846	261.1579	266.1585	(39)
Average = Sum(39)m / 12 =												261.5645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5253	1.5050	1.5050	1.4671	1.4762	1.4248	1.4248	1.4248	1.4410	1.4762	1.4671	1.4952	(40)
HLP (average)												1.4694	(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												2.9732	(42)
Average daily hot water use (litres/day)												110.3299	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m													
	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)
Water storage loss:													
Store volume												200.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115	(51)
Volume factor from Table 2a												0.8434	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0519	(55)
Total storage loss													
	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(56)
If cylinder contains dedicated solar storage													
	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
								Total per year (kWh/year) = Sum(64)m =				2393.7520	(64)
RHI water heating demand												2394	(64)
Heat gains from water heating, kWh/month													
	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509	(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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	85.8446	76.2464	62.0078	46.9439	35.0911	29.6254	32.0113	41.6095	55.8481	70.9120	82.7648	88.2305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)													
	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)
Water heating gains (Table 5)													
	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)
Total internal gains													
	863.4711	856.7394	823.5625	772.2533	719.0585	672.5500	646.3203	657.6665	688.0960	739.6572	796.5898	840.2941	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	13.3543	0.6300	0.7000	0.7700	37.6700	(75)
Southwest	12.8700	41.8189	0.6300	0.7000	0.7700	164.4838	(79)

Solar gains	202.1538	322.1473	463.8756	638.3318	740.4877	799.8262	754.2039	671.9948	550.8440	385.9549	242.3639	171.2181	(83)
Total gains	1065.6249	1178.8867	1287.4380	1410.5851	1459.5461	1472.3761	1400.5242	1329.6613	1238.9400	1125.6121	1038.9537	1011.5121	(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	81.9505	83.0563	83.0563	85.2023	84.6749	87.7323	87.7323	87.7323	86.7432	84.6749	85.2023	83.6015	
alpha	6.4634	6.5371	6.5371	6.6802	6.6450	6.8488	6.8488	6.8488	6.7829	6.6450	6.6802	6.5734	
util living area													
	0.9999	0.9998	0.9995	0.9972	0.9841	0.8865	0.7149	0.7588	0.9694	0.9982	0.9998	1.0000	(86)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	

CALCULATION OF HEAT DEMAND 09 Jan 2014

Tweekend	20.3098	20.3700	20.4887	20.6567	20.8128	20.9561	20.9922	20.9886	20.8901	20.6862	20.4824	20.3146	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9348	20.0255	20.2108	20.4640	20.7111	20.9326	20.9879	20.9824	20.8283	20.5156	20.1917	19.9422	(87)
Th 2	19.6686	19.6837	19.6837	19.7123	19.7054	19.7444	19.7444	19.7444	19.7320	19.7054	19.7123	19.6911	(88)
util rest of house													
	0.9999	0.9997	0.9990	0.9946	0.9655	0.7701	0.5124	0.5568	0.9225	0.9960	0.9997	0.9999	(89)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
Tweekend	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
MIT 2	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	(90)
Living area fraction									fLA = Living area / (4) =			0.4386	(91)
MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9997	0.9989	0.9945	0.9710	0.8245	0.6052	0.6507	0.9427	0.9961	0.9996	0.9999	(94)
Useful gains	1065.4650	1178.5064	1286.0134	1402.8478	1417.1757	1213.9850	847.5284	865.2144	1167.9141	1121.2065	1038.5508	1011.4054	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	3964.1292	3810.3014	3390.2395	2765.8586	2099.2869	1330.9464	859.5083	884.0835	1524.1878	2351.4461	3173.1932	3890.8828	(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													
	2156.6062	1768.5663	1565.5443	981.3677	507.4907	0.0000	0.0000	0.0000	0.0000	915.2983	1536.9425	2142.3312	(98)
Space heating												11574.1472	(98)
RHI space heating demand												11574	(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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	463.6144	(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							4 * 10	=	40.0000	(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) =	40.0000	/ (5) =	0.0863	(8)
Pressure test			No	
Measured/design AP50			15.0000	
Infiltration rate			0.8363	(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) =		0.6481	(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	0.8263	0.8101	0.7939	0.7129	0.6967	0.6157	0.6157	0.5995	0.6481	0.6967	0.7291	0.7615	(22b)
Effective ac	0.8414	0.8282	0.8152	0.7541	0.7427	0.6895	0.6895	0.6797	0.7100	0.7427	0.7658	0.7900	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss (33) + (36) =	152.5289	(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	128.7320	126.7036	124.7154	115.3769	113.6296	105.4961	105.4961	103.9899	108.6290	113.6296	117.1642	120.8595	(38)
Heat transfer coeff	281.2608	279.2325	277.2443	267.9057	266.1585	258.0249	258.0249	256.5187	261.1579	266.1585	269.6931	273.3883	(39)
Average = Sum(39)m / 12 =												267.8974	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5800	1.5686	1.5575	1.5050	1.4952	1.4495	1.4495	1.4410	1.4671	1.4952	1.5150	1.5358	(40)
HLP (average)												1.5050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9732 (42)
Average daily hot water use (litres/day)	110.3299 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:
Store volume 200.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8434 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 1.0519 (55)
Total storage loss

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (56)

If cylinder contains dedicated solar storage

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (64)

Total per year (kWh/year) = Sum(64)m = 2393.7520 (64)

Heat gains from water heating, kWh/month

	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509 (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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)

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

	85.8446	76.2464	62.0078	46.9439	35.0911	29.6254	32.0113	41.6095	55.8481	70.9120	82.7648	88.2305	(67)

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

	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156	(68)

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

	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	(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)

	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	(71)

Water heating gains (Table 5)

	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717	(72)

Total internal gains

	863.4711	856.7394	823.5625	772.2533	719.0585	672.5500	646.3203	657.6665	688.0960	739.6572	796.5898	840.2941	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	11.2829	0.6300	0.7000	0.7700	31.8270	(75)
Southwest	12.8700	36.7938	0.6300	0.7000	0.7700	144.7189	(79)

Solar gains	176.5460	311.2947	454.0072	609.6036	725.7672	739.4156	705.0115	615.4594	507.4361	351.6181	213.3866	149.8408	(83)
Total gains	1040.0171	1168.0341	1277.5697	1381.8569	1444.8256	1411.9656	1351.3318	1273.1258	1195.5321	1091.2754	1009.9763	990.1349	(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	79.1125	79.6872	80.2586	83.0563	83.6015	86.2368	86.2368	86.7432	85.2023	83.6015	82.5058	81.3906	
alpha	6.2742	6.3125	6.3506	6.5371	6.5734	6.7491	6.7491	6.7829	6.6802	6.5734	6.5004	6.4260	
util living area													
	0.9999	0.9999	0.9995	0.9978	0.9877	0.9283	0.7842	0.8361	0.9773	0.9987	0.9999	1.0000	(86)
Tweekday	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	
Tweekend	20.2709	20.3357	20.4518	20.6256	20.7891	20.9311	20.9847	20.9766	20.8721	20.6624	20.4502	20.2783	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8747	19.9725	20.1539	20.4154	20.6745	20.8942	20.9764	20.9639	20.8004	20.4789	20.1414	19.8862	(87)
Th 2	19.6280	19.6364	19.6447	19.6837	19.6911	19.7256	19.7256	19.7320	19.7123	19.6911	19.6762	19.6608	(88)
util rest of house													
	0.9999	0.9997	0.9992	0.9958	0.9733	0.8407	0.5893	0.6559	0.9402	0.9971	0.9997	0.9999	(89)
Tweekday	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	
Tweekend	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	
MIT 2	18.1504	18.3036	18.5726	18.9948	19.3627	19.6636	19.7209	19.7230	19.5561	19.0842	18.5928	18.1918	(90)
Living area fraction									fLA = Living area / (4) =			0.4386	(91)
MIT	18.9068	19.0356	19.2662	19.6179	19.9381	20.2034	20.2716	20.2673	20.1019	19.6959	19.2721	18.9350	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9068	19.0356	19.2662	19.6179	19.9381	20.2034	20.2716	20.2673	20.1019	19.6959	19.2721	18.9350	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9999	0.9997	0.9990	0.9956	0.9770	0.8810	0.6807	0.7422	0.9556	0.9971	0.9997	0.9999	(94)
Useful gains	1039.8768	1167.6566	1276.3056	1375.8202	1411.6588	1243.9850	919.8440	944.9485	1142.4468	1088.0840	1009.6475	990.0443	(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													
	4108.3079	3947.1241	3539.3616	2871.4000	2192.6343	1445.8087	947.3686	992.0318	1567.4341	2420.9609	3282.7250	4028.3863	(97)

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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													
	2282.9128	1867.8022	1683.7136	1076.8174	581.0458	0.0000	0.0000	0.0000	0.0000	991.6604	1636.6158	2260.5265	(98)
Space heating												12381.0945	(98)
Space heating per m2											(98) / (4) =	69.5528	(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 %)												280.1973	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												4418.7055	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2282.9128	1867.8022	1683.7136	1076.8174	581.0458	0.0000	0.0000	0.0000	0.0000	991.6604	1636.6158	2260.5265	(98)
Space heating efficiency (main heating system 1)													
	280.1973	280.1973	280.1973	280.1973	280.1973	0.0000	0.0000	0.0000	0.0000	280.1973	280.1973	280.1973	(210)
Space heating fuel (main heating system)													
	814.7518	666.6024	600.9028	384.3068	207.3702	0.0000	0.0000	0.0000	0.0000	353.9150	584.0940	806.7623	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
Efficiency of water heater												267.1400	(216)
(217)m	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	(217)
Fuel for water heating, kWh/month													
	88.2865	77.8145	81.7187	73.2504	71.7794	64.1324	61.5874	67.5872	67.4700	75.9567	80.3227	86.1606	(219)
Water heating fuel used												896.0665	(219)
Annual totals kWh/year													
Space heating fuel - main system												4418.7055	(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)												606.4171	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1004 * 1.00) =										-963.8364		-963.8364	(233)
Total delivered energy for all uses												4957.3527	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4418.7055	13.1900	582.8273	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	896.0665	13.1900	118.1912	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	606.4171	13.1900	79.9864	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-963.8364	13.1900	-127.1300	(252)
Total energy cost			653.8748	(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] =	1.2315	(257)
SAP value		82.8212	
SAP rating (Section 12)		83	(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	4418.7055	0.5190	2293.3081	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	896.0665	0.5190	465.0585	(264)
Space and water heating			2758.3667	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	606.4171	0.5190	314.7305	(268)
Energy saving/generation technologies				
PV Unit	-963.8364	0.5190	-500.2311	(269)
Total kg/year			2572.8660	(272)
CO2 emissions per m2			14.4500	(273)
EI value			84.5404	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating	85 (274)
EI band	B

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 2.8020 = 4.707, stars = 4
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 2.8020 = 0.1852, stars = 5
Water heating energy efficiency	13.19 / 2.6714 = 4.937, stars = 4
Water heating environmental impact	0.519 / 2.6714 = 0.1943, stars = 5

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)	
Basement floor	96.9200	(1a)	x 2.2400	(2a) =	217.1008	(1a) - (3a)
Ground floor	81.0900	(1b)	x 3.0400	(2b) =	246.5136	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	463.6144	(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							4 * 10 =	40.0000	(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) =	40.0000 / (5) =	0.0863	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8363	(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) =	0.6481	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.7453	0.7129	0.7129	0.6481	0.6643	0.5671	0.5671	0.5671	0.5995	0.6643	0.6481	0.6967	(22b)
Effective ac	0.7778	0.7541	0.7541	0.7100	0.7207	0.6608	0.6608	0.6608	0.6797	0.7207	0.7100	0.7427	(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	
Windows (Uw = 1.60)			22.1000	1.5038	33.2331			(27)
Door to Corridor			2.1000	1.4000	2.9400			(26)
BF			96.9200	0.2500	24.2300			(28)
BW	49.6000		49.6000	0.3000	14.8800			(29a)
EW	83.3300	22.1000	61.2300	0.3000	18.3690			(29a)
SEW-BF	8.9600		8.9600	0.2657	2.3809			(29a)
SEW-GF	40.6100	2.1000	38.5100	0.2679	10.3152			(29a)
SER	14.2400		14.2400	0.1497	2.1317			(30)
Total net area of external elements Aum(A, m2)			293.6600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	108.4799			(33)
Party Wall 1			36.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	44.0490	(36)
Total fabric heat loss	(33) + (36) = 152.5289	(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	118.9918	115.3769	115.3769	108.6290	110.2557	101.0979	101.0979	101.0979	103.9899	110.2557	108.6290	113.6296	(38)
Heat transfer coeff	271.5206	267.9057	267.9057	261.1579	262.7846	253.6268	253.6268	253.6268	256.5187	262.7846	261.1579	266.1585	(39)
Average = Sum(39)m / 12 =												261.5645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5253	1.5050	1.5050	1.4671	1.4762	1.4248	1.4248	1.4248	1.4410	1.4762	1.4671	1.4952	(40)
HLP (average)												1.4694	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9732 (42)
Average daily hot water use (litres/day)	110.3299 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3629	116.9497	112.5365	108.1233	103.7101	99.2969	99.2969	103.7101	108.1233	112.5365	116.9497	121.3629	(44)
Energy conte	179.9777	157.4097	162.4327	141.6127	135.8808	117.2548	108.6538	124.6818	126.1709	147.0400	160.5057	174.2988	(45)
Energy content (annual)										Total = Sum(45)m =		1735.9195	(45)
Distribution loss (46)m = 0.15 x (45)m	26.9967	23.6114	24.3649	21.2419	20.3821	17.5882	16.2981	18.7023	18.9256	22.0560	24.0759	26.1448	(46)

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

Water storage loss:
Store volume 200.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8434 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 1.0519 (55)
Total storage loss

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (56)

If cylinder contains dedicated solar storage

	32.6083	29.4527	32.6083	31.5564	32.6083	31.5564	32.6083	32.6083	31.5564	32.6083	31.5564	32.6083 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (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

	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695 (64)

Total per year (kWh/year) = Sum(64)m = 2393.7520 (64)

Heat gains from water heating, kWh/month

	104.5392	92.7098	98.7054	90.3410	89.8769	82.2420	80.8240	86.1533	85.2066	93.5874	96.6229	102.6509 (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	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	178.3918	(66)

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

	85.8446	76.2464	62.0078	46.9439	35.0911	29.6254	32.0113	41.6095	55.8481	70.9120	82.7648	88.2305 (67)

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

	521.8406	527.2556	513.6098	484.5595	447.8887	413.4233	390.3984	384.9833	398.6291	427.6794	464.3502	498.8156 (68)

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

	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124	55.8124 (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)

	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279	-118.9279 (71)

Water heating gains (Table 5)

	140.5096	137.9610	132.6686	125.4736	120.8023	114.2249	108.6344	115.7974	118.3425	125.7895	134.1985	137.9717 (72)

Total internal gains

	863.4711	856.7394	823.5625	772.2533	719.0585	672.5500	646.3203	657.6665	688.0960	739.6572	796.5898	840.2941 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2300	13.3543	0.6300	0.7000	0.7700	37.6700	(75)
Southwest	12.8700	41.8189	0.6300	0.7000	0.7700	164.4838	(79)

Solar gains	202.1538	322.1473	463.8756	638.3318	740.4877	799.8262	754.2039	671.9948	550.8440	385.9549	242.3639	171.2181 (83)
Total gains	1065.6249	1178.8867	1287.4380	1410.5851	1459.5461	1472.3761	1400.5242	1329.6613	1238.9400	1125.6121	1038.9537	1011.5121 (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	81.9505	83.0563	83.0563	85.2023	84.6749	87.7323	87.7323	87.7323	86.7432	84.6749	85.2023	83.6015	
alpha	6.4634	6.5371	6.5371	6.6802	6.6450	6.8488	6.8488	6.8488	6.7829	6.6450	6.6802	6.5734	
util living area													
	0.9999	0.9998	0.9995	0.9972	0.9841	0.8865	0.7149	0.7588	0.9694	0.9982	0.9998	1.0000	(86)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
Tweekend	20.3098	20.3700	20.4887	20.6567	20.8128	20.9561	20.9922	20.9886	20.8901	20.6862	20.4824	20.3146	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9348	20.0255	20.2108	20.4640	20.7111	20.9326	20.9879	20.9824	20.8283	20.5156	20.1917	19.9422	(87)
Th 2	19.6686	19.6837	19.6837	19.7123	19.7054	19.7444	19.7444	19.7444	19.7320	19.7054	19.7123	19.6911	(88)
util rest of house													
	0.9999	0.9997	0.9990	0.9946	0.9655	0.7701	0.5124	0.5568	0.9225	0.9960	0.9997	0.9999	(89)
Tweekday	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
Tweekend	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	
MIT 2	18.2691	18.4170	18.6856	19.0866	19.4242	19.7125	19.7427	19.7415	19.6054	19.1486	18.6932	18.2971	(90)
Living area fraction									fLA = Living area / (4) =			0.4386	(91)
MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9997	19.1225	19.3546	19.6908	19.9886	20.2477	20.2889	20.2858	20.1418	19.7482	19.3505	19.0187	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9997	0.9989	0.9945	0.9710	0.8245	0.6052	0.6507	0.9427	0.9961	0.9996	0.9999	(94)
Useful gains	1065.4650	1178.5064	1286.0134	1402.8478	1417.1757	1213.9850	847.5284	865.2144	1167.9141	1121.2065	1038.5508	1011.4054	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	3964.1292	3810.3014	3390.2395	2765.8586	2099.2869	1330.9464	859.5083	884.0835	1524.1878	2351.4461	3173.1932	3890.8828	(97)

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

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													
	2156.6062	1768.5663	1565.5443	981.3677	507.4907	0.0000	0.0000	0.0000	0.0000	915.2983	1536.9425	2142.3312	(98)
Space heating												11574.1472	(98)
Space heating per m2											(98) / (4) =	65.0196	(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 %)												279.7378	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												4137.4983	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2156.6062	1768.5663	1565.5443	981.3677	507.4907	0.0000	0.0000	0.0000	0.0000	915.2983	1536.9425	2142.3312	(98)
Space heating efficiency (main heating system 1)													
	279.7378	279.7378	279.7378	279.7378	279.7378	0.0000	0.0000	0.0000	0.0000	279.7378	279.7378	279.7378	(210)
Space heating fuel (main heating system)													
	770.9384	632.2228	559.6470	350.8170	181.4166	0.0000	0.0000	0.0000	0.0000	327.1986	549.4225	765.8354	(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													
	235.8484	207.8735	218.3034	195.6812	191.7515	171.3232	164.5245	180.5525	180.2394	202.9108	214.5741	230.1695	(64)
Efficiency of water heater												267.1400	(216)
(217)m	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	267.1400	(217)
Fuel for water heating, kWh/month													
	88.2865	77.8145	81.7187	73.2504	71.7794	64.1324	61.5874	67.5872	67.4700	75.9567	80.3227	86.1606	(219)
Water heating fuel used												896.0665	(219)
Annual totals kWh/year													
Space heating fuel - main system												4137.4983	(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)												606.4171	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1075 * 1.00) =										-1031.5690		-1031.5690	(233)
Total delivered energy for all uses												4608.4129	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4137.4983	19.4400	804.3297	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	896.0665	19.4400	174.1953	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	606.4171	19.4400	117.8875	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1031.5690	19.4400	-200.5370	(252)
Total energy cost			895.8755	(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	4137.4983	0.5190	2147.3616	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	896.0665	0.5190	465.0585	(264)
Space and water heating			2612.4201	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	606.4171	0.5190	314.7305	(268)
Energy saving/generation technologies				
PV Unit	-1031.5690	0.5190	-535.3843	(269)
Total kg/year			2391.7663	(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	4137.4983	3.0700	12702.1198	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	896.0665	3.0700	2750.9241	(264)
Space and water heating			15453.0440	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)

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

Energy for lighting	606.4171	3.0700	1861.7004 (268)
Energy saving/generation technologies			
PV Unit	-1031.5690	3.0700	-3166.9168 (269)
Primary energy kWh/year			14147.8276 (272)
Primary energy kWh/m2/year			79.4777 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 85

(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 83
Potential environmental impact rating: B 85

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
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	£1096	£1096	£0
Space heating	£804	£804	£0
Water heating	£174	£174	£0
Lighting	£118	£118	£0
Generated (PV)	-£201	-£201	£0
Total cost of fuels	£895	£895	£0
Total cost of uses	£895	£895	£0
Delivered energy	26 kWh/m²	26 kWh/m²	0 kWh/m²
Carbon dioxide emissions	2.4 tonnes	2.4 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	79 kWh/m²	79 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
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FULL SAP CALCULATION PRINTOUT
Calculation Type: Conversion (As Designed)

Design SAP
elmhurst energy

Property Reference	Fl03-Kingsley House	**Issued on Date**	10/05/2022
Assessment Reference	001-BASELINE	**Prop Type Ref**	PR9657
Property	Flat 03-Kingsley House, Crowsley Road, Shiplake, RG9 3LU		

SAP Rating	74 C	**DER**	N/A	**TER**	N/A
Environmental	73 C	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	2.35	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Iraj Maghounaki, ERS Consultants Ltd, Tel: 01865 378 885, info@erscltd.co.uk	**Assessor ID**	v571-0001
Client			

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	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss	(33) + (36) = 91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(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	2.4409	(42)
Average daily hot water use (litres/day)	97.0219	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
									Total per year (kWh/year) = Sum(64)m =			2117.3604	(64)
RHI water heating demand												2117	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	69.6130	61.8296	50.2832	38.0677	28.4560	24.0238	25.9585	33.7419	45.2883	57.5039	67.1155	71.5478	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	622.1477	615.4846	590.8133	554.2370	517.7535	486.1422	468.8675	479.5884	501.8437	538.6416	578.4120	607.5574	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	13.3543	0.6300	0.7000	0.7700	5.4689	(75)
Southwest	7.2700	41.8189	0.6300	0.7000	0.7700	92.9135	(79)
Northwest	2.1300	13.3543	0.6300	0.7000	0.7700	8.6931	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	107.0755	168.8395	238.6876	321.5601	367.5601	394.6742	373.0963	336.2494	281.0034	200.9841	128.0129	90.9256	(83)
Total gains	729.2232	784.3241	829.5009	875.7971	885.3136	880.8164	841.9638	815.8377	782.8471	739.6258	706.4250	698.4830	(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	63.6564	64.6238	64.6238	66.5106	66.0457	68.7509	68.7509	68.7509	67.8730	66.0457	66.5106	65.1020	
alpha	5.2438	5.3083	5.3083	5.4340	5.4030	5.5834	5.5834	5.5834	5.5249	5.4030	5.4340	5.3401	
util living area													
	0.9990	0.9984	0.9963	0.9887	0.9615	0.8379	0.6669	0.6971	0.9264	0.9895	0.9980	0.9992	(86)
MIT	19.7680	19.8778	20.0911	20.3943	20.6685	20.9170	20.9821	20.9773	20.8223	20.4674	20.0958	19.7803	(87)
Th 2	19.3577	19.3775	19.3775	19.4149	19.4059	19.4573	19.4573	19.4573	19.4410	19.4059	19.4149	19.3872	(88)
util rest of house													
	0.9984	0.9973	0.9936	0.9787	0.9209	0.6878	0.4331	0.4634	0.8346	0.9779	0.9963	0.9987	(89)

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MIT 2	18.2954	18.4208	18.6331	18.9619	19.2105	19.4347	19.4560	19.4553	19.3680	19.0278	18.6684	18.3313	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.9496	19.0680	19.2808	19.5981	19.8581	20.0932	20.1339	20.1314	20.0140	19.6673	19.3025	18.9749	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7996	18.9180	19.1308	19.4481	19.7081	19.9432	19.9839	19.9814	19.8640	19.5173	19.1525	18.8249	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9969	0.9930	0.9790	0.9312	0.7433	0.5182	0.5493	0.8669	0.9790	0.9959	0.9985	(94)
Useful gains	727.8240	781.8991	823.6749	857.4105	824.3859	654.6818	436.3227	448.1454	678.6570	724.1185	703.5433	697.4039	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	2229.8409	2138.2661	1896.1524	1533.6933	1150.4586	708.7509	442.1668	456.1471	822.6064	1301.0761	1771.4691	2184.1669	(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													
	1117.5006	911.4786	797.9233	486.9236	242.5981	0.0000	0.0000	0.0000	0.0000	429.2565	768.9066	1106.1516	(98)
Space heating												5860.7388	(98)
RHI space heating demand												5861	(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	78.8600	(1b)	x 2.7900	(2b) =	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(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	0.9606	0.9417	0.9229	0.8287	0.8099	0.7157	0.7157	0.6969	0.7534	0.8099	0.8476	0.8852	(22b)
Effective ac	0.9614	0.9434	0.9259	0.8434	0.8280	0.7561	0.7561	0.7428	0.7838	0.8280	0.8592	0.8918	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	69.8009	68.5002	67.2252	61.2365	60.1161	54.9002	54.9002	53.9343	56.9093	60.1161	62.3827	64.7524	(38)
Heat transfer coeff	161.1011	159.8003	158.5253	152.5367	151.4162	146.2003	146.2003	145.2344	148.2094	151.4162	153.6829	156.0526	(39)
Average = Sum(39)m / 12 =												152.5313	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0429	2.0264	2.0102	1.9343	1.9201	1.8539	1.8539	1.8417	1.8794	1.9201	1.9488	1.9789	(40)
HLP (average)												1.9342	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

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  Volume factor from Table 2a                                                                                    0.9283 (52)
  Temperature factor from Table 2b                                                                               0.5400 (53)
Enter (49) or (54) in (55)                                                                                       0.8683 (55)
Total storage loss
              26.9176    24.3126    26.9176    26.0493    26.9176    26.0493    26.9176    26.9176    26.0493    26.9176    26.0493    26.9176 (56)
If cylinder contains dedicated solar storage
              26.9176    24.3126    26.9176    26.0493    26.9176    26.0493    26.9176    26.9176    26.0493    26.9176    26.0493    26.9176 (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
             208.4487   183.7466   193.0199   173.0926   169.6707   151.6727   145.7279   159.8226   159.5134   179.4839   189.7067   203.4547 (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
             208.4487   183.7466   193.0199   173.0926   169.6707   151.6727   145.7279   159.8226   159.5134   179.4839   189.7067   203.4547 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m =   2117.3604 (64)
Heat gains from water heating, kWh/month
              92.7683    82.2847    87.6383    80.2557    79.8747    73.1336    71.9137    76.6001    75.7406    83.1375    85.7799    91.1078 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m        146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              69.6130    61.8296    50.2832    38.0677    28.4560    24.0238    25.9585    33.7419    45.2883    57.5039    67.1155    71.5478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             323.9425   327.3040   318.8331   300.7996   278.0355   256.6404   242.3472   238.9857   247.4566   265.4901   288.2542   309.6493 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350 (71)
Water heating gains (Table 5)
             124.6886   122.4474   117.7934   111.4662   107.3584   101.5744    96.6581   102.9572   105.1953   111.7440   119.1387   122.4568 (72)
Total internal gains
             622.1477   615.4846   590.8133   554.2370   517.7535   486.1422   468.8675   479.5884   501.8437   538.6416   578.4120   607.5574 (73)


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6. Solar gains
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[Jan]                                  Area        Solar flux              g              FF          Access          Gains
                                         m2          Table 6a     Specific data  Specific data      factor              W
                                                        W/m2     or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
Northeast                             1.3400          11.2829           0.6300         0.7000          0.7700          4.6206 (75)
Southwest                             7.2700          36.7938           0.6300         0.7000          0.7700         81.7488 (79)
Northwest                             2.1300          11.2829           0.6300         0.7000          0.7700          7.3447 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains   93.7141   163.6041   234.4070   308.1363   361.2891   365.7807   349.6952   308.9546   259.7691   183.6638   112.9716    79.7314 (83)
Total gains  715.8617   779.0888   825.2203   862.3733   879.0426   851.9229   818.5627   788.5430   761.6128   722.3054   691.3837   687.2888 (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          61.1883    61.6864    62.1825    64.6238    65.1020    67.4246    67.4246    67.8730    66.5106    65.1020    64.1418    63.1678
alpha         5.0792     5.1124     5.1455     5.3083     5.3401     5.4950     5.4950     5.5249     5.4340     5.3401     5.2761     5.2112
util living area
               0.9991     0.9984     0.9967     0.9905     0.9680     0.8828     0.7293     0.7689     0.9394     0.9915     0.9982     0.9993 (86)

MIT          19.6896    19.8072    20.0174    20.3349    20.6257    20.8758    20.9687    20.9582    20.7928    20.4232    20.0314    19.7079 (87)
Th 2         19.3049    19.3158    19.3265    19.3775    19.3872    19.4325    19.4325    19.4410    19.4149    19.3872    19.3677    19.3475 (88)
util rest of house
               0.9985     0.9974     0.9942     0.9822     0.9343     0.7574     0.4999     0.5498     0.8585     0.9821     0.9968     0.9989 (89)
MIT 2        18.1754    18.3013    18.5192    18.8736    19.1569    19.3910    19.4292    19.4355    19.3246    18.9699    18.5665    18.2274 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.4442 (91)
MIT          18.8480    18.9702    19.1847    19.5227    19.8093    20.0506    20.1130    20.1119    19.9768    19.6155    19.2172    18.8851 (92)
Temperature adjustment                                                                                          -0.1500
adjusted MIT 18.6980    18.8202    19.0347    19.3727    19.6593    19.9006    19.9630    19.9619    19.8268    19.4655    19.0672    18.7351 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9982     0.9970     0.9936     0.9822     0.9420     0.8033     0.5855     0.6326     0.8865     0.9828     0.9964     0.9986 (94)
Useful gains 714.5982   776.7139   819.9513   847.0142   828.0327   684.3662   479.2954   498.7936   675.1430   709.8717   688.9058   686.3374 (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
             2319.5355  2224.4564  1987.0695  1597.4728  1205.1729   774.9457   491.6756   517.3061   848.7622  1342.3734  1839.1523  2268.2340 (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
             1194.0733   972.8830   868.3360   540.3302   280.5923     0.0000     0.0000     0.0000     0.0000   470.5812   828.1775  1176.9311 (98)
Space heating                                                                                                   6331.9046 (98)
Space heating per m2                                                                                 (98) / (4) =     80.2930 (99)


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8c. Space cooling requirement
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	7628.8007	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1194.0733	972.8830	868.3360	540.3302	280.5923	0.0000	0.0000	0.0000	0.0000	470.5812	828.1775	1176.9311	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	1438.6425	1172.1482	1046.1879	651.0003	338.0630	0.0000	0.0000	0.0000	0.0000	566.9653	997.8042	1417.9893	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												83.0000	(216)
(217)m	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	(217)
Fuel for water heating, kWh/month													
	251.1430	221.3815	232.5541	208.5453	204.4226	182.7382	175.5758	192.5573	192.1848	216.2457	228.5622	245.1262	(219)
Water heating fuel used												2551.0366	(219)
Annual totals kWh/year													
Space heating fuel - main system												7628.8007	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												39.0000	(230c)
Total electricity for the above, kWh/year												39.0000	(231)
Electricity for lighting (calculated in Appendix L)												491.7549	(232)
Total delivered energy for all uses												10710.5922	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7628.8007	3.4800	265.4823	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2551.0366	3.4800	88.7761	(247)
Pumps and fans for heating	39.0000	13.1900	5.1441	(249)
Energy for lighting	491.7549	13.1900	64.8625	(250)
Additional standing charges			120.0000	(251)
Total energy cost			544.2649	(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] =	1.8456	(257)
SAP value		74.2544	
SAP rating (Section 12)		74	(258)
SAP band		C	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7628.8007	0.2160	1647.8209	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.0366	0.2160	551.0239	(264)
Space and water heating			2198.8449	(265)
Pumps and fans	39.0000	0.5190	20.2410	(267)
Energy for lighting	491.7549	0.5190	255.2208	(268)
Total kg/year			2474.3066	(272)
CO2 emissions per m2			31.3800	(273)
EI value			73.2313	
EI rating			73	(274)
EI band			C	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8800 = 3.955, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8800 = 0.2455, stars = 4
Water heating energy efficiency	3.48 / 0.8800 = 3.955, stars = 4
Water heating environmental impact	0.216 / 0.8800 = 0.2455, stars = 4

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	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

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

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  Volume factor from Table 2a                                                                                    0.9283 (52)
  Temperature factor from Table 2b                                                                               0.5400 (53)
Enter (49) or (54) in (55)                                                                                       0.8683 (55)
Total storage loss
              26.9176    24.3126    26.9176    26.0493    26.9176    26.0493    26.9176    26.9176    26.0493    26.9176    26.0493    26.9176 (56)
If cylinder contains dedicated solar storage
              26.9176    24.3126    26.9176    26.0493    26.9176    26.0493    26.9176    26.9176    26.0493    26.9176    26.0493    26.9176 (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
             208.4487   183.7466   193.0199   173.0926   169.6707   151.6727   145.7279   159.8226   159.5134   179.4839   189.7067   203.4547 (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
             208.4487   183.7466   193.0199   173.0926   169.6707   151.6727   145.7279   159.8226   159.5134   179.4839   189.7067   203.4547 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m =   2117.3604 (64)
Heat gains from water heating, kWh/month
              92.7683    82.2847    87.6383    80.2557    79.8747    73.1336    71.9137    76.6001    75.7406    83.1375    85.7799    91.1078 (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      146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525   146.4525 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               69.6130    61.8296    50.2832    38.0677    28.4560    24.0238    25.9585    33.7419    45.2883    57.5039    67.1155    71.5478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              323.9425   327.3040   318.8331   300.7996   278.0355   256.6404   242.3472   238.9857   247.4566   265.4901   288.2542   309.6493 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861    52.0861 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350   -97.6350 (71)
Water heating gains (Table 5)
              124.6886   122.4474   117.7934   111.4662   107.3584   101.5744    96.6581   102.9572   105.1953   111.7440   119.1387   122.4568 (72)
Total internal gains
              622.1477   615.4846   590.8133   554.2370   517.7535   486.1422   468.8675   479.5884   501.8437   538.6416   578.4120   607.5574 (73)


------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                          m2           Table 6a       Specific data    Specific data        factor                W
                                                          W/m2         or Table 6b      or Table 6c       Table 6d
------------------------------------------------------------------------------------------------------------
Northeast                                1.3400           13.3543           0.6300           0.7000           0.7700           5.4689 (75)
Southwest                                7.2700           41.8189           0.6300           0.7000           0.7700          92.9135 (79)
Northwest                                2.1300           13.3543           0.6300           0.7000           0.7700           8.6931 (81)
------------------------------------------------------------------------------------------------------------

Solar gains   107.0755   168.8395   238.6876   321.5601   367.5601   394.6742   373.0963   336.2494   281.0034   200.9841   128.0129    90.9256 (83)
Total gains   729.2232   784.3241   829.5009   875.7971   885.3136   880.8164   841.9638   815.8377   782.8471   739.6258   706.4250   698.4830 (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           63.6564    64.6238    64.6238    66.5106    66.0457    68.7509    68.7509    68.7509    67.8730    66.0457    66.5106    65.1020
alpha          5.2438     5.3083     5.3083     5.4340     5.4030     5.5834     5.5834     5.5834     5.5249     5.4030     5.4340     5.3401
util living area
               0.9990     0.9984     0.9963     0.9887     0.9615     0.8379     0.6669     0.6971     0.9264     0.9895     0.9980     0.9992 (86)

MIT           19.7680    19.8778    20.0911    20.3943    20.6685    20.9170    20.9821    20.9773    20.8223    20.4674    20.0958    19.7803 (87)
Th 2          19.3577    19.3775    19.3775    19.4149    19.4059    19.4573    19.4573    19.4573    19.4410    19.4059    19.4149    19.3872 (88)
util rest of house
               0.9984     0.9973     0.9936     0.9787     0.9209     0.6878     0.4331     0.4634     0.8346     0.9779     0.9963     0.9987 (89)
MIT 2         18.2954    18.4208    18.6331    18.9619    19.2105    19.4347    19.4560    19.4553    19.3680    19.0278    18.6684    18.3313 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.4442 (91)
MIT           18.9496    19.0680    19.2808    19.5981    19.8581    20.0932    20.1339    20.1314    20.0140    19.6673    19.3025    18.9749 (92)
Temperature adjustment                                                                                           -0.1500
adjusted MIT  18.7996    18.9180    19.1308    19.4481    19.7081    19.9432    19.9839    19.9814    19.8640    19.5173    19.1525    18.8249 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9981     0.9969     0.9930     0.9790     0.9312     0.7433     0.5182     0.5493     0.8669     0.9790     0.9959     0.9985 (94)
Useful gains 727.8240   781.8991   823.6749   857.4105   824.3859   654.6818   436.3227   448.1454   678.6570   724.1185   703.5433   697.4039 (95)
Ext temp.      4.4000     4.9000     6.7000     9.1000    12.0000    15.0000    16.9000    16.8000    14.2000    10.8000     7.2000     4.4000 (96)
Heat loss rate W
             2229.8409  2138.2661  1896.1524  1533.6933  1150.4586   708.7509   442.1668   456.1471   822.6064  1301.0761  1771.4691  2184.1669 (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
             1117.5006   911.4786   797.9233   486.9236   242.5981     0.0000     0.0000     0.0000     0.0000   429.2565   768.9066  1106.1516 (98)
Space heating                                                                                                   5860.7388 (98)
Space heating per m2                                                                                  (98) / (4) =     74.3183 (99)


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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	7061.1311	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1117.5006	911.4786	797.9233	486.9236	242.5981	0.0000	0.0000	0.0000	0.0000	429.2565	768.9066	1106.1516	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	1346.3862	1098.1670	961.3533	586.6549	292.2868	0.0000	0.0000	0.0000	0.0000	517.1765	926.3935	1332.7128	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												83.0000	(216)
(217)m	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	(217)
Fuel for water heating, kWh/month													
	251.1430	221.3815	232.5541	208.5453	204.4226	182.7382	175.5758	192.5573	192.1848	216.2457	228.5622	245.1262	(219)
Water heating fuel used												2551.0366	(219)
Annual totals kWh/year													
Space heating fuel - main system												7061.1311	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												39.0000	(230c)
Total electricity for the above, kWh/year												39.0000	(231)
Electricity for lighting (calculated in Appendix L)												491.7549	(232)
Total delivered energy for all uses												10142.9226	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7061.1311	3.6300	256.3191	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2551.0366	3.6300	92.6026	(247)
Pumps and fans for heating	39.0000	19.4400	7.5816	(249)
Energy for lighting	491.7549	19.4400	95.5972	(250)
Additional standing charges			95.0000	(251)
Total energy cost			547.1004	(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	7061.1311	0.2160	1525.2043	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.0366	0.2160	551.0239	(264)
Space and water heating			2076.2282	(265)
Pumps and fans	39.0000	0.5190	20.2410	(267)
Energy for lighting	491.7549	0.5190	255.2208	(268)
Total kg/year			2351.6900	(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	7061.1311	1.2200	8614.5799	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.0366	1.2200	3112.2647	(264)
Space and water heating			11726.8446	(265)
Pumps and fans	39.0000	3.0700	119.7300	(267)
Energy for lighting	491.7549	3.0700	1509.6875	(268)
Primary energy kWh/year			13356.2622	(272)
Primary energy kWh/m2/year			169.3668	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	C 74
Current environmental impact rating:	C 73

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

(For testing purposes):		
A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Recommended
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
E Low energy lighting	+ 0.6	-£ 21	-46 kg (2.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Low energy lighting	£21	0.58 kg/m²	C 75	C 74
Total Savings	£21	0.58 kg/m²		

Potential energy efficiency rating: C 75
Potential environmental impact rating: C 74

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
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	£103	£79	£24
Mains gas	£444	£447	-£3
Space heating	£359	£362	-£3
Water heating	£93	£93	-£0
Lighting	£96	£72	£24
Total cost of fuels	£547	£526	£21
Total cost of uses	£548	£527	£21
Delivered energy	129 kWh/m²	128 kWh/m²	1 kWh/m²
Carbon dioxide emissions	2.4 tonnes	2.3 tonnes	0.0 tonnes
CO2 emissions per m²	30 kg/m²	29 kg/m²	1 kg/m²
Primary energy	169 kWh/m²	166 kWh/m²	4 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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(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	0.9606	0.9417	0.9229	0.8287	0.8099	0.7157	0.7157	0.6969	0.7534	0.8099	0.8476	0.8852	(22b)
Effective ac	0.9614	0.9434	0.9259	0.8434	0.8280	0.7561	0.7561	0.7428	0.7838	0.8280	0.8592	0.8918	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	69.8009	68.5002	67.2252	61.2365	60.1161	54.9002	54.9002	53.9343	56.9093	60.1161	62.3827	64.7524	(38)
Heat transfer coeff	161.1011	159.8003	158.5253	152.5367	151.4162	146.2003	146.2003	145.2344	148.2094	151.4162	153.6829	156.0526	(39)
Average = Sum(39)m / 12 =												152.5313	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0429	2.0264	2.0102	1.9343	1.9201	1.8539	1.8539	1.8417	1.8794	1.9201	1.9488	1.9789	(40)
HLP (average)												1.9342	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
									Total per year (kWh/year) = Sum(64)m =			2117.3604	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	604.7444	600.0272	578.2425	544.7201	510.6395	480.1363	462.3779	471.1529	490.5217	524.2657	561.6332	589.6705	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	11.2829	0.6300	0.7000	0.7700	4.6206	(75)
Southwest	7.2700	36.7938	0.6300	0.7000	0.7700	81.7488	(79)
Northwest	2.1300	11.2829	0.6300	0.7000	0.7700	7.3447	(81)

Solar gains	93.7141	163.6041	234.4070	308.1363	361.2891	365.7807	349.6952	308.9546	259.7691	183.6638	112.9716	79.7314	(83)
Total gains	698.4585	763.6314	812.6495	852.8564	871.9286	845.9169	812.0730	780.1076	750.2908	707.9294	674.6048	669.4019	(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	61.1883	61.6864	62.1825	64.6238	65.1020	67.4246	67.4246	67.8730	66.5106	65.1020	64.1418	63.1678	
alpha	5.0792	5.1124	5.1455	5.3083	5.3401	5.4950	5.4950	5.5249	5.4340	5.3401	5.2761	5.2112	
util living area													
	0.9992	0.9986	0.9969	0.9910	0.9691	0.8853	0.7335	0.7743	0.9427	0.9923	0.9984	0.9994	(86)
MIT	19.6781	19.7970	20.0092	20.3288	20.6216	20.8737	20.9678	20.9566	20.7873	20.4140	20.0203	19.6960	(87)
Th 2	19.3049	19.3158	19.3265	19.3775	19.3872	19.4325	19.4325	19.4410	19.4149	19.3872	19.3677	19.3475	(88)
util rest of house													
	0.9987	0.9976	0.9946	0.9830	0.9361	0.7610	0.5037	0.5553	0.8644	0.9836	0.9972	0.9990	(89)
MIT 2	18.1639	18.2912	18.5111	18.8678	19.1535	19.3900	19.4291	19.4352	19.3210	18.9611	18.5554	18.2155	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.8365	18.9601	19.1766	19.5168	19.8057	20.0491	20.1126	20.1110	19.9723	19.6065	19.2061	18.8732	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6865	18.8101	19.0266	19.3668	19.6557	19.8991	19.9626	19.9610	19.8223	19.4565	19.0561	18.7232	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9972	0.9940	0.9830	0.9436	0.8065	0.5896	0.6382	0.8914	0.9841	0.9968	0.9988	(94)
Useful gains	697.3548	761.5011	807.7908	838.3356	822.7264	682.2710	478.8129	497.8727	668.7779	696.7076	672.4412	668.5819	(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													
	2317.6874	2222.8338	1985.7761	1596.5705	1204.6186	774.7255	491.6077	517.1869	848.1048	1341.0141	1837.4490	2266.3796	(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													
	1205.5275	982.0156	876.4211	545.9291	284.1279	0.0000	0.0000	0.0000	0.0000	479.3641	838.8056	1188.7615	(98)
Space heating												6400.9522	(98)
Space heating per m2											(98) / (4) =	81.1686	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	7711.9906	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1205.5275	982.0156	876.4211	545.9291	284.1279	0.0000	0.0000	0.0000	0.0000	479.3641	838.8056	1188.7615	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	1452.4427	1183.1513	1055.9290	657.7459	342.3227	0.0000	0.0000	0.0000	0.0000	577.5470	1010.6092	1432.2427	(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		
208.4487 183.7466 193.0199 173.0926 169.6707 151.6727 145.7279 159.8226 159.5134 179.4839 189.7067 203.4547		(64)
Efficiency of water heater	83.0000	(216)
(217)m 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000 83.0000		(217)
Fuel for water heating, kWh/month		
251.1430 221.3815 232.5541 208.5453 204.4226 182.7382 175.5758 192.5573 192.1848 216.2457 228.5622 245.1262		(219)
Water heating fuel used	2551.0366	(219)
Annual totals kWh/year		
Space heating fuel - main system	7711.9906	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	39.0000	(230c)
Total electricity for the above, kWh/year	39.0000	(231)
Electricity for lighting (calculated in Appendix L)	368.8162	(232)
Total delivered energy for all uses	10670.8434	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7711.9906	3.4800	268.3773	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2551.0366	3.4800	88.7761	(247)
Pumps and fans for heating	39.0000	13.1900	5.1441	(249)
Energy for lighting	368.8162	13.1900	48.6469	(250)
Additional standing charges			120.0000	(251)
Total energy cost			530.9443	(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] =	1.8004	(257)
SAP value		74.8845	
SAP rating (Section 12)		75	(258)
SAP band		C	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7711.9906	0.2160	1665.7900	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.0366	0.2160	551.0239	(264)
Space and water heating			2216.8139	(265)
Pumps and fans	39.0000	0.5190	20.2410	(267)
Energy for lighting	368.8162	0.5190	191.4156	(268)
Total kg/year			2428.4705	(272)
CO2 emissions per m2			30.7900	(273)
EI value			73.7272	
EI rating			74	(274)
EI band			C	

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

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

Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	604.7444	600.0272	578.2425	544.7201	510.6395	480.1363	462.3779	471.1529	490.5217	524.2657	561.6332	589.6705	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	13.3543	0.6300	0.7000	0.7700	5.4689	(75)
Southwest	7.2700	41.8189	0.6300	0.7000	0.7700	92.9135	(79)
Northwest	2.1300	13.3543	0.6300	0.7000	0.7700	8.6931	(81)

Solar gains	107.0755	168.8395	238.6876	321.5601	367.5601	394.6742	373.0963	336.2494	281.0034	200.9841	128.0129	90.9256	(83)
Total gains	711.8199	768.8667	816.9301	866.2802	878.1996	874.8104	835.4742	807.4023	771.5250	725.2498	689.6461	680.5961	(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	63.6564	64.6238	64.6238	66.5106	66.0457	68.7509	68.7509	68.7509	67.8730	66.0457	66.5106	65.1020	
alpha	5.2438	5.3083	5.3083	5.4340	5.4030	5.5834	5.5834	5.5834	5.5249	5.4030	5.4340	5.3401	
util living area													
	0.9991	0.9986	0.9966	0.9892	0.9627	0.8409	0.6711	0.7027	0.9301	0.9904	0.9982	0.9993	(86)
MIT	19.7564	19.8676	20.0829	20.3883	20.6646	20.9154	20.9816	20.9764	20.8172	20.4583	20.0846	19.7683	(87)
Th 2	19.3577	19.3775	19.3775	19.4149	19.4059	19.4573	19.4573	19.4573	19.4410	19.4059	19.4149	19.3872	(88)
util rest of house													
	0.9986	0.9976	0.9940	0.9797	0.9231	0.6915	0.4364	0.4681	0.8410	0.9796	0.9967	0.9989	(89)
MIT 2	18.2839	18.4106	18.6250	18.9561	19.2073	19.4341	19.4559	19.4552	19.3649	19.0192	18.6573	18.3193	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.9380	19.0578	19.2726	19.5923	19.8547	20.0921	20.1336	20.1309	20.0100	19.6584	19.2913	18.9630	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7880	18.9078	19.1226	19.4423	19.7047	19.9421	19.9836	19.9809	19.8600	19.5084	19.1413	18.8130	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9972	0.9934	0.9799	0.9330	0.7467	0.5220	0.5545	0.8723	0.9806	0.9963	0.9986	(94)
Useful gains	710.5982	766.6963	811.5633	848.8845	819.3724	653.2643	436.0760	447.7071	672.9664	711.2083	687.1282	679.6660	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	2228.0515	2136.7035	1894.9024	1532.8257	1149.9403	708.5984	442.1273	456.0812	822.0251	1299.7561	1769.8188	2182.3580	(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													
	1128.9853	920.6448	806.0043	492.4377	245.9425	0.0000	0.0000	0.0000	0.0000	437.8795	779.5372	1118.0029	(98)
Space heating												5929.4343	(98)
Space heating per m2											(98) / (4) =	75.1894	(99)

8c. Space cooling requirement

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	7143.8968	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1128.9853	920.6448	806.0043	492.4377	245.9425	0.0000	0.0000	0.0000	0.0000	437.8795	779.5372	1118.0029	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	1360.2232	1109.2106	971.0896	593.2984	296.3163	0.0000	0.0000	0.0000	0.0000	527.5657	939.2014	1346.9914	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												83.0000	(216)
(217)m	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	83.0000	(217)
Fuel for water heating, kWh/month													
	251.1430	221.3815	232.5541	208.5453	204.4226	182.7382	175.5758	192.5573	192.1848	216.2457	228.5622	245.1262	(219)
Water heating fuel used												2551.0366	(219)
Annual totals kWh/year													
Space heating fuel - main system												7143.8968	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												39.0000	(230c)
Total electricity for the above, kWh/year												39.0000	(231)
Electricity for lighting (calculated in Appendix L)												368.8162	(232)
Total delivered energy for all uses												10102.7495	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7143.8968	3.6300	259.3235	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2551.0366	3.6300	92.6026	(247)
Pumps and fans for heating	39.0000	19.4400	7.5816	(249)
Energy for lighting	368.8162	19.4400	71.6979	(250)
Additional standing charges			95.0000	(251)
Total energy cost			526.2055	(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	7143.8968	0.2160	1543.0817	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.0366	0.2160	551.0239	(264)
Space and water heating			2094.1056	(265)
Pumps and fans	39.0000	0.5190	20.2410	(267)
Energy for lighting	368.8162	0.5190	191.4156	(268)
Total kg/year			2305.7622	(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	7143.8968	1.2200	8715.5540	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.0366	1.2200	3112.2647	(264)
Space and water heating			11827.8187	(265)
Pumps and fans	39.0000	3.0700	119.7300	(267)
Energy for lighting	368.8162	3.0700	1132.2657	(268)
Primary energy kWh/year			13079.8144	(272)
Primary energy kWh/m2/year			165.8612	(273)

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

Design SAP
elmhurst energy

Property Reference	Fl03-Kingsley House	**Issued on Date**	10/05/2022
Assessment Reference	002-BE LEAN	**Prop Type Ref**	PR9657
Property	Flat 03-Kingsley House, Crowsley Road, Shiplake, RG9 3LU		

SAP Rating	81 B	**DER**	N/A	**TER**	N/A
Environmental	83 B	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	1.55	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Iraj Maghounaki, ERS Consultants Ltd, Tel: 01865 378 885, info@erscltd.co.uk	**Assessor ID**	v571-0001
Client			

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	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss	(33) + (36) = 91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(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	2.4409	(42)
Average daily hot water use (litres/day)	97.0219	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
RHI water heating demand												2117	(64)
Heat gains from water heating, kWh/month	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains	601.7444	597.0272	575.2425	541.7201	507.6395	477.1363	459.3779	468.1529	487.5217	521.2657	558.6332	586.6705	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	13.3543	0.6300	0.7000	0.7700	5.4689	(75)
Southwest	7.2700	41.8189	0.6300	0.7000	0.7700	92.9135	(79)
Northwest	2.1300	13.3543	0.6300	0.7000	0.7700	8.6931	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	107.0755	168.8395	238.6876	321.5601	367.5601	394.6742	373.0963	336.2494	281.0034	200.9841	128.0129	90.9256	(83)
Total gains	708.8199	765.8667	813.9301	863.2802	875.1996	871.8104	832.4742	804.4023	768.5250	722.2498	686.6461	677.5961	(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	63.6564	64.6238	64.6238	66.5106	66.0457	68.7509	68.7509	68.7509	67.8730	66.0457	66.5106	65.1020	
alpha	5.2438	5.3083	5.3083	5.4340	5.4030	5.5834	5.5834	5.5834	5.5249	5.4030	5.4340	5.3401	
util living area	0.9992	0.9986	0.9966	0.9894	0.9632	0.8424	0.6731	0.7047	0.9311	0.9906	0.9982	0.9993	(86)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
Tweekend	20.1948	20.2666	20.4058	20.6033	20.7821	20.9448	20.9879	20.9845	20.8809	20.6486	20.4069	20.2025	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	

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16 / 9	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7573	19.8656	20.0830	20.3806	20.6637	20.9152	20.9813	20.9761	20.8140	20.4576	20.0739	19.7691 (87)
Th 2	19.3577	19.3775	19.3775	19.4149	19.4059	19.4573	19.4573	19.4573	19.4410	19.4059	19.4149	19.3872 (88)
util rest of house												
	0.9986	0.9976	0.9941	0.9800	0.9240	0.6934	0.4379	0.4698	0.8426	0.9800	0.9968	0.9989 (89)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202
Tweekend	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202
MIT 2	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202 (90)
Living area fraction										fLA = Living area / (4) =		0.4442 (91)
MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9971	0.9934	0.9804	0.9367	0.7634	0.5473	0.5800	0.8820	0.9814	0.9963	0.9986	(94)
Useful gains	707.5754	763.6694	808.5825	846.3900	819.8304	665.5673	455.5792	466.5879	677.8633	708.8375	684.1391	676.6498	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	2208.1461	2121.1138	1887.9067	1536.7720	1164.4549	729.1965	463.5651	477.4892	840.6562	1306.9750	1762.1123	2163.1226	(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													
	1116.4246	912.2026	803.0172	497.0750	256.4006	0.0000	0.0000	0.0000	0.0000	445.0144	776.1407	1105.9358	(98)
Space heating												5912.2109	(98)
RHI space heating demand												5912	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (As Designed) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(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	0.9606	0.9417	0.9229	0.8287	0.8099	0.7157	0.7157	0.6969	0.7534	0.8099	0.8476	0.8852	(22b)
Effective ac	0.9614	0.9434	0.9259	0.8434	0.8280	0.7561	0.7561	0.7428	0.7838	0.8280	0.8592	0.8918	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	69.8009	68.5002	67.2252	61.2365	60.1161	54.9002	54.9002	53.9343	56.9093	60.1161	62.3827	64.7524	(38)
Heat transfer coeff	161.1011	159.8003	158.5253	152.5367	151.4162	146.2003	146.2003	145.2344	148.2094	151.4162	153.6829	156.0526	(39)
Average = Sum(39)m / 12 =												152.5313	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0429	2.0264	2.0102	1.9343	1.9201	1.8539	1.8539	1.8417	1.8794	1.9201	1.9488	1.9789	(40)
HLP (average)												1.9342	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	601.7444	597.0272	575.2425	541.7201	507.6395	477.1363	459.3779	468.1529	487.5217	521.2657	558.6332	586.6705	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	11.2829	0.6300	0.7000	0.7700	4.6206	(75)
Southwest	7.2700	36.7938	0.6300	0.7000	0.7700	81.7488	(79)
Northwest	2.1300	11.2829	0.6300	0.7000	0.7700	7.3447	(81)

Solar gains	93.7141	163.6041	234.4070	308.1363	361.2891	365.7807	349.6952	308.9546	259.7691	183.6638	112.9716	79.7314	(83)
Total gains	695.4585	760.6314	809.6495	849.8564	868.9286	842.9169	809.0730	777.1076	747.2908	704.9294	671.6048	666.4019	(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	61.1883	61.6864	62.1825	64.6238	65.1020	67.4246	67.4246	67.8730	66.5106	65.1020	64.1418	63.1678	
alpha	5.0792	5.1124	5.1455	5.3083	5.3401	5.4950	5.4950	5.5249	5.4340	5.3401	5.2761	5.2112	
util living area													
	0.9992	0.9986	0.9970	0.9911	0.9695	0.8866	0.7354	0.7763	0.9435	0.9924	0.9985	0.9994	(86)
Tweekday	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	
Tweekend	20.1442	20.2210	20.3582	20.5649	20.7543	20.9176	20.9789	20.9716	20.8615	20.6199	20.3654	20.1557	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.6791	19.7950	20.0095	20.3206	20.6208	20.8735	20.9674	20.9562	20.7838	20.4134	20.0090	19.6970	(87)
Th 2	19.3049	19.3158	19.3265	19.3775	19.3872	19.4325	19.4325	19.4410	19.4149	19.3872	19.3677	19.3475	(88)
util rest of house													
	0.9987	0.9977	0.9947	0.9833	0.9369	0.7628	0.5055	0.5572	0.8659	0.9839	0.9972	0.9990	(89)
Tweekday	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	
Tweekend	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	
MIT 2	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.5407	18.6930	18.9645	19.3800	19.7438	20.0376	20.1115	20.1093	19.9458	19.4947	18.9897	18.5797	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5407	18.6930	18.9645	19.3800	19.7438	20.0376	20.1115	20.1093	19.9458	19.4947	18.9897	18.5797	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9972	0.9940	0.9833	0.9465	0.8202	0.6144	0.6623	0.8997	0.9847	0.9968	0.9987	(94)
Useful gains	694.3291	758.4649	804.7812	835.6806	822.4347	691.3795	497.1230	514.6860	672.3643	694.1624	669.4395	665.5640	(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													
	2294.1991	2204.1229	1975.9422	1598.5852	1217.9636	794.9803	513.3786	538.7161	866.3954	1346.7997	1827.2485	2243.9852	(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													
	1190.3033	971.4822	871.3438	549.2913	294.2735	0.0000	0.0000	0.0000	0.0000	485.5621	833.6225	1174.3454	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating		6370.2241 (98)
Space heating per m2	(98) / (4) =	80.7789 (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 %)		323.0687 (206)
Efficiency of secondary/supplementary heating system, %		100.0000 (208)
Space heating requirement		1971.7865 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1190.3033	971.4822	871.3438	549.2913	294.2735	0.0000	0.0000	0.0000	0.0000	485.5621	833.6225	1174.3454	(98)
Space heating efficiency (main heating system 1)													
	323.0687	323.0687	323.0687	323.0687	323.0687	0.0000	0.0000	0.0000	0.0000	323.0687	323.0687	323.0687	(210)
Space heating fuel (main heating system)													
	368.4366	300.7046	269.7085	170.0231	91.0870	0.0000	0.0000	0.0000	0.0000	150.2969	258.0326	363.4971	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												282.8150	(216)
(217)m	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	(217)
Fuel for water heating, kWh/month													
	73.7049	64.9706	68.2495	61.2035	59.9935	53.6297	51.5276	56.5114	56.4020	63.4634	67.0780	71.9392	(219)
Water heating fuel used												748.6733	(219)
Annual totals kWh/year													
Space heating fuel - main system												1971.7865	(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)												368.8162	(232)
Total delivered energy for all uses												3089.2759	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1971.7865	13.1900	260.0786	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	748.6733	13.1900	98.7500	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	368.8162	13.1900	48.6469	(250)
Additional standing charges			0.0000	(251)
Total energy cost			407.4755	(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] =	1.3817 (257)
SAP value		80.7250
SAP rating (Section 12)		81 (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	1971.7865	0.5190	1023.3572	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	748.6733	0.5190	388.5614	(264)
Space and water heating			1411.9186	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.8162	0.5190	191.4156	(268)
Total kg/year			1603.3342	(272)
CO2 emissions per m2			20.3300	(273)
EI value			82.6541	
EI rating			83	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 3.2307 = 4.083, stars = 4
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 3.2307 = 0.1606, stars = 5
Water heating energy efficiency	13.19 / 2.8282 = 4.664, stars = 4
Water heating environmental impact	0.519 / 2.8282 = 0.1835, stars = 5

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	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

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

Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	601.7444	597.0272	575.2425	541.7201	507.6395	477.1363	459.3779	468.1529	487.5217	521.2657	558.6332	586.6705	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	13.3543	0.6300	0.7000	0.7700	5.4689	(75)
Southwest	7.2700	41.8189	0.6300	0.7000	0.7700	92.9135	(79)
Northwest	2.1300	13.3543	0.6300	0.7000	0.7700	8.6931	(81)

Solar gains	107.0755	168.8395	238.6876	321.5601	367.5601	394.6742	373.0963	336.2494	281.0034	200.9841	128.0129	90.9256	(83)
Total gains	708.8199	765.8667	813.9301	863.2802	875.1996	871.8104	832.4742	804.4023	768.5250	722.2498	686.6461	677.5961	(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	63.6564	64.6238	64.6238	66.5106	66.0457	68.7509	68.7509	68.7509	67.8730	66.0457	66.5106	65.1020	
alpha	5.2438	5.3083	5.3083	5.4340	5.4030	5.5834	5.5834	5.5834	5.5249	5.4030	5.4340	5.3401	
util living area													
	0.9992	0.9986	0.9966	0.9894	0.9632	0.8424	0.6731	0.7047	0.9311	0.9906	0.9982	0.9993	(86)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
Tweekend	20.1948	20.2666	20.4058	20.6033	20.7821	20.9448	20.9879	20.9845	20.8809	20.6486	20.4069	20.2025	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7573	19.8656	20.0830	20.3806	20.6637	20.9152	20.9813	20.9761	20.8140	20.4576	20.0739	19.7691	(87)
Th 2	19.3577	19.3775	19.3775	19.4149	19.4059	19.4573	19.4573	19.4573	19.4410	19.4059	19.4149	19.3872	(88)
util rest of house													
	0.9986	0.9976	0.9941	0.9800	0.9240	0.6934	0.4379	0.4698	0.8426	0.9800	0.9968	0.9989	(89)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
Tweekend	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
MIT 2	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9971	0.9934	0.9804	0.9367	0.7634	0.5473	0.5800	0.8820	0.9814	0.9963	0.9986	(94)
Useful gains	707.5754	763.6694	808.5825	846.3900	819.8304	665.5673	455.5792	466.5879	677.8633	708.8375	684.1391	676.6498	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	2208.1461	2121.1138	1887.9067	1536.7720	1164.4549	729.1965	463.5651	477.4892	840.6562	1306.9750	1762.1123	2163.1226	(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													
	1116.4246	912.2026	803.0172	497.0750	256.4006	0.0000	0.0000	0.0000	0.0000	445.0144	776.1407	1105.9358	(98)

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

Space heating		5912.2109 (98)
Space heating per m2	(98) / (4) =	74.9710 (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 %)		315.0875 (206)
Efficiency of secondary/supplementary heating system, %		100.0000 (208)
Space heating requirement		1876.3711 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1116.4246	912.2026	803.0172	497.0750	256.4006	0.0000	0.0000	0.0000	0.0000	445.0144	776.1407	1105.9358	(98)
Space heating efficiency (main heating system 1)													
	315.0875	315.0875	315.0875	315.0875	315.0875	0.0000	0.0000	0.0000	0.0000	315.0875	315.0875	315.0875	(210)
Space heating fuel (main heating system)													
	354.3221	289.5077	254.8553	157.7578	81.3744	0.0000	0.0000	0.0000	0.0000	141.2352	246.3254	350.9932	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												282.8150	(216)
(217)m	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	(217)
Fuel for water heating, kWh/month													
	73.7049	64.9706	68.2495	61.2035	59.9935	53.6297	51.5276	56.5114	56.4020	63.4634	67.0780	71.9392	(219)
Water heating fuel used												748.6733	(219)
Annual totals kWh/year													
Space heating fuel - main system												1876.3711	(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)												368.8162	(232)
Total delivered energy for all uses												2993.8606	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1876.3711	19.4400	364.7665	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	748.6733	19.4400	145.5421	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	368.8162	19.4400	71.6979	(250)
Additional standing charges			0.0000	(251)
Total energy cost			582.0065	(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	1876.3711	0.5190	973.8366	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	748.6733	0.5190	388.5614	(264)
Space and water heating			1362.3980	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.8162	0.5190	191.4156	(268)
Total kg/year			1553.8136	(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	1876.3711	3.0700	5760.4592	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	748.6733	3.0700	2298.4270	(264)
Space and water heating			8058.8863	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.8162	3.0700	1132.2657	(268)
Primary energy kWh/year			9191.1519	(272)
Primary energy kWh/m2/year			116.5502	(273)

SAP 2012 EPC IMPROVEMENTS

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

Current energy efficiency rating: B 81
Current environmental impact rating: B 83

(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)			

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

Potential energy efficiency rating: B 81
Potential environmental impact rating: B 83

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
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	£582	£582	£0
Space heating	£365	£365	£0
Water heating	£146	£146	£0
Lighting	£72	£72	£0
Total cost of fuels	£582	£582	£0
Total cost of uses	£583	£583	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.6 tonnes	1.6 tonnes	0.0 tonnes
CO2 emissions per m²	20 kg/m²	20 kg/m²	0 kg/m²
Primary energy	117 kWh/m²	117 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
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FULL SAP CALCULATION PRINTOUT
Calculation Type: Conversion (As Designed)

Design SAP
elmhurst energy

Property Reference	Fl03-Kingsley House	**Issued on Date**	10/05/2022
Assessment Reference	003-BE GREEN	**Prop Type Ref**	PR9657
Property	Flat 03-Kingsley House, Crowsley Road, Shiplake, RG9 3LU		

SAP Rating	83 B	**DER**	N/A	**TER**	N/A
Environmental	84 B	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	1.38	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Iraj Maghounaki, ERS Consultants Ltd, Tel: 01865 378 885, info@erscltd.co.uk	**Assessor ID**	v571-0001
Client			

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	78.8600	(1b)	x 2.7900	(2b) =	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss	(33) + (36) = 91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(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	2.4409	(42)
Average daily hot water use (litres/day)	97.0219	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
RHI water heating demand												2117	(64)
Heat gains from water heating, kWh/month	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains	601.7444	597.0272	575.2425	541.7201	507.6395	477.1363	459.3779	468.1529	487.5217	521.2657	558.6332	586.6705	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	13.3543	0.6300	0.7000	0.7700	5.4689	(75)
Southwest	7.2700	41.8189	0.6300	0.7000	0.7700	92.9135	(79)
Northwest	2.1300	13.3543	0.6300	0.7000	0.7700	8.6931	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	107.0755	168.8395	238.6876	321.5601	367.5601	394.6742	373.0963	336.2494	281.0034	200.9841	128.0129	90.9256	(83)
Total gains	708.8199	765.8667	813.9301	863.2802	875.1996	871.8104	832.4742	804.4023	768.5250	722.2498	686.6461	677.5961	(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	63.6564	64.6238	64.6238	66.5106	66.0457	68.7509	68.7509	68.7509	67.8730	66.0457	66.5106	65.1020	
alpha	5.2438	5.3083	5.3083	5.4340	5.4030	5.5834	5.5834	5.5834	5.5249	5.4030	5.4340	5.3401	
util living area	0.9992	0.9986	0.9966	0.9894	0.9632	0.8424	0.6731	0.7047	0.9311	0.9906	0.9982	0.9993	(86)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
Tweekend	20.1948	20.2666	20.4058	20.6033	20.7821	20.9448	20.9879	20.9845	20.8809	20.6486	20.4069	20.2025	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	

CALCULATION OF HEAT DEMAND 09 Jan 2014

16 / 9	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7573	19.8656	20.0830	20.3806	20.6637	20.9152	20.9813	20.9761	20.8140	20.4576	20.0739	19.7691 (87)
Th 2	19.3577	19.3775	19.3775	19.4149	19.4059	19.4573	19.4573	19.4573	19.4410	19.4059	19.4149	19.3872 (88)
util rest of house												
	0.9986	0.9976	0.9941	0.9800	0.9240	0.6934	0.4379	0.4698	0.8426	0.9800	0.9968	0.9989 (89)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202
Tweekend	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202
MIT 2	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202 (90)
Living area fraction										fLA = Living area / (4) =		0.4442 (91)
MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9971	0.9934	0.9804	0.9367	0.7634	0.5473	0.5800	0.8820	0.9814	0.9963	0.9986	(94)
Useful gains	707.5754	763.6694	808.5825	846.3900	819.8304	665.5673	455.5792	466.5879	677.8633	708.8375	684.1391	676.6498	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	2208.1461	2121.1138	1887.9067	1536.7720	1164.4549	729.1965	463.5651	477.4892	840.6562	1306.9750	1762.1123	2163.1226	(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													
	1116.4246	912.2026	803.0172	497.0750	256.4006	0.0000	0.0000	0.0000	0.0000	445.0144	776.1407	1105.9358	(98)
Space heating												5912.2109	(98)
RHI space heating demand												5912	(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	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(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	0.9606	0.9417	0.9229	0.8287	0.8099	0.7157	0.7157	0.6969	0.7534	0.8099	0.8476	0.8852	(22b)
Effective ac	0.9614	0.9434	0.9259	0.8434	0.8280	0.7561	0.7561	0.7428	0.7838	0.8280	0.8592	0.8918	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	69.8009	68.5002	67.2252	61.2365	60.1161	54.9002	54.9002	53.9343	56.9093	60.1161	62.3827	64.7524	(38)
Heat transfer coeff	161.1011	159.8003	158.5253	152.5367	151.4162	146.2003	146.2003	145.2344	148.2094	151.4162	153.6829	156.0526	(39)
Average = Sum(39)m / 12 =												152.5313	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0429	2.0264	2.0102	1.9343	1.9201	1.8539	1.8539	1.8417	1.8794	1.9201	1.9488	1.9789	(40)
HLP (average)												1.9342	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

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Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	601.7444	597.0272	575.2425	541.7201	507.6395	477.1363	459.3779	468.1529	487.5217	521.2657	558.6332	586.6705	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	11.2829	0.6300	0.7000	0.7700	4.6206	(75)
Southwest	7.2700	36.7938	0.6300	0.7000	0.7700	81.7488	(79)
Northwest	2.1300	11.2829	0.6300	0.7000	0.7700	7.3447	(81)

Solar gains	93.7141	163.6041	234.4070	308.1363	361.2891	365.7807	349.6952	308.9546	259.7691	183.6638	112.9716	79.7314	(83)
Total gains	695.4585	760.6314	809.6495	849.8564	868.9286	842.9169	809.0730	777.1076	747.2908	704.9294	671.6048	666.4019	(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	61.1883	61.6864	62.1825	64.6238	65.1020	67.4246	67.4246	67.8730	66.5106	65.1020	64.1418	63.1678	
alpha	5.0792	5.1124	5.1455	5.3083	5.3401	5.4950	5.4950	5.5249	5.4340	5.3401	5.2761	5.2112	
util living area													
	0.9992	0.9986	0.9970	0.9911	0.9695	0.8866	0.7354	0.7763	0.9435	0.9924	0.9985	0.9994	(86)
Tweekday	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	
Tweekend	20.1442	20.2210	20.3582	20.5649	20.7543	20.9176	20.9789	20.9716	20.8615	20.6199	20.3654	20.1557	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.6791	19.7950	20.0095	20.3206	20.6208	20.8735	20.9674	20.9562	20.7838	20.4134	20.0090	19.6970	(87)
Th 2	19.3049	19.3158	19.3265	19.3775	19.3872	19.4325	19.4325	19.4410	19.4149	19.3872	19.3677	19.3475	(88)
util rest of house													
	0.9987	0.9977	0.9947	0.9833	0.9369	0.7628	0.5055	0.5572	0.8659	0.9839	0.9972	0.9990	(89)
Tweekday	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	
Tweekend	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	
MIT 2	17.6309	17.8122	18.1293	18.6283	19.0429	19.3696	19.4274	19.4324	19.2760	18.7604	18.1751	17.6867	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.5407	18.6930	18.9645	19.3800	19.7438	20.0376	20.1115	20.1093	19.9458	19.4947	18.9897	18.5797	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5407	18.6930	18.9645	19.3800	19.7438	20.0376	20.1115	20.1093	19.9458	19.4947	18.9897	18.5797	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9972	0.9940	0.9833	0.9465	0.8202	0.6144	0.6623	0.8997	0.9847	0.9968	0.9987	(94)
Useful gains	694.3291	758.4649	804.7812	835.6806	822.4347	691.3795	497.1230	514.6860	672.3643	694.1624	669.4395	665.5640	(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													
	2294.1991	2204.1229	1975.9422	1598.5852	1217.9636	794.9803	513.3786	538.7161	866.3954	1346.7997	1827.2485	2243.9852	(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													
	1190.3033	971.4822	871.3438	549.2913	294.2735	0.0000	0.0000	0.0000	0.0000	485.5621	833.6225	1174.3454	(98)

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Space heating			6370.2241 (98)
Space heating per m2		(98) / (4) =	80.7789 (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 %)	323.0687 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	1971.7865 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1190.3033	971.4822	871.3438	549.2913	294.2735	0.0000	0.0000	0.0000	0.0000	485.5621	833.6225	1174.3454	(98)
Space heating efficiency (main heating system 1)													
	323.0687	323.0687	323.0687	323.0687	323.0687	0.0000	0.0000	0.0000	0.0000	323.0687	323.0687	323.0687	(210)
Space heating fuel (main heating system)													
	368.4366	300.7046	269.7085	170.0231	91.0870	0.0000	0.0000	0.0000	0.0000	150.2969	258.0326	363.4971	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												282.8150	(216)
(217)m	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	(217)
Fuel for water heating, kWh/month													
	73.7049	64.9706	68.2495	61.2035	59.9935	53.6297	51.5276	56.5114	56.4020	63.4634	67.0780	71.9392	(219)
Water heating fuel used												748.6733	(219)
Annual totals kWh/year													
Space heating fuel - main system												1971.7865	(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)												368.8162	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.40 * 1004 * 1.00) =										-321.2788		-321.2788	(233)
Total delivered energy for all uses												2767.9972	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1971.7865	13.1900	260.0786	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	748.6733	13.1900	98.7500	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	368.8162	13.1900	48.6469	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-321.2788	13.1900	-42.3767	(252)
Total energy cost			365.0988	(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] =	1.2380 (257)
SAP value		82.7296
SAP rating (Section 12)		83 (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	1971.7865	0.5190	1023.3572	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	748.6733	0.5190	388.5614	(264)
Space and water heating			1411.9186	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.8162	0.5190	191.4156	(268)
Energy saving/generation technologies				
PV Unit	-321.2788	0.5190	-166.7437	(269)
Total kg/year			1436.5905	(272)
CO2 emissions per m2			18.2200	(273)
EI value			84.4580	
EI rating			84	(274)
EI band			B	

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Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 3.2307 = 4.083, stars = 4
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 3.2307 = 0.1606, stars = 5
Water heating energy efficiency	13.19 / 2.8282 = 4.664, stars = 4
Water heating environmental impact	0.519 / 2.8282 = 0.1835, stars = 5

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	78.8600 (1b)	x	2.7900 (2b)	=	220.0194	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.0194	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1364	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8864	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7534	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750	(22a)
Adj infilt rate	0.8664	0.8287	0.8287	0.7534	0.7722	0.6592	0.6592	0.6592	0.6969	0.7722	0.7534	0.8099	(22b)
Effective ac	0.8753	0.8434	0.8434	0.7838	0.7982	0.7173	0.7173	0.7173	0.7428	0.7982	0.7838	0.8280	(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	
Windows (Uw = 1.60)			10.7400	1.5038	16.1504			(27)
Door			4.5400	1.8000	8.1720			(26)
GF			78.8600	0.2500	19.7150			(28a)
EW	86.6000	15.2800	71.3200	0.3000	21.3960			(29a)
R@Joists	3.3800		3.3800	0.1600	0.5408			(30)
Total net area of external elements Aum(A, m2)			168.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.9742			(33)
Party Wall 1			25.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.3260	(36)
Total fabric heat loss (33) + (36) =	91.3002	(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	63.5547	61.2365	61.2365	56.9093	57.9524	52.0797	52.0797	52.0797	53.9343	57.9524	56.9093	60.1161	(38)
Heat transfer coeff	154.8549	152.5367	152.5367	148.2094	149.2526	143.3799	143.3799	143.3799	145.2344	149.2526	148.2094	151.4162	(39)
Average = Sum(39)m / 12 =												148.4702	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9637	1.9343	1.9343	1.8794	1.8926	1.8182	1.8182	1.8182	1.8417	1.8926	1.8794	1.9201	(40)
HLP (average)												1.8827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4409 (42)
Average daily hot water use (litres/day)	97.0219 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7241	102.8432	98.9623	95.0814	91.2006	87.3197	87.3197	91.2006	95.0814	98.9623	102.8432	106.7241	(44)
Energy conte	158.2687	138.4228	142.8399	124.5313	119.4908	103.1114	95.5479	109.6426	110.9521	129.3040	141.1454	153.2748	(45)
Energy content (annual)										Total = Sum(45)m =		1526.5317	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7403	20.7634	21.4260	18.6797	17.9236	15.4667	14.3322	16.4464	16.6428	19.3956	21.1718	22.9912	(46)

Water storage loss:	
Store volume	150.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115 (51)

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

Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8683	(55)
Total storage loss													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(56)
If cylinder contains dedicated solar storage													
	26.9176	24.3126	26.9176	26.0493	26.9176	26.0493	26.9176	26.9176	26.0493	26.9176	26.0493	26.9176	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
								Total per year (kWh/year) = Sum(64)m =				2117.3604	(64)
Heat gains from water heating, kWh/month													
	92.7683	82.2847	87.6383	80.2557	79.8747	73.1336	71.9137	76.6001	75.7406	83.1375	85.7799	91.1078	(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	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	146.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2097	46.3722	37.7124	28.5507	21.3420	18.0178	19.4689	25.3064	33.9662	43.1279	50.3366	53.6608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.9425	327.3040	318.8331	300.7996	278.0355	256.6404	242.3472	238.9857	247.4566	265.4901	288.2542	309.6493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	52.0861	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	-97.6350	(71)
Water heating gains (Table 5)													
	124.6886	122.4474	117.7934	111.4662	107.3584	101.5744	96.6581	102.9572	105.1953	111.7440	119.1387	122.4568	(72)
Total internal gains													
	601.7444	597.0272	575.2425	541.7201	507.6395	477.1363	459.3779	468.1529	487.5217	521.2657	558.6332	586.6705	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3400	13.3543	0.6300	0.7000	0.7700	5.4689	(75)
Southwest	7.2700	41.8189	0.6300	0.7000	0.7700	92.9135	(79)
Northwest	2.1300	13.3543	0.6300	0.7000	0.7700	8.6931	(81)

Solar gains	107.0755	168.8395	238.6876	321.5601	367.5601	394.6742	373.0963	336.2494	281.0034	200.9841	128.0129	90.9256	(83)
Total gains	708.8199	765.8667	813.9301	863.2802	875.1996	871.8104	832.4742	804.4023	768.5250	722.2498	686.6461	677.5961	(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	63.6564	64.6238	64.6238	66.5106	66.0457	68.7509	68.7509	68.7509	67.8730	66.0457	66.5106	65.1020	
alpha	5.2438	5.3083	5.3083	5.4340	5.4030	5.5834	5.5834	5.5834	5.5249	5.4030	5.4340	5.3401	
util living area													
	0.9992	0.9986	0.9966	0.9894	0.9632	0.8424	0.6731	0.7047	0.9311	0.9906	0.9982	0.9993	(86)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
Tweekend	20.1948	20.2666	20.4058	20.6033	20.7821	20.9448	20.9879	20.9845	20.8809	20.6486	20.4069	20.2025	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7573	19.8656	20.0830	20.3806	20.6637	20.9152	20.9813	20.9761	20.8140	20.4576	20.0739	19.7691	(87)
Th 2	19.3577	19.3775	19.3775	19.4149	19.4059	19.4573	19.4573	19.4573	19.4410	19.4059	19.4149	19.3872	(88)
util rest of house													
	0.9986	0.9976	0.9941	0.9800	0.9240	0.6934	0.4379	0.4698	0.8426	0.9800	0.9968	0.9989	(89)
Tweekday	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
Tweekend	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	
MIT 2	17.7821	17.9584	18.2725	18.7403	19.1131	19.4229	19.4552	19.4542	19.3283	18.8369	18.3024	17.8202	(90)
Living area fraction									fLA = Living area / (4) =			0.4442	(91)
MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6595	18.8056	19.0767	19.4689	19.8019	20.0858	20.1331	20.1302	19.9883	19.5568	19.0893	18.6859	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9971	0.9934	0.9804	0.9367	0.7634	0.5473	0.5800	0.8820	0.9814	0.9963	0.9986	(94)
Useful gains	707.5754	763.6694	808.5825	846.3900	819.8304	665.5673	455.5792	466.5879	677.8633	708.8375	684.1391	676.6498	(95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W													
	2208.1461	2121.1138	1887.9067	1536.7720	1164.4549	729.1965	463.5651	477.4892	840.6562	1306.9750	1762.1123	2163.1226	(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													
	1116.4246	912.2026	803.0172	497.0750	256.4006	0.0000	0.0000	0.0000	0.0000	445.0144	776.1407	1105.9358	(98)

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

Space heating		5912.2109 (98)
Space heating per m2	(98) / (4) =	74.9710 (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 %)	315.0875 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	1876.3711 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1116.4246	912.2026	803.0172	497.0750	256.4006	0.0000	0.0000	0.0000	0.0000	445.0144	776.1407	1105.9358	(98)
Space heating efficiency (main heating system 1)													
	315.0875	315.0875	315.0875	315.0875	315.0875	0.0000	0.0000	0.0000	0.0000	315.0875	315.0875	315.0875	(210)
Space heating fuel (main heating system)													
	354.3221	289.5077	254.8553	157.7578	81.3744	0.0000	0.0000	0.0000	0.0000	141.2352	246.3254	350.9932	(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													
	208.4487	183.7466	193.0199	173.0926	169.6707	151.6727	145.7279	159.8226	159.5134	179.4839	189.7067	203.4547	(64)
Efficiency of water heater												282.8150	(216)
(217)m	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	(217)
Fuel for water heating, kWh/month													
	73.7049	64.9706	68.2495	61.2035	59.9935	53.6297	51.5276	56.5114	56.4020	63.4634	67.0780	71.9392	(219)
Water heating fuel used												748.6733	(219)
Annual totals kWh/year													
Space heating fuel - main system												1876.3711	(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)												368.8162	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.40 * 1075 * 1.00) =										-343.8563		-343.8563	(233)
Total delivered energy for all uses												2650.0042	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1876.3711	19.4400	364.7665	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	748.6733	19.4400	145.5421	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	368.8162	19.4400	71.6979	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-343.8563	19.4400	-66.8457	(252)
Total energy cost			515.1608	(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	1876.3711	0.5190	973.8366	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	748.6733	0.5190	388.5614	(264)
Space and water heating			1362.3980	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.8162	0.5190	191.4156	(268)
Energy saving/generation technologies				
PV Unit	-343.8563	0.5190	-178.4614	(269)
Total kg/year			1375.3522	(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	1876.3711	3.0700	5760.4592	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	748.6733	3.0700	2298.4270	(264)
Space and water heating			8058.8863	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.8162	3.0700	1132.2657	(268)
Energy saving/generation technologies				

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

PV Unit	-343.8563	3.0700	-1055.6389 (269)
Primary energy kWh/year			8135.5130 (272)
Primary energy kWh/m2/year			103.1640 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 84

(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 83
Potential environmental impact rating: B 84

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
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	£582	£582	£0
Space heating	£365	£365	£0
Water heating	£146	£146	£0
Lighting	£72	£72	£0
Generated (PV)	-£67	-£67	£0
Total cost of fuels	£515	£515	£0
Total cost of uses	£516	£516	£0
Delivered energy	34 kWh/m²	34 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.4 tonnes	0.0 tonnes
CO2 emissions per m²	17 kg/m²	17 kg/m²	0 kg/m²
Primary energy	103 kWh/m²	103 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
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Job no:	PRXXXX
Date:	XX/XX/XXXX
Assessor name:	Rajohn Ali
Registration no:	BRE400012
Development name:	Appendix G of Energy Statement

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WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

		Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8		Type 9		Type 10	
	House Type:																				
	Description:	Dwelling																			
Installation Type	**Unit of measure**	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual																			
WC	Full flush volume	6	8.76		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
	Part flush volume	3	8.88		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	6	11.06		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower																			
Bath	Capacity to overflow	155	17.05		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	8	34.96		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	6	13.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a washing machine been specified?		No																			
Washing Machine	Litres / kg	7	17.16		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a dishwasher been specified?		No																			
Dishwasher	Litres / place setting	0.9	4.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a waste disposal unit been specified?		No	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
	Calculated Use		115.4		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
	Normalisation factor		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91
Code for Sustainable Homes	**Total Consumption**		**105.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**
	Mandatory level		**Level 3/4**		-		-		-		-		-		-		-		-		-
Building Regulations 17.K	External use		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0
	Total Consumption		**110.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**
	17.K Compliance?		**Yes**		-		-		-		-		-		-		-		-		-