

# **ENERGY & SUSTAINABILITY STATEMENT**

(To Accompany Planning Application)

Site 29-30 HIGH HOLBORN LONDON WC1V 6AZ

Proposal PROPOSED REVISIONS TO CHANGE THE MIX AND PROVIDE AN ENLARGED FLAT AT ROOF LEVEL

Client
WESTCOMBE MANAGEMENT

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## 1.0 INTRODUCTION

- a) Doherty Energy Limited have been instructed by Westcombe Management to prepare an Energy and Sustainability Statement to support the submission of the planning application for the development at 29-30 High Holborn, London WC1V 6AZ. This report must be read in conjunction with the application forms, certificates, detailed plans and other supporting documents submitted to the Local Authority as part of the application.
- b) The Application is for the redevelopment of the site to change the mix and provide an enlarged flat at roof level. The development will create a total of four studio flats and a two bedroom flat.
- c) The objectives of this Energy and Sustainability Statement are to outline the possible measures that can be incorporated into the development during detailed design, to make an appraisal of the carbon dioxide emissions of the proposed development, assess the potential fabric and building services efficiencies to reduce the carbon dioxide emission and to suggest the most appropriate means by which the development can contribute towards the aspiration of policy relating to reducing carbon dioxide emissions and energy consumption. It also investigates the water usage of the development with a view to reducing the water consumption of the dwellings.
- d) The Assessment shall be carried out following the principles set out in the "Energy Hierarchy". These principles can be summarised as follows:
  - Be Lean –use less energy
  - Be Clean supply energy efficiently
  - Be Green use renewable energy
- e) At this stage in the design of the development, the detailed Building Regulations construction information has not been prepared and therefore following detailed construction design, the energy calculations will be revisited to ensure the energy requirements and carbon dioxide emissions are up to date.



- f) In order to demonstrate the carbon dioxide emissions, it is proposed to use the Standard Assessment Procedure (SAP) for the calculations to obtain initial baseline carbon dioxide emissions figures for the dwelling.
- g) Further calculations will be used to demonstrate the potential carbon dioxide emission savings from the initial calculations by enhancements to the building fabric, plant and controls – BE LEAN. The suitability of supplying energy, both heat and power, through the use of a combined heat and power system shall be assessed – BE CLEAN. Finally, the carbon dioxide emission saving by the use of renewable energy shall be assessed through the outputs from the SAP calculation – BE GREEN.



## 2.0 POLICY CONTEXT

- a) The London Borough of Camden require all developments to ensure compliance with the applicable energy and sustainability standards stipulated in the London Plan, London Borough of Camden Local Plan and associated documented issued by the Mayor of London.
- b) The London Plan, March 2016, Policy 5.2 expects development proposals to make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
  - Be Lean –use less energy
  - Be Clean supply energy efficiently
  - Be Green use renewable energy
- c) The Policy also states that the Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential buildings:

Year	Improvement on 2010 building Regulations 2010
2010-2013	25 per cent (Code for Sustainable Homes Level 4)
2013-2016	40 per cent
2016-2031	Zero Carbon

Non-domestic buildings:

Year	Improvement on 2010 building Regulations 2010
2010-2013	25 per cent
2013-2016	40 per cent
2016-2019	As per Building Regulations
2019-2031	Zero Carbon



- d) The Energy Statement follows the principles set out in the Energy Hierarchy and is broken down to provide the following details:
  - Estimated site-wide regulated carbon dioxide emissions and reductions (broken down for the domestic and non-domestic elements of the development), expressed in tonnes per annum, after each stage of the energy hierarchy
  - A clear commitment to regulated carbon dioxide emissions savings compared to a Part L 2013 of the Building Regulations compliant development through energy demand reduction measures alone
  - iii) Clear evidence that the risk of overheating has been mitigated through passive design
  - iv) Evidence of investigation into existing or planned district heating networks that the development could be connected to, including relevant correspondence with local heat network operators
  - v) Commitment to a site heat network served by a single energy centre linking all apartments and non-domestic building uses, if appropriate for the development
  - Where applicable, investigations of the feasibility of installing CHP in the proposed development (if connection can't be made to an area wide network) before considering renewables
  - vii) An initial feasibility test for renewable energy technologies and, where appropriate, commitment to further reduce carbon dioxide emissions through the use of onsite renewable energy generation
- As can be seen above, the London Plan policy 5.2 sets a zero carbon target for residential developments over the Building Regulations 2010.
- However, as the Building Regulations were revised in 2013, the Greater London Authority issued their "Sustainable Design and Construction SPG" in April 2014, which clarifies the current target. This document states:



"To avoid complexity and extra costs for developers, the Mayor will adopt a flat carbon dioxide improvement target beyond Part L 2013 of 35% to both residential and non-residential development."

- e) Under The London Plan Policy 5.5, the Mayor expects 25 per cent of the heat and power used in London to be generated through the use if localised decentralised energy system by 2025. The London Heat Map has been used to assess the district heat systems, both current and proposed, with the view to connecting the building to them.
- j) Policy 5.7 seeks to increase the proportion of energy generated from renewable energy sources and expects that projects that developments will provide on-site renewable energy generation in order to meet the requirements of Policy 5.2.
- k) The aim of the Energy Statement is to meet the carbon dioxide reduction targets on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, as per the requirements of The London Plan, any shortfall may be provided off-site or through a "cash in lieu" contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.
- I) London and the South East is classified as 'seriously' water stressed, meaning that more water is taken from the environment than the environment can sustain in the long term. London is relatively resilient to drought and it takes two consecutive drier than normal winters to create water supply issues.
- m) In 2006 and 2012, London experienced significant droughts, and in 2012 only avoided serious water restrictions by the wettest summer in a century.
- Proposed developments should minimise vulnerability of people and property and be fully adapted and resilient to the future impacts of climate change. Conserving water resources by maximising the flood storage role of rivers, aquifers, ponds, natural floodplains and other surface water features;



promoting the benefits of SuDS for groundwater recharge; and achieving high standards of water efficiency.

 The Local Plan requires all new dwellings will be expected to meet the requirement of 110 litres per person per day (including 5 litres for external use).



## 3.0 SUSTAINABLE DESIGN AND CONSTRUCTION ASSESSMENT

- a) The building fabric, the building services and the management of the building broadly determines its energy usage. The detailed design of a building is an iterative process, often requiring the involvement of different professional disciplines to establish the fundamental objectives of the design. An overall design philosophy in this respect has been established at an early stage.
- b) As a result of central Government objectives, followed through at local level the general design philosophy for this site has a strong emphasis on sustainable design. This is not only in terms of the location and suitability of the site but also in relation to the way in which the building is constructed and will be used by its future occupants.
- c) The first step in developing an integrated design is to establish the function of the buildings envelope and how it interacts with the usage patterns of the building and the technology used to condition the individual spaces.
- d) Good fabric design can minimize the need for services. Where appropriate, designs should avoid simply excluding the environment, but should respond to factors like weather and occupancy and make good use of natural light, ventilation, solar gains and shading, where they are beneficial.
- e) This section of the report will look at the ways in which energy is used within the proposed building and how the design can encourage efficient levels of energy consumption.

## 3.1 Management

a) Although improvements can be made to the fabric and services of a building, often the biggest impact on the day-to-day energy consumption is influenced by the way in which the building is managed. It is common to find well-designed buildings operating badly due to poor management. Conversely, poorly designed buildings can be optimised to their maximum efficiency through good management practices.



- b) It is recommended that due consideration is given to the management strategy of the building. It is understood that the dwelling will be within private ownership. However, there is still an opportunity to provide for the most efficient management system and to encourage the future occupants to manage their homes efficiently.
- c) This may include the use of movement sensor switched lighting systems, the installation of energy efficient electrical appliances, efficient lighting and fittings that do not permit the use of non-efficient lamps, tightly controlled heating and ventilation specific to the location within the dwelling, installation of efficient hot water systems and the provision of recycling facilities.
- d) The EU energy efficiency labelling scheme rates products from A (the most efficient) to G (the least efficient). For refrigeration, the scale now extends to A++. The occupants of the dwelling shall be provided with information on the EU Energy Efficiency Labelling Scheme so that they are informed of the benefits of the scheme.

## 3.2 Ventilation

- a) Natural ventilation is the most energy efficient form of ventilating any space. The proposed use and traditional architectural design of this building enables it to make best use of natural ventilation via openable windows.
- b) Horizontal pivoted windows produce the most effective ventilation because of their inherent characteristic to develop large openings, where air will tend to enter at the lower level and exit via the top. They are easily adjustable to provide control and reduce the amount of energy required to run and maintain artificial ventilation systems. Normal casement windows can provide a degree of natural ventilation and with the layout of the dwelling; it is possible to obtain good cross ventilation.
- c) Given the historical records for the British Isles, the weather permits a possible energy saving with the use of windows to provide cooling and ventilation. When the outside temperature ranges between 14 °C through to



24 °C, people are able to moderate the heat build-up in the space with the use of an openable window systems.

- d) In addition to allowing direct and flexible control of heat through the use of openable windows they, also provide for the natural provision of fresh air to the occupants eliminating the need for artificially produced fresh air supply.
- e) At other times of the year, mechanical ventilation with heat recovery can conserve energy in each dwelling by recovering heat from the warm moist extracted air and transferring it to the incoming fresh air. This works both ways so if the outside temperature is higher than inside the exchanger helps to maintain a comfortable internal environment. The mechanical ventilation with heat recovery system ensures high air quality whilst maintaining a balance between extraction and supply.

## 3.3 Heating System

- a) The method of heating for the dwellings is not yet decided, however, it proposed method of heating for the dwelling will use of a highly efficient heat source, with weather compensation. It shall be appropriately designed to provide suitable conditions for the occupants and to offset the heat losses through the fabric of the dwelling.
- b) The heating systems will be provided with thermostat, programmer and thermostatic radiator valves to control the heating in the spaces.
- c) Weather compensation will be used to help control the heating system. It uses an outdoor temperature sensor to adjust the system controls to compensate for changes in outdoor temperature automatically. As the weather gets colder the system works harder and produces more heat to the space. However, the weather warms up the system reduces the temperature of the heating system thereby reducing the energy consumption and carbon dioxide emissions.
- d) If a central heating system was used, the heat would be have to be available for any occupant all the time, which would require a large buffer storage



vessel and distribution around the building all the time. With the local heating systems, there are no storage or distribution losses.

e) Due to the high level of insulation standards required under the current building regulations and the associated heat gains of the building, the level of artificially produced heat required to the internal spaces is envisaged to be low.

## 3.4 Lighting (Natural / Artificial)

- a) The proposed design makes best use of natural daylight to reduce the amount of electrical energy used to provide the minimum luminance for the required conditions. It is envisaged that all the habitable rooms within the dwelling are to be provided with natural light via windows. The number of windows proposed and the use of dimming controls on the lighting scheme where appropriate may assist in achieving the maximum reduction of electrical consumption.
- b) The dwellings are orientated so that the large windows do not face south or are shaded, thus avoiding excessive solar gains during the summer.
- c) When selecting luminaries, consideration should be given to their inherent local power consumption and luminance levels. This together with the use of energy saving lamps will reduce the consumption of energy through lighting to a minimum. It is suggested that a development of this kind could reduce the energy usage further by installing luminaries that only allow the use of energy saving lamps.
- d) Any lighting in the external areas shall be fitted with automatic control systems, like passive infrared sensors, time switches or "dawn to dusk" day light sensors. These luminaires shall be fitted with low energy lamps.

## 3.5 Hot Water Systems

a) The hot water demand for the dwellings shall be generated using the efficient heating source and if necessary, a very well insulated hot water storage cylinder is to be provided.



- b) The hot water system shall be designed to appropriate standards required by the current building regulations. This will ensure the minimum amount of heat loss from hot water pipe work by applying a high standard of thermal insulation and ensuring the correct circulation throughout the system.
- c) Waste Water Heat Recovery Systems can be attached to the showers and are a proven and cost effective way to achieve energy savings and carbon emission reductions. They are either fitted around the waste pipe from a shower or bath, or in the shower tray itself, and recover heat from the drain water as it leaves the shower or bath. This recovered heat is used to preheat the cold water feed to the boiler and therefore reduces the amount of energy used by the boiler.
- d) It is possible, with the ever-increasing demand on the limited supply of the natural resource of water, to suitably restrict the flow of water outlets. Flow restrictors can be installed on outlets where a reduced flow is acceptable, for example on showers and basins. This system allows for a uniform maximum flow to be provided regardless of natural water pressures throughout the dwelling.

## 3.6 Cold Water Systems

- a) Cold water consumption can be kept to a minimum by the installation of a numbers of facilities.
- b) Modern water efficient dual flush WC cisterns should be fitted as standard and as with the hot water system flow restrictors can be fitted to provide a uniform maximum flow rate throughout the dwelling.
- c) Simple water butts can be provided in appropriate locations, allowing for the collection of rain water for the direct use on external landscaped areas. Water butts are the cheapest and easiest way of reducing the use of drinking water for this purpose. There are many products on the market ranging in price and size and some local authorities offer their own option at a subsidised price to the consumer.



d) It is not possible to estimate the total water saving from the installation and use of such a device as this is very much dependant on the landscaping design for the dwelling, the annual rain fall and the required usage of this water within the domestic setting. However, an average storage device can produce up to 5000 litres of usable rainwater per year.

## 3.7 Sustainable methods of construction

- a) Sustainable methods of construction can range from the simplest of solutions, such as construction in locations with access to sustainable modes of transport to the more complex solutions including passive solar design and rainwater harvesting.
- b) The following paragraphs will briefly discuss some of the additional options available for incorporation into the scheme at this early stage or later during the detailed design process.

## 3.8 Passive Solar Design

- a) Passive solar gain can be experienced in both a positive and negative manner. South facing facades can often benefit from solar passive gain during the winter months but this is counteracted by the increased requirement for cooling during the summer.
- b) In a scheme like that proposed, it is important to recognise where solar passive gains will be experienced and to design the scheme to enhance the effect during the winter and protect from it during the summer.

## 3.9 Building Envelope

a) All facades of the dwellings shall be designed to ensure that the minimum standards required by the Approved Document L of the Building Regulations are exceeded and that care shall be exercised to ensure flexibility and good shading systems are installed where necessary.



b) Any insulation that is used in this development shall have global warming potential of less than 5. This shall include not only the thermal insulation, but any acoustic insulation.

## 3.10 Enhanced Construction Details

a) The dwellings envelope shall be designed using the Enhanced Construction Details to limit recurring thermal bridging. This exceeds the requirement of the Building Regulations and helps lower the carbon emissions of the dwelling by reducing the heat losses by cold bridging.

## 3.11 Surface Water Drainage

- a) Surface water drainage at the site will follow the Sustainable Drainage Systems (SuDS) management train.
- b) The surface water will drain into the existing watercourse on site, with the permeable surfacing acting as an attenuation device for slowing and holding the surface water run-off.

## 3.12 Rainwater Harvesting

- a) The harvesting and recycling of rainwater can considerably reduce mains water consumption for toilets and other uses that do not need a sanitized water supply.
- b) However, the plant space requirement for treatment and storage is often difficult to incorporate into a scheme. It also requires additional public health and water system risers to be installed to serve the facilities able to utilise such a water supply. If this system were to be considered then early design allowances would be required.
- c) An alternative option would be to install a water butt system as discussed above, that allows the collection of rainwater from the roof to be used in the amenity space provided.



#### 3.13 Sustainable Material Choices

- a) A high percentage of carbon dioxide emissions are generated by unsustainable modes of transport. This is not only made up of the use of the private car but is substantially increased by the use of road as the popular way of transporting materials and goods needed during the construction purposes.
- b) Many opportunities are now available to Architects wishing to make more sustainable choices when specifying building materials. The consideration can include where the materials come from, its' travel distance, mode of transport, and the nature in which the material resource is manufactured and managed.
- c) Throughout the design process consideration will be given to not only the quality of materials to be specified, but also to the quantities. Additional consideration will be given to building material selection that maximises the life expectancy of the building by selecting materials build-ups from the Green Guide to Specification published by the Building Research Establishment (BRE).
- d) The proposed development will be constructed of materials with a low environmental impact, achieving a Green Guide rating of between A+ and D for all five elements of construction, as follows:
  - Roof.
  - External walls.
  - Internal walls.
  - Upper and ground floors.
  - Windows.
- e) Consideration will also be given to the use of materials and products manufactured in the UK and Europe. Once a contractor is appointed, the opportunities for the use of local suppliers for their supply chain will also be explored.



 f) All timber, including that used in the construction processes, will be required to be legally sourced. The definition of legally sourced timber follows the UK Government's definition of legally sourced timber, according to the CPET 2<sup>nd</sup> Edition report on UK Government timber procurement policy.

## 3.14 Recycling Facilities

- a) In order to encourage the homeowners to recycle household waste, the dwelling can be provided with recycling bins, both within the dwelling and in the external waste storage area.
- b) The recycling bins could be in the form of three internal in a dedicated non obstructive location in the kitchen. The bins shall be in a variety of sizes and a total capacity of 30 litres and no individual bins shall have a capacity of less than 7 litres.
- c) External bins shall be provided for the Local Authority collection scheme.
   These shall be located in a dedicated location.



## 4.0 ENERGY ASSESSMENT

### 4.1 Introduction

- a) This section of the Energy and Sustainability Statement shall make an appraisal of the carbon dioxide emissions of the proposed development, assess the implications of fabric and building services enhancements, the various methods of generating and using renewable energy at source, and to suggest the most appropriate means by which the development can contribute towards the aspiration of policy relating to reducing energy consumption and renewable energy provision.
- b) In order to assess the impact of the improved building envelope and the fixed building services, the initial Standard Assessment Procedure 2012 (SAP) Assessments have been carried out on the proposed dwellings as if they were constructed simply to comply with the requirements of the current Building Regulations. Further SAP calculations have been undertaken to demonstrate an improvement in the carbon emissions by incorporating better fabric constructions, better windows and doors, improved ventilation systems and efficient building services.
- c) The energy assessment shall follow the principles set out in the London Plan, March 2016, Policy 5.2, which expects development proposals to make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
  - Be Lean –use less energy
  - Be Clean supply energy efficiently
  - Be Green use renewable energy

## 4.2 Baseline Carbon Dioxide Emissions

 a) In order to assess the carbon dioxide emissions of the development, the delivered energy demand needs to be estimated. At this stage in the design of the dwellings, the detailed construction drawings have not been prepared



and therefore detailed carbon emission calculations cannot be undertaken to produce the carbon dioxide emissions.

- b) However, the dwellings carbon dioxide emission estimates can be based on initial stage SAP calculations.
- c) Based on the current design and using construction information, the proposed dwelling complies with the current Building Regulations.
- d) The building services information is based on standard building services to meet the requirements of the building regulations.
- e) Table 1 below summarises the results from the SAP Worksheets that can be found in Appendix A.

Dwelling	Floor Area (m2)	Heating (kg/yr)	Water Heating (kg/yr)	Pumps & Fans (kg/yr)	Electricity for Lighting (kg/yr)	Total Emissions (kg/yr)	Dwelling CO2 Emission Rate
1	40.6	305.2	447.2	43.6	101.3	897.4	22.1
2	40.6	358.0	445.4	43.6	101.3	948.3	23.4
3	40.6	358.0	445.4	43.6	101.3	948.3	23.4
4	40.6	358.0	445.4	43.6	101.3	948.3	23.4
5	81.2	734.4	515.5	38.9	182.8	1,471.6	18.12
Dwelling TER (kg/m²/yr) Area (m²)				ea (m²)	Emission	s (kg/yr)	
1	L	32.3		40.6		1,311.4	
2	2	34.24		40.6		1,390.1	
3	3	34.24		40.6		1,390.1	
4		34.24		40.6		1,390.1	
5 26.59 81.2					2,15	9.1	
Ва	Baseline Carbon Dioxide Emissions (kg/yr)				7,6	41	

 Table 1 – Baseline Carbon Dioxide Emissions



## 4.3 Improved Baseline Carbon Dioxide Emissions

- a) Following the principles set out in the Mayor's "Energy Hierarchy" which is implemented through the London Plan and the Local Policy, the proposed design has been improved to use less energy and lower the carbon dioxide emissions - BE LEAN.
- b) This has been achieved by improving the thermal performance of the various constructions, like the walls, roof, floors, windows, doors etc and incorporating mechanical ventilation heat recovery and improving the air tightness of the dwellings.
- c) The floor U Values can be improved by incorporating insulation under the screed, or by using insulation blocks instead of concrete blocks between the beams. For the purposes of these calculations, the U Values of the current floor constructions have been calculated as 0.12 W/m<sup>2</sup>K.
- d) The wall U Values can be improved by improving the thermal performance of the insulation, either by increased thickness or lower thermal conductivity. For the purposes of these calculations, the U Values of the current wall constructions have been calculated as 0.19 W/m<sup>2</sup>K.
- e) The party wall is fully filled with sealed edges, so the U Value is 0.0W/m<sup>2</sup>K.
- f) The roof areas offer excellent opportunity to enhance the insulation levels and for the purposes of these calculations, the U Value of 0.09 W/m<sup>2</sup>K have been used.
- g) The thermal performance of the windows can be improved by adding coatings to the panes or adding an inert gas to the cavities. For the purposes of these calculations, a U Value for the windows of 1.2 W/m<sup>2</sup>K has been used, which uses double glazed planitherm glass, argon gas and warm edge spacer bars.
- h) A composite front door can be used instead of a timber door. Modern composite doors have good thermal, fire, acoustic and security properties. These types of door can have U Values as low as 0.55 W/m<sup>2</sup>K.



- The air leakage rate for the dwelling can be improved. The maximum allowed under the current Building Regulations Approved Document L1A:2013 is 10 m<sup>3</sup>/hr/m<sup>2</sup> at 50 Pascal's. With carful detailing, this can be easily improved to 3 m<sup>3</sup>/hr/m<sup>2</sup> at 50 Pascal's.
- j) The use of Accredited Construction Details in the development means that the thermal bridging coefficient can be greatly improved thus a lower γ Value can be used.
- k) With regard to the heating, at this time it is proposed to use highly efficient air source heat pumps, with thermostats and programmers. This provides excellent control for the dwelling occupants.
- More efficient controls can be installed to control the heating, which can include weather compensation and the use of time and temperature zone control could improve the efficiency of the heating system.
- m) Instead of simply installing 75% of the light fittings as low energy efficient light fittings, as required by the current Building Regulations, 100% of the light fitting could be low energy fittings.
- n) The use of natural lighting has been considered and although its use is not measured in the SAP calculations, it can help lower the energy use and therefore carbon dioxide emissions. This is carefully assessed against any unwanted solar overheating. Whilst a degree of solar gain can be beneficial for the occupants and helps lower the carbon dioxide emissions, it must be controlled to minimise the risk of solar overheating. The calculations show that there is only a slight to medium risk of overheating.
- o) Mechanical ventilation heat recovery systems work by removing the warm moist air from kitchens and bathrooms and passing it through a heat exchanger to recover waste heat. This waste heat can then be used to warm the fresh air that is brought into the living areas of the dwellings, therefore reducing the heating load.



- p) The development shall be designed to ensure that the Dwelling Emission Rates are better than the Target Emission Rates and the Fabric Energy Efficiency is better than the Target Fabric Energy Efficiency. These are the requirements from Criterion 1 of the current Building Regulations Approved Document L (2013).
- q) By incorporating items like those stated above, the SAP calculations have been updated to demonstrate the effect of these improvements and the results are listed in Table 2 below.
- r) Full details of the SAP calculations can be found in the Full SAP Calculations Printout in Appendix A.

Dwelling	Ar (n 40 40	<b>Dor</b> rea n <sup>2</sup> ) 0.6	Heating (kg/yr) 203.6 255.0	Water Heating (kg/yr) 389.6 389.6	Pumps & Fans (kg/yr) 66.4 65.2	Electricity for Lighting (kg/yr) 100.5 100.5	Total Emissions (kg/yr) 760.2 810.4	Dwelling Target CO <sub>2</sub> Emission Rate 18.72 19.96
3		).6 ).6	255.0 255.0	389.6 389.6	65.2 65.2	100.5 100.5	810.4 810.4	19.96 19.96
5	81	1.2	586.4	500.1	51.1	181.3	1,318.9	16.24
Dwelling DER (kg/m²/yr) Area (m²)			Emissior	ns (kg/yr)				
1			18.72	40.61			76	0.2
2			19.96	40.6		81	0.4	
3			19.96	40.6				0.4
4			19.96	40.6			810.4	
5			16.24	81.2			1,318.7	
-	Total Carbon Dioxide Emissions (kg/yr)					4,5	510	
	Percentage Improvement over current Building Regulations						41.	0 %

 Table 2 – Actual Carbon Dioxide Emissions

s) As demonstrated in Table 2 above, it can be seen that the improvements in the thermal performance and fixed building services, a reduction of 41.0% can be achieved in the carbon dioxide emissions of the development.



## 4.4 Supplying Energy Efficiently – BE CLEAN

 Following the principles set out in the Energy Hierarchy, the next step is to reduce the carbon dioxide emissions by supplying energy efficiently - BE CLEAN.

## 4.5 District Heat Network

- a) The London Heat Map is an online tool that can help identify opportunities for the use of decentralised energy networks and systems for use in projects.
- b) Using the Heat Map, there appears to be no district heating systems available or even proposed in the area within the next five years, so it would not be feasible to install plant for future connection to such a network at this time.
- c) In line with the Greater London Authority's "Sustainable Design and Construction SPG" in published in April 2014, it is considered that no potential heat networks available in the foreseeable future.

## 4.6 Combined Heat and Power

- a) Combined Heat and Power typically generates electricity on site as a byproduct of generating heat. It uses fuel efficient energy technology that, unlike traditional forms of power generation, uses the by-product of the heat generation required for the development. Normally during power generation, the heat is discharged or wasted to atmosphere.
- b) A typical CHP plant can increase the overall efficiency of the fuel use to more than 75%, compared to the traditional power supplies of 40%, which uses inefficient power stations and takes into account transmission and distribution losses.
- c) The use of this development is residential and it will be built to exceed the current Building Regulations. The aim of these regulations is to minimise the base heating load and electrical loads. The site base heating and electrical loads is key to the sizing and operation of any CHP system.



d) Due to the high levels of insulation and energy efficiency measures that will be incorporated into this development, there is no year round heat load for the CHP plant and therefore, a CHP system would be considered not viable on this development. As such, if a CHP system were to be incorporated, it would not operate efficiently and therefore NOT BE CLEAN.



### 4.7 Renewable Technologies Considered – BE GREEN

- a) Taking into account the requirements of planning policy set out by London Borough of Camden and the London Plan, the developments annual carbon dioxide emission reduction target of 35%, based on the Building Regulations 2013, from energy efficiencies and renewable technology has been calculated as 7,641 kgCO<sub>2</sub>/year.
- b) The final step in the Energy Hierarchy is to reduce the carbon dioxide emissions by the use of renewable technologies BE GREEN.
- c) A review of the potential renewable technologies has been undertaken to identify any potential low or zero carbon technologies which could be incorporated at a later date. The following renewable energy resources have been assessed for availability and appropriateness in relation to the site location, building occupancy and design.
  - Combined Heat and Power
  - Biomass Heating
  - Biomass CHP
  - Heat Pumps
  - Solar Photovoltaics
  - Domestic Solar Hot Water Systems
  - Wind Power
- d) A preliminary assessment has been carried out for each renewable energy technology and for those appearing viable a further detailed appraisal has been undertaken.
- e) The preliminary study considered the site location and the type of building in the development and surroundings and produced a shortlist of renewable energy technologies that will be the subject of a further feasibility study.
- f) Table 3 below provides a summary of the assessment.



## 4.8 Renewables Toolkit Assessment

Energy System	Description	Comment
Combined Heat and Power (CHP)	Combined Heat and Power systems use the waste heat from an engine to provide heating and hot water, while the engine drives an electricity generator. These systems uses gas or oil as the main fuel and therefore can not truly be considered as renewable technology however, it is recognised that they have a significant reduced impact on the environment compared to conventional fossil fueled systems.	As CHP systems produce roughly twice as much heat as they generate electricity, they are usually sized according to the base load heat demand of a building, to minimise heat that is wasted during part-load operations. Therefore, to be viable economically they require a large and constant demand for heat, which make their use in new energy efficient housing, with high insulation, not really suitable. The efficiency of small scale CHP is relatively low and is unlikely to result in CO <sub>2</sub> emission savings. Economic viability relies on 4000 hours running time, which is unlikely to be achieved in this scheme.
Combined H	leat and Power	Feasible – NO
Biomass Heating	Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating. Biomass can be burnt directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel and is used commercially in the form of wood chips or pellets, although traditional logs are also used. Other forms of Biomass can be used, e.g. bio-diesel.	Wood pellet or wood chip fired or dual bio- diesel/gas-fired boilers could be considered. As this development consists of a new building, it offers the opportunity to accommodate such a system. The flues would have to be discharged to atmosphere above roof level and concerns raised by Environmental Health regarding the pollutants and particles, which would have to be addressed. Care need to be taken with the design of the flue to ensure particle discharge is not a concern to residents. The fuel storage silo/tank would have to be located external to the building, which is not available on this site. A suitable local fuel supplier is required to supply the site.
Biomass He	ating	Feasible – NO



Energy System	Description	Comment
Biomass CHP	CHP as above, but with biomass as the fuel.	Whilst the Biomass CHP system may overcome the issue of the reduction in carbon dioxide emissions via true renewable sources, however, the lack of a year round base load is still a problem and therefore Biomass CHP is not feasible for this development.
Biomass CHP		Feasible - NO
Ground/Air Source Heat Pumps (GSHP / ASHP) - heating	The ground collector can be installed, either as a loop of pipe, in the piles or using a borehole and a compressor offer efficient heating of a space in winter, as the temperature of the ground (below approx 2m) remains almost constant all year. For air source, the external condensing unit can be located adjacent to the dwelling in a	Ground and air source heat pumps are most efficient when supplying heat continuously and in areas where a mains gas supply is not available. In dwellings, GSHP and ASHP are capable of supplying the majority of the total space heating and pre heat for the hot water demand. This site does not appear to have external areas of sufficient size for the installation of ground loops for the collection of heat. It is considered that the use of ASHP to offset the heat losses of the dwellings could also be feasible.
Ground/Air S	discreet location. ource Heat Pumps	Feasible – YES
Ground/All St	burce near Fullips	reasible – 1ES
Solar Photovoltaics (PV)Building Integrated Photovoltaics (BIPV) or Roof mounted collectors provide noiseless, low maintenance, carbon free electricity.		There appears to be areas of roof that could be utilitised to install PV panels onto the scheme. These could be integrated into the roof finishes or mounted on frames on the roof and orientated towards the south for optimal performance. Careful consideration must be given to the chosen roof finish to ensure compatibility.
Solar PhotoV	oltaics	Feasible – YES
Solar Thermal Hot Water	Solar collectors for low temperature hot water systems require direct isolation, so the chosen location, orientation and tilt are critical.	This solution could be utilised to generate hot water using the energy from the sun. There are areas of roof that could be used for the installation of solar thermal collectors and careful consideration must be given to the chosen roof finish to ensure compatibility.
Solar Therma	I Hot Water	Feasible - YES
Energy	Description	Comment



System		
Wind Power		, , , , , , , , , , , , , , , , , , , ,
Wind Power		Feasible – NO

#### Table 3 – Renewable Technology Feasibility Assessment

- a) From the above it has been established that there are three potential ways of providing energy via renewable sources appropriate for inclusion in this scheme, these being the use of heat pumps, solar photovoltaics or domestic solar hot water or a combination of these.
- b) CHP and Micro CHP are considered not feasible as the economic viability relies on at least 4,000 hours runtime which is unlikely to be achieved in this development.
- c) Biomass systems have been considered unfeasible for this site due to particle discharge in a built up area, fuel handling and storage on a site with limited open space, required plant areas and the on going maintenance of the system.
- d) Ground source heat pumps have been considered not feasible for this development as there is insufficient ground area for the installation of ground loops.
- e) Wind has been considered not viable for this site as there are a lot of the buildings and trees in the surrounding area which are likely to cause disruption to air flows.



#### 4.9 Solar Photovoltaics

- a) Photovoltaics (PV) is a technology that allows the production of electricity directly from sunlight. The term originates from "Photo" referring to light and "voltaic" referring to voltage. This type of technology has been developed for incorporation within building design to produce electricity for either direct consumption or re-sale to the National Grid.
- b) PV panels come in modular panels which can be fitted on the top of roofs or incorporated in the finishes like slates or shingles to form integral part of the roof covering. PV cells can be incorporated into glass for atria walls and roofs or used in the cladding or rain screen on a building wall.
- c) When planning to install PV panels, it is important to consider the inherent cost of installation in comparison to possible alternatives. The aesthetic impact of the PV panels also requires careful consideration.
- d) Roof mounted PV panels should ideally face south-east to south-west at an elevation of about 30-40°. However, in the UK even if installed flat on a roof, they receive 90% of the energy of an optimum system.
- e) PV installations are expressed in terms of the electrical output of the system, i.e. kilowatt peak (kWp). The Department of Trade and Industry estimate that an installation of 1kWp, could produce approximately 700-850 kWh/yr, which would require an area of between 8-20m<sup>2</sup>, depending on the efficiencies and type of PV panel used.
- f) It is also estimated that a gas heated, well insulated typical dwelling would use approximately 1,500kWh/year electricity for the lights and appliances, therefore the 1kWp system could save approximately 45% of a single dwellings electrical energy requirements.
- g) Although often not unattractive, and possible to integrate into the building or roof cladding, PV systems are still considered likely to have visual implications, therefore careful sighting of the panels is required.



- As this installation will be contained on the roof of the proposed dwellings, it involves no additional land use. With regard to noise and vibration, a PV system is completely silent in operation.
- i) Care must be taken with the design and installation of PV systems as they need to meet standards for electrical safety.
- j) Space has been identified on the roof areas of the dwellings that can be used for the installation of photovoltaic systems.
- k) However, initial calculations have demonstrated that there is insufficient area available to make a significant contributions towards the target of zero carbon, whilst maintenance some amenity space for the dwellings occupants.
- a) Therefore, at this stage, the use of photovoltaics will not be considered further. The use of photovoltaic systems may be considered at a later date.



#### 4.10 Domestic Solar Hot Water System

- b) This system uses the energy from the sun to heat water, most commonly to provide the hot water demands of the development. The system uses heat collectors, generally mounted on the roof, in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate cylinder or a twin coil hot water cylinder inside the dwelling. The system works very successfully in the UK, as it can operate in diffused light conditions.
- c) As with PV panels, the collectors should be mounted facing in a southerly direction, from south-east through to south-west and at an elevation of 10 to 60°. The panels can be installed on the roof, either on the slope of the roof, on a frame, or they can be integrated into the roof finishes.
- d) This system would be best suited on sites where the solar thermal collectors can be located close to the hot water storage vessel within the dwelling and therefore any losses can be minimised.
- e) Approximately 2-4m<sup>2</sup> of solar thermal collectors could provide the hot water requirements of a typical dwelling. These could be used to feed twin coil hot water cylinders positioned within the dwelling, allowing the water to be heated by the sun when possible whilst retaining the backup of the main heating system when required.
- f) This system would be relatively easy to install. However, the visual impact needs to be given consideration.
- g) Although often not unattractive, and possible to integrate into the building or roof cladding system domestic solar thermal collectors are still considered likely to have visual implications, therefore careful sighting of the panels is required.
- As this installation will be contained on the roof of the proposed development, it involves no additional land use.



- i) With regard to noise and vibration, a domestic solar hot water system is completely silent in operation.
- Space has been identified on the roof areas of the dwellings that can be used for the installation of solar hot water systems.
- j) However, initial calculations have demonstrated that there is insufficient area available to make a significant contributions towards the target of zero carbon, whilst maintenance some amenity space for the dwellings occupants. In addition, due to the height of the dwelling, the efficiency of the systems would be reduced.
- k) Therefore, at this stage, the use of domestic solar hot water will not be considered further. The use of domestic solar hot water may be considered at a later date.



#### 4.11 Heat Pumps

- a) Heat pumps are used to extract the heat from the ground, air or water and transfer it to a heating distribution system, such as under floor heating or radiators using an electric pump. They are usually efficient enough to provide for all space heating requirements and a pre-heat for the domestic hot water systems.
- b) The system would comprise of a heat exchanger either buried in the ground, or mounted on the exterior of the building, or located within a water course, and a heat pump. These would be connected to a traditional heating distribution system, like radiators, underfloor heating, fan coil units etc.
- c) The system uses the latent solar energy stored in the ground or water, or the latent temperature of the air around or within the building. The heat pump upgrades the heat energy to provide the heating for the building. The heat pump operates on the same principles as a refrigeration cycle, like a domestic fridge, except the heat is retained and the cold rejected.
- d) Ground source heat pumps are generally the most efficient however can be expensive to install as the heat exchanger needs to be buried under the ground. Their efficiency and practicality can also be affected by the ground conditions of the site. Water source heat pumps are only suitable where there is a water source available and when appropriate consents have been obtained to utilize this source. Air source heat pumps are generally more flexible as the heat pump and exchanger unit is usually mounted external to the building or within a garage or storage space.
- e) This development is in a built up area and not at ground floor level so there is no scope for the installation of ground loops or heat exchangers, therefore, the use of ground source heat pumps is not feasible.
- f) Air source heat pumps could be installed with the outdoor units installed either on the flat roof areas either at first floor level or at level seven.
- g) With regard to emissions, noise and vibration, heat pump installations are pollution free and noise levels are generally low. There are no local



emissions and, although there will be carbon dioxide emissions associated with their electricity use, these are much less than other forms of electric heating and can be lower than those associated with conventional gas or oil fired boilers.

- h) Heat pump installations are unobtrusive. The technology used in air source heating systems has very low visual impact.
- i) Many of the safety considerations appropriate to any refrigeration or air conditioning systems apply to the use of heat pumps since the working fluid is often a controlled substance that needs to be handled by trained personnel. However, once the system is commissioned, accidental release of refrigerant is unlikely.
- j) In general terms heat pumps of all kinds are expected to operate an average output efficiency of 3:1, this means that for every 1 unit of energy used to run the system it will produce 3 units of energy as a result.
- k) As the heat pumps use electricity as the fuel source, the baseline carbon dioxide emission from the SAP Assessments has to be changed to use electricity as the fuel source as well. Full details of the SAP calculations can be found in the Full SAP Worksheets in Appendix A.
- I) The carbon dioxide emission figures for the dwellings using the use of an air source heat pump to provide the heating and hot water, have been included with the improvements in the thermal performance from Table 2. These demonstrate an overall improvement of 41.0% over the current Building Regulations.



#### 4.12 Annual Carbon Dioxide Emission Reduction

- Based on the initial SAP calculations for the dwellings, it has been calculated that the baseline carbon dioxide emissions figure for the development is 7,641 kgCO<sub>2</sub>/year.
- b) In accordance with the Planning Policies set out by London Borough of Camden, this report has demonstrated an improvement in carbon dioxide emissions by fabric and energy efficiencies and the inclusion of renewable technologies of 41.0%.
- c) A number of options have been considered and the potential carbon dioxide reductions calculated using the SAP calculations and a summary of the results is provided in Table 4 below.

	Total Carbon Dioxide Emissions	Reduction in Carbon Dioxide Emissions
	(kgCO <sub>2</sub> /yr)	(%)
Building Regulations Compliant Development	7,641	-
Development incorporating Energy Efficiency Measures and ASHPs	4,510	41.0%
Percentage Improvement incorp Efficiency Measures and renewal	41.0 %	

Table 4 - Summary of Reduction in Carbon Dioxide Emissions

- d) It has been demonstrated that it is possible to achieve a 41.0% reduction in carbon dioxide emissions over and above the 2013 Building Regulations by improving the energy efficiency of the development and its building services efficiencies and the incorporation of air source heat pumps systems. This could be further improved during detailed design.
- e) CHP and Biomass CHP have been analysed but are considered not feasible for this development as the heating and electrical load profiles would not provide a good clean efficient system for the development.



- f) Biomass heating has been analysed but is considered not feasible for this development due to particle discharge in the built up area, space requirements and the cost and the reliability of a biomass fuel source.
- g) Wind power is considered not feasible for this development due to the visual impact in the area and the turbulence caused by the surrounding buildings and trees etc.
- h) Solar hot water has been considered but due to the height of the building and the minimal reduction in carbon dioxide emissions, it is not being considered further at this stage.
- i) The installation of ground source heat pumps would not be feasible for this development.
- j) The initial calculations for photovoltaic systems demonstrated that there was not enough roof area for the installation of the panels to achieve a meaningful reduction in carbon dioxide emissions for this development, whilst also providing some amenity space for the building occupants.
- k) At this stage of the development, the use of air source heat pumps is considered favorable as it is likely to provide a good reduction in carbon dioxide emissions for the development.
- Detailed calculations of the total carbon dioxide emissions compared to the estimated carbon dioxide reduction for the development can be undertaken once the detailed design has progressed to construction drawing stage.
- m) For the purpose of planning and based on the figures provided by initial SAP calculations, this report has demonstrated that it is feasible, with the improvement of the building fabric, the introduction of energy efficient controls and systems and the incorporation of air source heat pumps, a reduction of 41.0% of the developments carbon dioxide emissions could be achieved. This complies with the requirements of the planning policies set out by the London Borough of Camden.



### 4.13 Energy Hierarchy Carbon Dioxide Emissions Summary

- a) The concept of applying the energy hierarchy in relation to Approved Document L of the Building Regulations 2013, the Energy Planning, Greater London Authority Guidance on Preparing Energy Assessments (March 2016) document provides further guidance on how the carbon dioxide emission figures can be presented.
- b) The regulated carbon dioxide emissions reduction target for the development would be to achieve zero carbon as assessed under the Approved Document L 2013 of the Building Regulations.
- c) These figures are based on the current design information and are subject to change when the detailed construction information is produced.
- Table 5 provides Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings.

		Tonnes CO <sub>2</sub> /yr
Baseline: Part L 2013 of the Building Regulations Compliant Development	а	7.6
After energy demand reduction	b	4.5
After heat network / CHP	с	4.5
After renewable energy	d	4.5

Table 5 – Carbon Dioxide Emissions after each stage of the Energy Hierarchy



e) Table 6 provides Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings

		Tonnes CO <sub>2</sub> /yr		%
Savings from energy demand reduction	a-b	3.1	(a-b)/a*100	41.0%
Savings from heat network / CHP	b-c	0.0	(b-c)/a*100	0.0%
Savings from renewable energy	c-d	0.0	(c-d)/a*100	0.0%
Cumulative on site savings	a-d=e	3.1	(a-d)/a*100	41.0%
Annual Savings from off-set payment	a-e=f	4.5		
Cumulative savings for off-set payment	f*30=g	135.3		

Table 6 – Regulated carbon dioxide savings from each stage of the Energy Hierarchy

f) The calculations contained within this Energy Statement are based on the current design information and are subject to change when the detailed design is undertaken and the construction information is produced.



### 5.0 OVERHEATING

- a) It is important to consider the internal comfort conditions for the occupants of the dwelling. At design stage, this can be met through the use of the "cooling hierarchy", as set out in the London Plan. The cooling hierarchy, in Policy 5.9, seeks to reduce any potential overheating and also the need to cool a building through active cooling measures. Air conditioning systems are a very resource intensive form of active cooling, increasing carbon dioxide emissions, and also emitting large amounts of heat into the surrounding area. By incorporating the cooling hierarchy into the design process buildings will be better equipped to manage their cooling needs and to adapt to the changing climate they will experience over their lifetime.
- b) The development shall reduce the potential for overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
  - a) minimise internal heat generation through energy efficient design
  - reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
  - c) manage the heat within the building through exposed internal thermal mass and high ceilings
  - d) passive ventilation
  - e) mechanical ventilation
  - f) active cooling systems (ensuring they are the lowest carbon options).
- c) During the initial design, the initial SAP Assessment was carried out for the dwelling to help assess the energy demand and carbon emissions of the development. The SAP Assessment includes an overheating assessment in line with the requirements of the Building Regulations.
- d) Based on this SAP Assessment, the dwelling has a slight risk of solar overheating. This is acceptable under the requirements of the Building Regulations.



- e) The internal heat generation has been minimised through energy efficient design. All of the luminaires shall be low energy which will also remove an internal heat generating load.
- f) The heat entering the building in summer is reduced through the optimisation of glazing area, the use of shading via building form and other protruding edges, together with the inclusion of very high performance façade materials and improved air tightness. The use of a solar control glazing, which has a coating applied to lower the G Value of the glass, can be applied. This acts in the same way that the low e coating lowers the U Value which helps reduce heat losses through the windows.
- g) The dwelling could have a mechanical ventilation system installed, which provides filtered fresh air to the dwelling. This is tempered by the crossover heat exchanger, which recovers waste heat from the extract air from the dwelling. The ventilation systems shall be controlled locally by the occupants.
- h) Low energy lamps shall be used in the luminaires to reduce heat gain. These lamps do not emit heat like traditional GLS lamps.
- i) It is also possible to include passive ventilation within the cores and staircase by utilising the smoke vents. The smoke vents are linked to thermostats and can be opened if the temperature exceeds an upper limit, thus providing passive and natural ventilation to these areas to remove any potential heat build-up.
- j) If required, during the detailed design phase of this project, dynamic thermal modelling, using IES software to produce an SBEM model, in accordance with CIBSE Guide A, TM52 and TM49, can be used to ensure that the finding of the initial overheating assessment are still valid and provide a more detailed assessment and prediction of the overheating risk for the development.



### 6.0 WATER CALCULATIONS

- k) The London Borough of Camden recognises that London and the South East is classified as 'seriously' water stressed, meaning that more water is taken from the environment than the environment can sustain in the long term. London is relatively resilient to drought and it takes two consecutive drier than normal winters to create water supply issues.
- The Local Plan requires all new dwellings will be expected to meet the requirement of 110 litres per person per day (including 5 litres for external use).
- m) Low water usage fitting, or flow restrictors can be fitted in the dwelling.
   Efficient white goods that are not only energy efficient but also water efficient can also be installed.
- n) At this stage in the design, the final selection of the water fittings and appliance has not been made, but this calculations shows the design intent for these fittings and appliances.
- Dual flush toilets can be installed to reduce the water consumption of the dwelling. A full flush capacity of 4.5 litres and a part flush capacity of 3 litres has been selected.
- p) Flow restrictors shall be installed to limit the flow rates of the taps to 3 litres / minute. Flow restrictors shall also be installed in the kitchen taps and the showers to restrict their flow to 8 litres / minute. The showers shall be restricted to 8 litres / minute.
- q) No bath is being provided.
- r) No Appliances have been selected at this time, so the default Best Practise values have been used. The washing machine shall have a water consumption of 8.17 litres / kg of dry load. The dishwasher shall have a water consumption of 1.25 litres / place setting.
- s) No water softeners are being installed.



- t) Using the Building Regulations Approved Document G Calculator, the water consumption has been calculated as 97.92 litres / person / day for the studios and 97.94 litres / person / day for the two bedroom flat. This includes the 5 litre per day external water allowance.
- u) The calculated water consumption for the dwellings complies with the requirements of the Local Plan and the Building Regulations Approved Document G.
- v) Details of the calculations can be found in Appendix B.



### 7.0 <u>CONCLUSION</u>

- a) The London Borough of Camden and the London Plan 2016 Policy 5.2 requires new residential developments to minimise and exhibit the highest standards of sustainable design and construction. The reduction in carbon dioxide emissions target has been set as zero carbon. The development should achieve a minimum of 35% over the Target Emission Rate, as defined by the Building Regulations 2013.
- b) The Application at 29-30 High Holborn, London WC1V 6AZ is for the redevelopment of the site to change the mix and provide an enlarged flat at roof level. The development will create a total of four studio flats and a two bedroom flat
- c) It is proposed that in order to meet the requirements of policy this development will adopt a high standard of design with regard to energy efficiency principles. It has been estimated that the proposed development will achieve a reduction in the carbon dioxide emissions through fabric and services efficiencies and a further reduction through the use on-site renewable energy generation. This results in a total of 41.0%. It is envisaged during detailed construction design, these figures can be improved.
- d) At planning stage it is not possible to produce the final reports on the energy demand, carbon dioxide emissions, based on the initial construction information. It is envisaged that during detailed design, the reduction in carbon dioxide emissions can be improved.
- e) This report has assessed the risk of overheating and the development has been identified as having a slight risk, which can be reduced by incorporating low G value glazing, internal shading by light coloured curtains or cross ventilation by opening the windows fifty percent of the time.
- f) The water usage has been assessed and although the actual water fittings have not been selected yet, the calculations show that it is possible for this development to achieve the requirements of the planning policy, thus minimising the impact of the development on the local water resources.



g) This Energy and Sustainability Statement demonstrates that the proposed development complies with the requirements of planning policy with regard to carbon dioxide reduction, incorporation of low and zero carbon technologies and water consumption. It is for these reasons it is considered that this application should be viewed favorably by the London Borough of Camden.



### Appendix A – Full SAP Calculations Printout



<b>Property Reference</b>	E1052-01				Issued on Date	12/01/2021			
Assessment	E1052-01-ASHP			Prop Type Ref					
Reference									
Property	Flat 1, Alliance House, 29	Flat 1, Alliance House, 29 High Holborn, London, WC1V 6AZ							
SAP Rating		81 B	DER	18.72	TER	32.30			
Environmental		83 B	% DER <ter< th=""><th></th><th>42.04</th><th></th></ter<>		42.04				
CO <sub>2</sub> Emissions (t/ye	ar)	0.98	DFEE	31.19	TFEE	42.41			
General Requireme	nts Compliance	Pass	% DFEE <tfe< th=""><th>E</th><th>26.45</th><th></th></tfe<>	E	26.45				
Assessor Details	Mr. Jason Doherty, Doherty E jason@doherty-energy.co.uk		l, Tel: 0148045	1569,	Assessor ID	L143-0001			
Client									





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

REGULATIONS COM				
DWELLING AS DES	IGNED			
Mid-floor flat,	total floor area 41 $\rm m^2$			
It is not a com	vers items included within uplete report of regulation	ons compliance.		
la TER and DER Fuel for main h Fuel factor:1.5 Farget Carbon E Dwelling Carbon	eating:Electricity 55 (electricity) Dioxide Emission Rate (TE 1 Dioxide Emission Rate (	R) 32.30 kgCO□/m² DER) 18.72 kgCO□/m²OK		
b TFEE and DFE arget Fabric E	E Cnergy Efficiency (TFEE)4 E Energy Efficiency (DFEE	12.4 kWh/m²/yr		
2 Fabric U-valu	les			
Element External wall Party wall Floor Roof	0.19 (max. 0.30) 0.00 (max. 0.20) (no floor)	Highest 0.19 (max. 0.70) OF - OF		
Openings	(no roof) 1.08 (max. 2.00)	1.20 (max. 3.30) OF	¢	
2a Thermal brid	lging ug calculated from linear	thermal transmittances for e	each junction	
Air permeabil Air permeabilit Maximum		3.00 (design value)		
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Heating efficients lain heating sy UIBE F205P Secondary heating cylinder insu cylinder insu cylinder insu cylinder stora controls pace heating controls lot water con	<pre>siency stem:</pre>	Heat pump with radiators or None No cylinder Programmer and room thermost No cylinder 	at	OK
Heating effic ain heating sy IBE F205P econdary heati 	<pre>:iency :stem:</pre>	Heat pump with radiators or None No cylinder Programmer and room thermost No cylinder Progy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.57 m², No overhang	at	OK
4 Heating effic 4 A Heating effic 4 A Heating sy VIBE F205P Secondary heati 5 Cylinder insu 40 Water stora 5 Cylinder insu 40 Water stora 5 Cylinder insu 40 Water controls 5 Space heating c 40 Water controls 40 Water controls 5 Cylinder factor 7 Low energy li Percentage of f 4 inimum 3 Mechanical ve 5 Continuous extr 5 Continuous extr 5 Continuous extr 5 Sased on: 5 Vershading: Windows facing Air change rate 8 linds/curtains	<pre>:iency :stem:</pre>	Heat pump with radiators or None No cylinder Programmer and room thermost No cylinder 	at	OK
4 Heating effic 4 Heating spirate 5 Secondary heati 5 Cylinder insu- 5 Cylinder insu- 5 Cylinder insu- 5 Controls 5 Space heating co- 10 water control 10 water contr	<pre>::ency :stem:</pre>	Heat pump with radiators or None No cylinder Programmer and room thermost No cylinder 	at	OK
4 Heating effic 4 Heating sefic 5 Cylinder insu- 5 Cylinder insu- 5 Cylinder insu- 5 Controls 5 Controls 5 Space heating control 4 Heating response 4 Heating ris- 8 Mechanical vec 5 Controls of the 1 Heating ris- 9 Summertime tec 9	<pre>siency stem:</pre>	Heat pump with radiators or None No cylinder Programmer and room thermost No cylinder Progy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.00 ach Light-coloured curtain or ro 0.00 W/m²K	at	OK
4 Heating effic 4 Heating spice 5 Cylinder insu 5 Cylinder insu 6 Cylinder insu 7 Low energy li 9 Sumertime te 9 Summertime te 8 Acchanical ve 9 Summertime te 9 Summertime te 8 Acchanical ve 9 Summertime te 9 Summe	<pre>inency istem: ing system: ilation ige controls: isted lights with low-ene intilation iact system wer: imperature ik (Thames Valley): North: South: i: iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii</pre>	Heat pump with radiators or None No cylinder Programmer and room thermost No cylinder argy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.00 ach Light-coloured curtain or ro	at	OK

elmhurst energy



Volume

101.5000 (5)

0.0000 (6a)

0.0000 (6b)

0.0000 (7a)

0.0000 (7b)

0.0000 (7c)

0.0000 (8)

0.8500 (20) 0.1275 (21)

4.7000 (22) 1.1750 (22a)

0.1498 (22b)

0.5000 (23a) 0.5000 (23b)

0.5000 (25)

АхК

kJ/K

1250.4000 (29a)

3240.0000 (32)

1624.0000 (32d)

1624.0000 (32b) 202.5000 (32c)

8849.9000 (34) 217.9778 (35) 2 0560 (36)

20.3861 (37)

16.7475 (38)

37.1336 (39)

37,1336 (39)

Dec 0.9146 (40) 0.9146 (40)

1,4224 (42)

67.9814 (43)

74.7795 (44) 107.3967 (45)

Dec

31 (41)

Dec

909.0000 (29a)

(27) (26)

(31)

(33)

Dog

2 (19)

Yes 3.0000 0.1500 (18)

m3 per hour

(m3) 101.5000 (1b) - (3b)

(4)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014 SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014 1. Overall dwelling dimensions Area Storey height (m2) (m) 2.5000 (2b) 40.6000 (1b) х = Ground floor Total floor area TFA =  $(la) + (lb) + (lc) + (ld) + (le) \dots (ln)$ Dwelling volume 40.6000  $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ Ventilation rate other main secondarv total heating 0 0 heating Number of chimneys Number of open flues 0 \* 40 = 0 \* 20 = 0 \* 10 = 0 0 Number of intermittent fans Number of passive vents Number of flueless gas fires 0 \* 10 = 0 \* 40 = Air changes per hour Infiltration due to chimneys, flues and fans = (6a) + (6b) + (7a) + (7b) + (7c) =0.0000 / (5) =Pressure test Measured/design AP50 Infiltration rate Number of sides sheltered  $\begin{array}{rrrr} - & [0.075 \times (19)] \\ (21) & = & (18) \times (20) \end{array}$ Shelter factor Infiltration rate adjusted to include shelter factor (20) = 1 \_ May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Jan Feb Mar Tun .Tu 1 Oct Not 5.1000 1.2750 5.0000 1.2500 4.9000 4.4000 1.1000 3.8000 3.8000 4.3000 4.5000 Wind speed Wind factor Adj infilt rate 0.1626 0.1594 0.1562 0.1371 0.1211 0.1179 0.1275 0.1403 0.1211 0.1371 0.1434 Mechanical extract ventilation - centralised If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 0.5000 Effective ac 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 3. Heat losses and heat loss parameter K-value Element Gross Openings NetArea U-value AxU m2 W/m2K W/K kJ/m2K m2 -m2 9.1600 Window (Uw = 1.20) 1.1450 10.4885 2.1000 Door External Wall 30.0000 9.1600 60.0000 20.8400 0.1900 3.9596 External Wall Sheltered Wall Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) Party Wall 1 Party Floor 1 Party Ceilings 1 Internal Wall 1 17.2500 2.1000 15.1500 0.1800 2.7270 60.0000 47.2500 (26)...(30) + (32) = 18.0000 0.0000 40.6000 18.3301 180.0000 0.0000 40.0000 40.6000 40.0000 9.0000 Heat capacity Cm = Sum(A x k) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss (28)...(30) + (32) + (32a)...(32e) = (33) + (36) = Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) Jan Feb Mar Apr May (38)m 16.7475 Heat transfer coeff 37.1336 Apr 16.7475 May 16.7475 Jun Jul Oct Aug 16.7475 Sep 16.7475 Nov 16.7475 16.7475 16.7475 16.7475 16.7475 16.7475 37.1336 37.1336 37.1336 37.1336 37.1336 37.1336 37.1336 37.1336 37.1336 37.1336 Average = Sum(39)m / 12 =Jan 0.9146 Jun 0.9146 Feb May 0.9146 Jul Aug 0.9146 Apr 0.9146 Sep 0.9146 0.9146 0.9146 0.9146 0.9146 0.9146 HLP (average) Days in month 31 28 31 30 31 30 31 31 30 31 30 4. Water heating energy requirements (kWh/year) \_\_\_\_\_ -----Assumed occupancy Average daily hot water use (litres/day) Mar Jan Feb Jul May Jun Aug Sep Oct Nov Apr Daily hot water use 74.7795 66.6217 72.0602 69.3410 63.9025 61.1832 61.1832 63,9025 69.3410 72.0602 66.6217 77.7420



96.9902

100.0852

87.2567

83.7249

Energy conte 110.8958

HLP

98.8979

90.6008

66.9486



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conten	t (annual)									Total = Su	um (45) m =	1069.6114	(45)
Distribution	loss (46)m	= 0.15 x (	45)m										
	16.6344	14.5485	15.0128	13.0885	12.5587	10.8372	10.0423	11.5237	11.6613	13.5901	14.8347	16.1095	(46)
Water storage	loss:												
Store volume												150.0000	(47)
a) If manufa	cturer decla	ared loss fa	actor is kno	own (kWh/da	ay):							1.6800	(48)
Temperature												0.5400	
Enter (49) or	(54) in (5	5)										0.9072	(55)
Total storage													
	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	(56)
If cylinder c													
	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat re													
	139.0190	122.3918	128.2084	114.4727	111.8481	99.4642	95.0718	104.9477	104.9580	118.7240	126.1139	135.5199	
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	
								Solar inpu	it (sum of i	months) = Su	1m (63) m =	0.0000	(63)
Output from w													
	139.0190	122.3918	128.2084	114.4727	111.8481	99.4642	95.0718	104.9477	104.9580	118.7240	126.1139	135.5199	
								Total pe	er year (kWl	h/year) = Sı	1m (64) m =	1400.7394	(64)
Heat gains fr													
	36.8729	32.2492	33.2783	29.0129	27.8385	24.0225	22.2604	25.5441	25.8492	30.1248	32.8835	35.7094	(65)

5. Internal ga	ins (see Tal	ble 5 and 5	5a)									
Metabolic gain:	s (Table 5)	, Watts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186 (66)
Lighting gains	(calculated	d in Append	dix L, equat	ion L9 or	L9a), also s	see Table 5						
	10.9677	9.7414	7.9223	5.9977	4.4833	3.7850	4.0898	5.3161	7.1353	9.0599	10.5743	11.2726 (67)
Appliances gain	ns (calculat	ted in Appe	endix L, equ	ation L13	or L13a), a	lso see Tab	le 5					
	123.0453	124.3222	121.1046	114.2548	105.6082	97.4815	92.0524	90.7756	93.9932	100.8430	109.4896	117.6163 (68)
Cooking gains	(calculated	in Append:	ix L, equati	on L15 or	L15a), also	see Table !	5					
	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119 (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. eva	aporation (1	negative va	alues) (Tabl	.e 5)								
	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949 (71)
Water heating of	gains (Table	e 5)										
	49.5603	47.9899	44.7289	40.2956	37.4174	33.3646	29.9199	34.3335	35.9017	40.4903	45.6716	47.9965 (72)
Total internal	gains											
	227.9090	226.3892	218.0914	204.8837	191.8445	178.9668	170.3978	174.7609	181.3658	194.7288	210.0711	221.2209 (73)

#### \_\_\_\_\_

6. Solar gains

[Jan]	n]		A	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab		Acce: facto Table	or	Gains W	
North South			5.5 <sup>:</sup> 3.5 <sup>:</sup>		10.6334 46.7521		0.7200 0.7200		.7000 .7000	0.77 0.77		20.7610 58.2952	
Solar gains Total gains	79.0562 306.9651	135.1478 361.5369	189.0330 407.1244	245.7419 450.6256	289.1101 480.9546	294.0081 472.9748	280.4810 450.8788	246.4675 421.2283	208.0995 389.4653	150.2043 344.9330	94.7110 304.7821	67.6798 288.9007	( )

Temperature d						'hl (C)						21.0000 (8
Utilisation f					able 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016	66.2016
alpha	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134	5.4134
util living a												
	0.9887	0.9730	0.9356	0.8428	0.6798	0.4964	0.3614	0.4037	0.6328	0.8876	0.9755	0.9916 (8
Tweekday	19.6168	19.8321	20.0993	20.3573	20.4981	20.5368	20.5420	20.5414	20.5214	20.3308	19.9165	19.5533
Tweekend	20.4467	20.5700	20.7247	20.8786	20.9678	20.9950	20.9993	20.9987	20.9830	20.8602	20.6176	20.4105
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
TIN	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (8
Th 2	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427 (8
til rest of	house											
	0.9871	0.9696	0.9278	0.8261	0.6527	0.4625	0.3242	0.3642	0.5966	0.8713	0.9719	0.9905 (8
Fweekday	19.6168	19.8321	20.0993	20.3573	20.4981	20.5368	20.5420	20.5414	20.5214	20.3308	19.9165	19.5533
Fweekend	20.0183	20.1402	20.2916	20.4377	20.5174	20.5393	20.5423	20.5420	20.5306	20.4227	20.1881	19.9823
4IT 2	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427	20.5427 (9
Living area f	raction								fLA =	Living area	/ (4) =	0.8670 (9
AIT	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392 (9
lemperature a	djustment											0.0000
adjusted MIT	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392	20.9392 (9
-												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9725	0.9346	0.8407	0.6762	0.4919	0.3565	0.3985	0.6281	0.8855	0.9751	0.9915 (9	94)
Useful gains	303.4245	351.6069	380.4990	378.8427	325.2420	232.6598	160.7345	167.8438	244.6330	305.4481	297.1831	286.4395 (9	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 (9	96)
Heat loss rate	e W												





### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

CALCOLAI									Jan 2014				
Month fracti Space heating	617.8733 1.0000	595.5931 1.0000	536.1793 1.0000	447.0585 1.0000	343.0843 1.0000	235.3967 0.0000	161.1294 0.0000	168.5561 0.0000	253.9635 0.0000	383.9313 1.0000	513.8991 1.0000	621.5867 1.0000	
Space heating Space heating	233.9499	163.9588	115.8261	49.1154	13.2747	0.0000	0.0000	0.0000	0.0000		156.0355 ) / (4) =	249.3495 1039.9015 25.6133	(98)
8c. Space cool Not applicable 9a. Energy rec Fraction of sp	ing require	ment	l heating s	ystems, inc	luding micro	D-CHP						0.0000	(201)
Fraction of sp Efficiency of Efficiency of Space heating	main space secondary/s	heating sy upplementa	stem 1 (in									1.0000 265.0547 100.0000 392.3347	(206) (208)
On the base is a	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	233.9499	163.9588	115.8261	49.1154	13.2747	0.0000	0.0000	0.0000	0.0000	58.3915	156.0355	249.3495	(98)
Space heating	265.0547	265.0547	265.0547		265.0547	0.0000	0.0000	0.0000	0.0000	265.0547	265.0547	265.0547	(210)
Space heating	88.2648	61.8585		18.5303	5.0083	0.0000	0.0000	0.0000	0.0000	22.0300	58.8692	94.0747	(211)
Water heating	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 Efficiency of	139.0190 water heate	122.3918 r	128.2084	114.4727	111.8481	99.4642	95.0718	104.9477	104.9580	118.7240	126.1139	135.5199 186.5800	(216)
(217)m Fuel for water		Wh/month	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	
Water heating Annual totals Space heating	kWh/year fuel - mair		68.7150	61.3531	59.9464	53.3091	50.9550	56.2481	56.2536	63.6317	67.5924	72.6337 750.7447 392.3347 0.0000	(219)
	or pumps and lised, Data ventilation sity for the or lighting	l fans: base: in-u fans (SFP above, kW (calculate	h/year d in Append	8450)	P = 0.8450)							127.8850 127.8850 193.6937 1464.6581	(230a) (231) (232)
12a. Carbon di	oxide emiss	ions - Ind	ividual hea	ting system	s including	micro-CHP							
Space heating Space heating Water heating Space and wate	- main syst - secondary (other fuel	em 1						Energy kWh/year 392.3347 0.0000 750.7447		ion factor kg CO2/kWh 0.5190 0.5190 0.5190	k	Emissions cg CO2/year 203.6217 0.0000 389.6365 593.2582	(261) (263) (264)
Pumps and fans Energy for lig Total CO2, kg/ Dwelling Carbo	hting 'year	mission Ra	te (DER)					127.8850 193.6937		0.5190 0.5190		66.3723 100.5270 760.1576 18.7200	(268) (272)
16 CO2 EMISSIC DER Total Floor An Assumed number CO2 emissions CO2 emissions Total CO2 emis Residual CO2 emis Additional all Resulting CO2 Net CO2 emissi	rea c of occupar actor in Ta from applia from cookir sions missions of owable elec emissions c	ats able 12 for ances, equa ag, equatio ffset from ctricity ge	electricit tion (L14) n (L16) biofuel CHP neration, k	y displaced Wh/m²/year	from grid		fy generati	ON TECHNOLO	SIES		TFA N EF	18.7200 40.6000 1.4224 0.5190 17.9591 3.7718 40.4510 0.0000 0.0000 0.0000 40.4510	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7





### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

LCULATION OF			s Designed) 09 Jan 20	(Version	9.92, Januar								
Overall dwel													
								Area	Stor	ey height		Volume	
ound floor tal floor are	a TFA = (1a	a)+(1b)+(1	c)+(1d)+(1e	)(1n)	4	0.6000		(m2) 40.6000	(1b) x	(m) 2.5000	(2b) =	(m3) 101.5000	(1b) · (4)
elling volume		_, . (, . (	-, - (, - (	,,				(	3a)+(3b)+(3c)	+(3d)+(3e)	(3n) =	101.5000	
Ventilation	rate				main		condary		other	tot	-ə] m	13 per hour	
nber of chimn	ieys				heating 0		heating 0	+	0 =		0 * 40 =	0.0000	(6a)
aber of open aber of inter aber of passi aber of fluel	mittent far				0	+	0	+	0 =		0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 20.0000 0.0000 0.0000	(7a) (7b)
iltration du	a to chimp	ove flues	and fanc	- (62)+(6b)	)+(7a)+(7b)+(	70) -				20 0000	Air change / (5) =	es per hour 0.1970	(9)
essure test asured/design		JJ, LIUES	ana talis	- (Ja) T (DD)	, . (, u) + (/D) + (	, -				20.0000	, (3) -	0.1970 Yes 5.0000	
filtration ra mber of sides	ate											0.4470	(18) (19)
elter factor filtration ra	ite adjusted	d to includ	de shelter	factor					(20) = 1 - (2		x (19)] = x (20) =	0.8500 0.3800	
nd speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000		Oct 4.3000	Nov 4.5000	Dec 4.7000	
nd factor j infilt rate	1.2750 0.4845	1.2500 0.4750	1.2250 0.4655	1.1000	1.0750	0.9500	0.9500	0.9250		1.0750 0.4085	1.1250 0.4275	1.1750 0.4465	
fective ac	0.6174	0.6128	0.6083	0.5874	0.5834	0.5652	0.5652	0.5618		0.5834	0.5914	0.5997	
Heat losses ement R Opaque door R Opening Typ cernal Wall eltered Wall	and heat lo	oss paramet	ter			Net 2. 8. 21. 15.	Area m2 1000 0500 9500 1500		A x W/ 2.100 10.672 3.951 2.727	K 0 3 0	-value kJ/m2K	A x K kJ/K	(26) (27) (29a) (29a)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area	and heat lo	40)	ter	Gross m2 30.0000	Openings m2 8.0500	Net 2. 8. 21. 15.	Area m2 1000 0500 9500 1500 2500	U-value W/m2K 1.0000 1.3258 0.1800	W/ 2.100 10.672 3.951 2.727	к 0 3 0			(26) (27) (29a)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges	of external ss, W/K = St arameter (Th s (Sum(L x F	40) l elements um (A x U) MP = Cm / 2	Aum(A, m2)	Gross m2 30.0000 17.2500 m2K	Openings m2 8.0500 2.1000	Net 2. 8. 21. 15.	Area m2 1000 0500 9500 1500 2500	U-value W/m2K 1.0000 1.3258 0.1800 0.1800	W/ 2.100 10.672 3.951 2.727	K 0 3 0 0 3			(26) (27) (29a) (31) (33) (35) (36)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal bridges tal fabric he ntilation hea	of external s, W/K = St arameter (TM s (Sum(L x F teat loss at loss cald Jan	40) 1 elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb	Aum(A, m2) TFA) in kJ/i lated using nthly (38)m Mar	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr	Openings m2 8.0500 2.1000 ) 225)m x (5) May	Net 2. 8. 21 15. 47.	-Area m2 1000 0500 9500 1500 (26)( Jul	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug	W/ 2.100 10.672 3.951 2.727 = 19.450 Sep	K 0 3 0 0 3 (33) 0Ct	kJ/m2K + (36) = Nov	kJ/K 250.0000 2.1200 21.5703 Dec	(26) (27) (29a) (31) (33) (35) (36) (37)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric hea ntilation hea 8)m	of external so, W/K = St arameter (TH s (Sum(L x H eat loss at loss calc Jan 20.6786	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor	Aum(A, m2) TFA) in kJ/i lated using nthly (38)m	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2	Openings m2 8.0500 2.1000	Net 2. 8 21. 15. 47.	EArea m2 1000 0500 9500 1500 2500 (26)(	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32)	W/ 2.100 10.672 3.951 2.727 = 19.450 Sep 19.1657	K 0 0 0 3 (33)	kJ/m2K + (36) =	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (38)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric he	and heat lo e (Uw = 1.4 of external s, W/K = Si arameter (Th s (Sum (L x I b at loss tt loss calo Jan 20.6786 coeff 42.2489 39)m / 12 =	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963	Aum(A, m2) TFA) in kJ/: lated using nthly (38)m Mar 20.3763 41.9466	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420 41.1124	Net 2. 8 21 15 47. 47. 47. 40.5003	Area m2 1000 9500 1500 (26)( Jul 18.9299 40.5003	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug 18.8166 40.3869	W/ 2.100 10.672 3.951 2.727 = 19.450 Sep 19.1657 40.7360	K 0 3 0 3 3 (33) Oct 19.5420 41.1124	kJ/m2K + (36) = Nov 19.8080 41.3784	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (38)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric hea ntilation hea 8)m at transfer c erage = Sum (3 P P (average)	of external ss, W/K = St arameter (TM s (Sum(L x H eat loss calc Jan 20.6786 coeff 42.2489	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420	Net 2. 8 21. 15. 47. Jun 18.9299	Jul 18.9299	U-value W/m2K 1.0000 0.1800 0.1800 30) + (32) Aug 18.8166	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 Sep 19.1657 40.7360 Sep</pre>	K 0 3 0 0 3 (33) 0 ct 19.5420	kJ/m2K + (36) = Nov 19.8080	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40)
Heat losses menent & Opaning Typ ternal Wall eltered Wall eltered Wall eltered Wall eltered Wall eltered Wall eltered Wall estal nass pa ermal mass pa ermal bridges tal fabric he ntilation head S)m at transfer c erage = Sum (3 P (average)	and heat 1d of external ss, W/K = Sti arameter (TH s (Sum(L x H sat loss at loss cald Jan 20.6786 coeff 42.2489 39)m / 12 = Jan	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb	Aum(A, m2) TFA) in kJ/i lated wi3g mthly (38)m Mar 20.3763 41.9466 Mar	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420 41.1124 May	Net 2 8 21 15 47 47 47 47 47 47 47 47 47 5003 40.5003 Jun	Area m2 1000 1500 2500 (26)( Jul 18.9299 40.5003 Jul	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug 18.8166 40.3869 Aug	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034</pre>	<pre>K K 0 3 0 0 3 (33) 0 Cct 19.5420 41.1124 Oct</pre>	kJ/m2K + (36) = Nov 19.8080 41.3784 Nov	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40)
Heat losses ment & Opaque door & Opaning Typ ternal Wall eltered Wall eltered Wall eltered Wall eltered Wall eltered Wall estal fabric he trial horidges cal fabric he trilation heat 3)m at transfer c erage = Sum (3 2 (average)	and heat lo the (Uw = 1.4 of external as, W/K = Su arameter (TH arameter (TH bat loss cald Jan 20.6786 coeff 42.2489 30)m / 12 = Jan 1.0406	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb 1.0369	Aum(A, m2) IFA) in kJ/; lated using nthly (38)m Mar 20.3763 41.9466 Mar 1.0332	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr 1.0159	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 41.1124 May 1.0126	Net 2 8 21 15 47 47 47 47 40 5003 Jun 0.9975	Area m2 1000 1500 2500 (26)( Jul 18.9299 40.5003 Jul 0.9975	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 40.3869 Aug 0.9948	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034</pre>	K 0 3 0 3 (33) 0 0 19.5420 41.1124 0 0 ct 1.0126	<pre>kJ/m2K + (36) =     Nov     19.8080     41.3784     Nov     1.0192</pre>	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40) (40)
Heat losses ment & Opaque door & Opening Typ Lernal Wall all net area oric heat los ermal mass pa fabric heat htilation hea )m ht transfer c brage = Sum (3 2 2 (average) ys in month Water heatin	and heat 10 c (Uw = 1.4 of external ss, W/K = St arameter (Th arameter (Th set loss at loss cald Jan 20.6786 coeff 42.2489 39)m / 12 = Jan 1.0406 31 g energy re	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb 1.0369 28 equirements	Aum(A, m2) IFA) in kJ/i lated using Mar 20.3763 41.9466 Mar 1.0332 31 s (kWh/year	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr 1.0159 30	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420 41.1124 May 1.0126 31	Net 2 8 21 15 47 47 47 47 47 47 47 47 47 47 47 47 47	Area m2 1000 1500 2500 (26)( Jul 18.9299 40.5003 Jul 0.9975 31	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 40.3869 Aug 0.9948 31	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034</pre>	K 0 3 0 3 (33) 0 0 19.5420 41.1124 0 0 ct 1.0126	<pre>kJ/m2K + (36) =     Nov     19.8080     41.3784     Nov     1.0192</pre>	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40) (40)
Heat losses ment R Opaque door R Opaque door R Opaning Typ ternal Wall tal net area oric heat los ermal mass pa ermal bridges tal fabric he att transfer c erage = Sum (3 P P (average) ys in month Water heatin 	and heat 1 we (Uw = 1.4 of external us, W/K = Si rrameter (Th s (Sum(L x I tat loss s (Sum(L x I tat loss at loss cald Jan 20.6786 coeff 42.2489 39) m / 12 = Jan 1.0406 31 ag energy re- coy	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb 1.0369 28 equirements	<pre>ter Aum(A, m2) TFA) in kJ/, lated using nthly (38)m Mar 20.3763 41.9466 Mar 1.0332 31 s (kWh/year</pre>	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr 1.0159 30	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420 41.1124 May 1.0126 31	Net 2 8 21 15 47 47 47 47 47 47 47 47 47 47 47 47 47	Area m2 1000 1500 2500 (26)( Jul 18.9299 40.5003 Jul 0.9975 31	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 40.3869 Aug 0.9948 31	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034</pre>	K 0 3 0 3 (33) 0 0 19.5420 41.1124 0 0 ct 1.0126	<pre>kJ/m2K + (36) =     Nov     19.8080     41.3784     Nov     1.0192</pre>	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (40) (41) (41)
Heat losses ment R Opaque door R Opaning Typ ternal Wall Eltered Wall tal net area oric heat los ermal mass pa tal fabric heat ntilation head 3)m at transfer c erage = Sum (3 P P (average) ys in month Water heatin sumed occupan erage daily h	and heat 1d c (Uw = 1.4 of external ss, W/K = St arameter (TH eat loss at loss cald Jan 20.6786 coeff 42.2489 39)m / 12 = Jan 1.0406 31 	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb 1.0369 28 equirements	<pre>ter Aum(A, m2) TFA) in kJ/, lated using nthly (38)m Mar 20.3763 41.9466 Mar 1.0332 31 s (kWh/year</pre>	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr 1.0159 30	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420 41.1124 May 1.0126 31	Net 2 8 21 15 47 47 47 47 47 47 47 47 47 47 47 47 47	Area m2 1000 1500 2500 (26)( Jul 18.9299 40.5003 Jul 0.9975 31	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 40.3869 Aug 0.9948 31	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034</pre>	K 0 3 0 3 (33) 0 0 19.5420 41.1124 0 0 ct 1.0126	<pre>kJ/m2K + (36) =     Nov     19.8080     41.3784     Nov     1.0192</pre>	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158 31	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (40) (41) (41)
Heat losses ment R Opaque door R Opaque door R Opaque door R Opaque door ternal wall eltered Wall tal net area oric heat los ermal bridges tal fabric he ntilation hea 3)m at transfer c erage = Sum(3 P P (average) ys in month Water heatin sumed occupan rage daily h ily hot water ergy conte	and heat 10 of external so, W/K = St arameter (TH sat loss cald Jan 20.6786 coeff 42.2489 90m / 12 = Jan 1.0406 31 	40) l elements um (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb 1.0369 28 equirements se (litres,	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 41.9466 Mar 1.0332 31 s (kWh/year /day)	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr 1.0159 30	Openings m2 8.0500 2.1000 ) 25)m x (5) May 19.5420 41.1124 May 1.0126 31	Net 2. 8 21. 15. 15. 47. 47. 47. 47. 40.5003 Jun 0.9975 30	Area m2 1000 0500 1500 (26)( Jul 18.9299 40.5003 Jul 0.9975 31	U-value W/m2K 1.0000 0.1800 30) + (32) Aug 18.8166 40.3869 Aug 0.9948 31	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034 30 \$ep 66.6217</pre>	<pre>K K 0 3 0 0 3 (33) Oct 19.5420 41.1124 Oct 1.0126 31 Oct 69.3410 90.6008</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     41.3784     Nov     1.0192     30     Nov     72.0602     98.8979</pre>	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158 31 1.4224 67.9814 Dec 74.7795 107.3967	(26) (27) (29a) (31) (33) (35) (36) (37) (39) (40) (40) (40) (41) (41) (42) (44) (44)
Heat losses ment R Opaque door R Opaning Typ ternal Wall tal net area oric heat los ermal mass pa ermal bridges tal fabric he ntilation hea 3)m at transfer c erage = Sum (3 P P (average) ys in month Water heatin output to the second sumed occupan erage daily h	and heat 10 (UW = 1.4 of external (UW = 1.4 of external (UW = 1.4 (UW =	40) 1 elements 1 m (A x U) MP = Cm / ? Psi) calcul culated mor Feb 20.5259 42.0963 Feb 1.0369 28 equirements se (litres, Feb 72.0602 96.9902	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 41.9466 Mar 1.0332 31 s (kWh/year /day) Mar 69.3410 100.0852	Gross m2 30.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 41.2438 Apr 1.0159 30 ) Apr 66.6217	Openings m2 8.0500 2.1000 ) 225)m x (5) May 19.5420 41.1124 May 1.0126 31 	Net 2. 8 21 15 47. 47. 47. 47. 47. 47. 47. 47. 40.5003 Jun 0.9975 30 Jun 0.9975 30	Area m2 1000 0500 2500 (26)( Jul 18.9299 40.5003 Jul 0.9975 31 Jul Jul 61.1832	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 40.3869 Aug 0.9948 31 	<pre>w/ 2.100 10.672 3.951 2.727 = 19.450 \$ep 19.1657 40.7360 \$ep 1.0034 30 \$ep 66.6217 77.7420</pre>	<pre>K K 0 3 0 0 3 (33) Oct 19.5420 41.1124 Oct 1.0126 31 Oct 69.3410 90.6008</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     41.3784     Nov     1.0192     30     Nov     72.0602</pre>	kJ/K 250.0000 2.1200 21.5703 Dec 20.0861 41.6565 41.2432 Dec 1.0260 1.0158 31 1.4224 67.9814 Dec 74.7795 107.3967 1069.6114	(26) (27) (29a) (31) (33) (36) (37) (38) (39) (40) (40) (40) (41) (41) (42) (43) (44)







### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder co	ntains dedi	icated solar	storage										
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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 rec	uired for w	water heatin	ng calculate	ed for each	month								
	157.4907	139.0759	146.6801	132.3485	130.3198	117.3400	113.5435	123.4194	122.8338	137.1957	143.9897	153.9916	(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 inpu	it (sum of r	nonths) = Su	1m (63) m =	0.0000	(63)
Output from w/	'n												
-	157.4907	139.0759	146.6801	132.3485	130.3198	117.3400	113.5435	123.4194	122.8338	137.1957	143.9897	153.9916	(64)
								Total pe	er year (kWh	n/year) = Su	1m (64) m =	1618.2288	(64)
Heat gains fro	om water hea	ating, kWh/r	nonth					-	-	-			
	74.1488	65.9178	70.5542	65.0863	65.1144	60.0960	59.5363	62.8201	61.9227	67.4007	68.9570	72.9853	(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	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186 (6	6)
Lighting gains	(calculated	d in Append:	ix L, equat	ion L9 or I	19a), also s	ee Table 5							
	11.0571	9.8208	7.9868	6.0465	4.5199	3.8159	4.1232	5.3594	7.1934	9.1337	10.6604	11.3644 (6	7)
Appliances gair	ns (calculat	ed in Apper	ndix L, equ	ation L13 d	or L13a), al	so see Tabl	.e 5						
	123.0453	124.3222	121.1046	114.2548	105.6082	97.4815	92.0524	90.7756	93.9932	100.8430	109.4896	117.6163 (6	8)
Cooking gains	(calculated	in Appendi:	x L, equati	on L15 or I	15a), also	see Table 5							
	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119 (6	9)
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 (7	0)
Losses e.g. eva	aporation (r	negative val	lues) (Tabl	e 5)									
	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949 (7	1)
Water heating o	gains (Table	e 5)											
	99.6623	98.0920	94.8310	90.3977	87.5194	83.4667	80.0219	84.4356	86.0037	90.5923	95.7736	98.0985 (7	2)
Total internal	gains												
	281.1004	279.5706	271.2580	258.0346	244.9830	232.0997	223.5332	227.9062	234.5260	247.9046	263.2593	274.4148 (7	3)

6. Solar gain	s												
[Jan]			Area m2		Solar flux g Table 6a Specific data W/m2 or Table 6b		fic data	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North South			4.9 3.1		10.6334 46.7521		0.6300 0.6300		.7000 .7000	0.77		15.9560 44.8644	. ,
Solar gains Total gains	60.8205 341.9209	103.9692 383.5398	145.4106 416.6686	189.0114 447.0461	222.3485 467.3316	226.1073 458.2069	215.7076 439.2407	189.5621 417.4683	160.0701 394.5960	115.5489 363.4535	72.8635 336.1228	52.0688 326.4836	1 7

Temperature d						hl (C)						21.0000	(85)
Utilisation f	actor for ga	ins for liv	ring area, n	il,m (see I	'able 9a)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.7341	66.9761	67.2150	68.3604	68.5790	69.6155	69.6155	69.8109	69.2125	68.5790	68.1381	67.6833	
alpha	5.4489	5.4651	5.4810	5.5574	5.5719	5.6410	5.6410	5.6541	5.6142	5.5719	5.5425	5.5122	
util living a	rea												
	0.9900	0.9802	0.9567	0.8900	0.7518	0.5556	0.4042	0.4425	0.6782	0.9076	0.9782	0.9920	(86)
MIT	20.1336	20.2871	20.5046	20.7601	20.9264	20.9890	20.9984	20.9975	20.9680	20.7682	20.4162	20.1102	(87)
Th 2	20.4797	20.4816	20.4834	20.4921	20.4937	20.5012	20.5012	20.5026	20.4983	20.4937	20.4904	20.4870	(88)
util rest of !	house												
	0.9884	0.9772	0.9501	0.8745	0.7222	0.5152	0.3590	0.3956	0.6372	0.8912	0.9744	0.9907	(89)
MIT 2	19.6640	19.8176	20.0328	20.2854	20.4367	20.4942	20.5005	20.5013	20.4764	20.2972	19.9535	19.6468	(90)
Living area f	raction								fLA =	Living area	(4) =	0.8670	(91)
MIT	20.0712	20.2247	20.4418	20.6970	20.8613	20.9232	20.9322	20.9315	20.9026	20.7055	20.3547	20.0486	(92)
Temperature a	djustment											0.6000	
adjusted MIT	20.6712	20.8247	21.0418	21.2970	21.4613	21.5232	21.5322	21.5315	21.5026	21.3055	20.9547	20.6486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9792	0.9571	0.8982	0.7766	0.5965	0.4518	0.4916	0.7163	0.9162	0.9779	0.9911	(94)
Useful gains	338.1606	375.5648	398.8092	401.5527	362.9433	273.3040	198.4705	205.2352	282.6491	333.0063	328.6853	323.5887	(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	e W												
	691.6636	670.3698	609.9801	511.2986	401.3090	280.3904	199.7558	207.2446	301.5529	440.1299	573.2828	685.1896	(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												
	263.0062	198.1089	157.1111	79.0171	28.5441	0.0000	0.0000	0.0000	0.0000	79.6999	176.1102	269.0311	(98)
Space heating												1250.6286	(98)
Space heating	per m2									(98)	/ (4) =	30.8037	(99)

8c. Space cooling requirement

Not applicable





### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements												
Fraction of space heat Fraction of space heat Efficiency of main space Efficiency of secondary Space heating requirement	from seconda from main sy e heating sy /supplementa	ary/supplemen vstem(s) vstem 1 (in S	ntary syste 8)								0.0000 1.0000 88.5000 0.0000 1413.1397	(202) (206) (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requireme 263.0062 Space heating efficience	198.1089	157.1111	79.0171	28.5441	0.0000	0.0000	0.0000	0.0000	79.6999	176.1102	269.0311	(98)
88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (mai 297.1822	223.8519	177.5267	89.2848	32.2532	0.0000	0.0000	0.0000	0.0000	90.0564	198.9946	303.9899	(211)
Water heating requireme 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 requireme 157.4907	139.0759	146.6801	132.3485	130.3198	117.3400	113.5435	123.4194	122.8338	137.1957	143.9897	153.9916	
Efficiency of water hea (217)m 81.1522	80.7364	79.9762	78.4713	76.5206	74.8000	74.8000	74.8000	74.8000	78.4056	80.3309	74.8000 81.2681	
Fuel for water heating, 194.0685	172.2593	183.4047	168.6586	170.3067	156.8717	151.7961	164.9992	164.2164	174.9821	179.2456	189.4859	
Water heating fuel used Annual totals kWh/year											2070.2948	
Space heating fuel - ma Space heating fuel - se											1413.1397 0.0000	
Electricity for pumps a central heating pump main heating flue fa Total electricity for t Electricity for lightin Total delivered energy	n he above, kW g (calculate	ed in Append:	ix L)								39.0000 45.0000 84.0000 195.2718 3762.7063	(230e) (231) (232)
12a. Carbon dioxide emi												
Space heating - main sy Space heating - second Water heating (other fu Space and water heating Pumps and fans Energy for lighting Total CO2, kg/m2/year Emissions per m2 for sp Fuel factor (electricit Emissions per m2 for pu Emissions per m2 for pu	ry el) ace and wate y) ghting	-					Energy kWh/year 1413.1397 0.0000 2070.2948 84.0000 195.2718		ion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190	k	Emissions g CO2/year 305.2382 0.0000 447.1837 752.4219 43.5960 101.3461 897.3639 18.5326 1.5500 2.4962	(263) (264) (265) (267) (268) (272) (272a)





Property Reference	E1052-02				Issued on Date	12/01/2021
Assessment	E1052-02-ASHP			Prop Type Ref		
Reference						
Property	Flat 2, Alliance House, 29	High Holborn	, London, WC1	V 6AZ		
SAP Rating		80 C	DER	19.96	TER	34.24
Environmental		82 B	% DER <ter< th=""><th></th><th>41.71</th><th></th></ter<>		41.71	
CO <sub>2</sub> Emissions (t/ye	ear)	1.03	DFEE	36.37	TFEE	48.02
General Requireme	ents Compliance	Pass	% DFEE <tfe< th=""><th>E</th><th>24.26</th><th></th></tfe<>	E	24.26	
Assessor Details	Mr. Jason Doherty, Doherty E jason@doherty-energy.co.uk	0,	l, Tel: 0148045	1569,	Assessor ID	L143-0001
Client						





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

	ved Document L1A, 2013 Edition, England	
DWELLING AS DESIGNED		
Mid-floor flat, total floor area 41 m	2	
This report covers items included with It is not a complete report of regular	tions compliance.	
la TER and DER Fuel for main heating:Electricity Fuel factor:1.55 (electricity) Target Carbon Dioxide Emission Rate (' Duelling Carbon Dioxide Emission Rate	TER) 34.24 kgCO□/m² (DER) 19.96 kgCO□/m²OK	
lb TFEE and DFEE Target Fabric Energy Efficiency (TFEE Dwelling Fabric Energy Efficiency (DF)		
2 Fabric U-values Element Average	Highest	
	0.19 (max. 0.70) OK	
Roof (no roof) Openings 1.08 (max. 2.00)	1.20 (max. 3.30) OK	
2a Thermal bridging	ar thermal transmittances for each junction	
3 Air permeability Air permeability at 50 pascals: Maximum	3.00 (design value) 10.0	ОК
4 Heating efficiency Main heating system: NIBE F205P	Heat pump with radiators or underfloor - Electr	
Secondary heating system:	None	
5 Cylinder insulation Hot water storage	No cylinder	
5 Cylinder insulation Hot water storage		
5 Cylinder insulation Hot water storage 6 Controls	No cylinder	
5 Cylinder insulation Hot water storage 6 Controls Space heating controls: Hot water controls:	No cylinder Programmer and room thermostat	oĸ
5 Cylinder insulation Hot water storage 6 Controls Space heating controls: Hot water controls: 7 Low energy lights Percentage of fixed lights with low-en Minimum	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75%	oĸ
5 Cylinder insulation Hot water storage 6 Controls Space heating controls: Hot water controls: 7 Low energy lights Percentage of fixed lights with low-en Minimum 	No cylinder Programmer and room thermostat No cylinder nergy fittings:100%	ок
5 Cylinder insulation Hot water storage 6 Controls Space heating controls: Hot water controls: 7 Low energy lights Percentage of fixed lights with low-en Minimum 8 Mechanical ventilation Continuous extract system Specific fan power: Maximum	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75% 0.65 0.7	ок
5 Cylinder insulation Hot water storage 6 Controls Space heating controls: Hot water controls: 7 Low energy lights Percentage of fixed lights with low-energy Minimum 8 Mechanical ventilation Continuous extract system Specific fan power: Maximum 9 Summertime temperature Overheating risk (Thames Valley): Based on:	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75% 0.65 0.7	ок ОК
5 Cylinder insulation Hot water storage 6 Controls Space heating controls: Hot water controls: 7 Low energy lights Percentage of fixed lights with low-en Minimum 8 Mechanical ventilation Continuous extract system Specific fan power: Maximum 9 Summertime temperature Overheating risk (Thames Valley): Based on: Overshading:	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75% 0.65 0.7 Medium Average	ок ок
5 Cylinder insulation Hot water storage 	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.57 m², No overhang	ок ок
5 Cylinder insulation Hot water storage 	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.57 m², No overhang 3.00 ach Light-coloured curtain or roller blind, closed	ок ок ок
5 Cylinder insulation Hot water storage 	No cylinder Programmer and room thermostat No cylinder mergy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.57 m², No overhang 3.57 m², No overhang 3.60 ach Light-coloured curtain or roller blind, closed i	ок ок ок
5 Cylinder insulation Hot water storage 	No cylinder Programmer and room thermostat No cylinder nergy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.00 ach Light-coloured curtain or roller blind, closed 0.55 W/m²K	ок ок ок
5 Cylinder insulation Hot water storage 	No cylinder Programmer and room thermostat No cylinder mergy fittings:100% 75% 0.65 0.7 Medium Average 5.59 m², No overhang 3.57 m², No overhang 3.57 m², No overhang 3.60 ach Light-coloured curtain or roller blind, closed i	ок ок ок





### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions									
Ground floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) Dwelling volume	40.6000	Area (m2) 40.6000	(1b) x	orey height (m) 2.5000 c)+(3d)+(3e)	(2b)	=	Volume (m3) 101.5000 101.5000	(4)	- (3b)

2. Ventilation	rate												
					main heating		econdary heating	c	ther	tota	l m3	per hour	
Number of chimm	neys				ő	+	ő	+	0 =		0 * 40 =	0.0000	(6a)
Number of open	flues				0	+	0	+	0 =		0 * 20 =	0.0000	(6b)
Number of inter	rmittent fa	ns									0 * 10 =	0.0000	(7a)
Number of pass	ive vents										0 * 10 =	0.0000	(7b)
Number of flue	less gas fi	res									0 * 40 =	0.0000	(7c)
											Air changes	per hour	
Infiltration du Pressure test	ue to chimn	eys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =				0.0000	/ (5) =	0.0000 Yes	(8)
Measured/design	n AP50											3.0000	
Infiltration ra	ate											0.1500	(18)
Number of sides	s sheltered											2	(19)
Shelter factor								(	20) = 1 -	[0.075 x	(19)] =	0.8500	(20)
Infiltration ra	ate adjuste	d to includ	e shelter f	actor					(2	1) = (18) x	(20) =	0.1275	(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	
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 1500										(0.01.)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Mechanical ext			ntrailsed									0 5000	(0.2 - )
If mechanical v If exhaust air			div N (22b	) - (232) x	Emir (oquat	ion (N5))	othorwico (	22h) - (22a	)			0.5000	
II CANdust dif	near pump	using Appen	uin N, (25D	) = (25d) X	rmv (equal	1011 (103)),	otherwise (	2307 - (236	.)			0.5000	(200)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	Net	Area	U-value	A x U	K-	value	АхК	
	m2	m2		m2	W/m2K	W/K	k	J/m2K	kJ/K	
Window (Uw = 1.20)			9.	1600	1.1450	10.4885				(27)
Door			2.	1000	0.5500	1.1550				(26)
External Wall	48.0000	9.1600	38.	8400	0.1900	7.3796	60	.0000	2330.4000	(29a
Sheltered Wall	17.2500	2.1000	15.	1500	0.1800	2.7270	60	.0000	909.0000	(29a
Total net area of external elements Aum(A,	m2)		65.	2500						(31)
Fabric heat loss, W/K = Sum (A x U)				(26)(	30) + (32) =	21.7501				(33)
Party Floor 1			40.	6000			40	.0000	1624.0000	(32d
Party Ceilings 1			40.	6000			40	.0000	1624.0000	(32b
Internal Wall 1			22.	5000			ġ	0000	202.5000	(32c
Heat capacity $Cm = Sum(A \times k)$					(28)	. (30) + (32)	+ (32a)	.(32e) =	6689.9000	(34)
Thermal mass parameter (TMP = Cm / TFA) in	kJ/m2K								164.7759	(35)
Thermal bridges (Sum(L x Psi) calculated us		)							2.0560	(36)
Total fabric heat loss							(33)	+ (36) =	23.8061	(37)
Ventilation heat loss calculated monthly (3	8)m = 0.33 x (	25)m x (5)								
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m 16.7475 16.7475 16.74	75 16.7475	16.7475	16.7475	16.7475	16.7475	16.7475	16.7475	16.7475	16.7475	(38)
Heat transfer coeff										
40.5536 40.5536 40.55	36 40.5536	40.5536	40.5536	40.5536	40.5536	40.5536	40.5536	40.5536	40.5536	(39)
Average = Sum(39)m / 12 =									40.5536	(39)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
LP 0.9989 0.9989 0.99	0.9989	0.9989	0.9989	0.9989	0.9989	0.9989	0.9989	0.9989	0.9989	(40)
LP (average)									0.9989	
Days in month										

4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 1.4224 (42) 67.9814 (43) Feb Mar Jan Apr May Jun Jul Aug Sep Oct Nov Dec Daily hot water use 74.7795 Energy conte 110.8958 72.0602 69.3410 96.9902 100.0852 63.9025 69.3410 72.0602 90.6008 98.8979 Total = Sum(45)m = 69.3410 61.1832 74.7795 (44) 107.3967 (45) 1069.6114 (45) 61.1832 66.6217 63.9025 66.6217 Energy conte 110.8958 Energy content (annual) 87.2567 83.7249 72.2482 66.9486 76.8245 77.7420





### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution 2													
	16.6344	14.5485	15.0128	13.0885	12.5587	10.8372	10.0423	11.5237	11.6613	13.5901	14.8347	16.1095	(46)
Water storage	loss:												
Store volume												150.0000	(47)
a) If manufad	cturer decla	ared loss fa	actor is kno	own (kWh/da	ay):							1.6800	(48)
Temperature	factor from	m Table 2b			-							0.5400	(49)
Enter (49) or	(54) in (5	5)										0.9072	(55)
Total storage		- /											( )
	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	(56)
If cylinder co	ontains ded	icated solar	storage										
	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat red	quired for	water heatir	ng calculate	ed for each	month								
	139.0190	122.3918	128.2084	114.4727	111.8481	99.4642	95.0718	104.9477	104.9580	118.7240	126.1139	135.5199	(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 inpu	ut (sum of :	months) = S	um (63) m =	0.0000	(63)
Output from w	/h							-					
	139.0190	122.3918	128.2084	114.4727	111.8481	99.4642	95.0718	104.9477	104.9580	118.7240	126.1139	135.5199	(64)
								Total pe	er vear (kW	h/year) = S	um (64) m =	1400.7394	(64)
Heat gains fro	om water he	ating, kWh/m	onth					. cont pr					
	36.8729	32.2492	33.2783	29.0129	27.8385	24.0225	22.2604	25.5441	25.8492	30.1248	32.8835	35.7094	(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	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186 (66)
Lighting gain:	s (calculate	d in Append	dix L, equa	tion L9 or 3	L9a), also s	see Table 5						
	10.9677	9.7414	7.9223	5.9977	4.4833	3.7850	4.0898	5.3161	7.1353	9.0599	10.5743	11.2726 (67)
Appliances ga	ins (calcula	ited in Appe	endix L, eq	ation L13	or L13a), a	lso see Tabl	Le 5					
	123.0453	124.3222	121.1046	114.2548	105.6082	97.4815	92.0524	90.7756	93.9932	100.8430	109.4896	117.6163 (68)
Cooking gains	(calculated	l in Appendi	ix L, equat:	ion L15 or :	L15a), also	see Table 5	5					
	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119 (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. e	vaporation (	negative va	alues) (Tab	le 5)								
	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949 (71)
Water heating	gains (Tabl	.e 5)										
	49.5603	47.9899	44.7289	40.2956	37.4174	33.3646	29.9199	34.3335	35.9017	40.4903	45.6716	47.9965 (72)
Total interna	l gains											
	227.9090	226.3892	218.0914	204.8837	191.8445	178.9668	170.3978	174.7609	181.3658	194.7288	210.0711	221.2209 (73)

## 6. Solar gains

gui													
[Jan]			A	rea m2			g Specific data or Table 6b		FF Specific data or Table 6c		ss or 6d	Gains W	
North South			5.5		10.6334 46.7521		0.7200 0.7200		.7000 .7000	0.77 0.77		20.7610 58.2952	
Solar gains	79.0562	135.1478 361 5369	189.0330	245.7419	289.1101 480 9546	294.0081 472 9748	280.4810 450 8788	246.4675	208.0995	150.2043	94.7110 304 7821	67.6798 288 9007	

Cemperature du Jtilisation fa						'hl (C)						21.0000
	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
au	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234	45.8234
lpha	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549	4.0549
til living an	rea											
	0.9775	0.9572	0.9179	0.8348	0.6949	0.5259	0.3901	0.4336	0.6533	0.8737	0.9603	0.9820
weekday	19.1572	19.4183	19.7592	20.1199	20.3681	20.4716	20.4950	20.4918	20.4286	20.1041	19.5533	19.0812
'weekend	20.1976	20.3473	20.5441	20.7564	20.9087	20.9770	20.9946	20.9917	20.9460	20.7439	20.4235	20.1542
4 / 16	9	8	9	8	9	9	9	9	8	9	8	9
4 / 9	22	20	22	22	22	21	22	22	22	22	22	22
6/9	0	0	0	0	0	0	0	0	0	0	0	0
IIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000
'h 2	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006
til rest of h	nouse											
	0.9751	0.9529	0.9098	0.8190	0.6687	0.4896	0.3476	0.3892	0.6172	0.8580	0.9555	0.9801
'weekday	19.1572	19.4183	19.7592	20.1199	20.3681	20.4716	20.4950	20.4918	20.4286	20.1041	19.5533	19.0812
'weekend	19.7397	19.8876	20.0807	20.2850	20.4256	20.4842	20.4974	20.4956	20.4598	20.2760	19.9640	19.6967
IIT 2	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006	20.5006
iving area fo	raction								fLA =	Living area	/ (4) =	0.8670
IIT	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336
emperature ad	djustment											0.0000
djusted MIT	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336	20.9336

(94)
(95)
(96)
(97)





CALCULATION OF	DWELLIN	G EMISSI	ONS FOR	REGULA	TIONS CO	OMPLIAN	CE 09	Jan 2014						
Month fracti 1.0000 Space heating kWh 278.6934 Space heating Space heating per m2	1.0000 204.5195	1.0000 157.7628	1.0000 81.1699	1.0000 31.1466	0.0000	0.0000	0.0000	0.0000		1.0000 193.3268 ) / (4) =	1.0000 293.8632 1328.5577 32.7231	(98) (98)		
8c. Space cooling requi 	rement													
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 %)       270.3552 (206)         Efficiency of secondary/supplementary heating system, %       100.0000 (201)         Space heating requirement       491.4120 (211)														
	204.5195		81.1699	31.1466	0.0000	0.0000	0.0000	0.0000	88.0755	193.3268	293.8632	(98)		
	270.3552	270.3552		270.3552	0.0000	0.0000	0.0000	0.0000	270.3552	270.3552	270.3552	(210)		
	75.6485		30.0234	11.5206	0.0000	0.0000	0.0000	0.0000	32.5777	71.5085	108.6952	(211)		
	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 requireme: 139.0190 Efficiency of water heat (217)m 186.5800 Fuel for water heating, Water heating fuel used Annual totals kWh/year Space heating fuel - ma Space heating fuel - se Electricity for pumps a	122.3918 ter 186.5800 kWh/month 65.5975 in system condary	128.2084 186.5800 68.7150	114.4727 186.5800 61.3531	111.8481 186.5800 59.9464	99.4642 186.5800 53.3091	95.0718 186.5800 50.9550	104.9477 186.5800 56.2481	104.9580 186.5800 56.2536	118.7240 186.5800 63.6317	126.1139 186.5800 67.5924	135.5199 186.5800 186.5800 72.6337 750.7447 491.4120 0.0000	(216) (217) (219) (219) (211)		
(MEVCentralised, Da mechanical ventilati Total electricity for t Electricity for lightin Total delivered energy	tabase: in-u on fans (SFP he above, kW g (calculate	= 0.8 h/year	3450)	P = 0.8450)							125.7003 125.7003 193.6937 1561.5507	(231) (232)		
12a. Carbon dioxide emi														
Space heating - main sy Space heating - seconda Water heating (other fu Space and water heating Pumps and fans Energy for lighting Total CO2, kg/year Dwelling Carbon Dioxide	stem 1 ry el)						Energy kWh/year 491.4120 0.0000 750.7447 125.7003 193.6937		ion factor cg CO2/kWh 0.5190 0.5190 0.5190 0.5190 0.5190	k	Emissions cg CO2/year 255.0428 0.0000 389.6365 644.6793 65.2385 100.5270 810.4448 19.9600	(263) (264) (265) (267) (268) (272)		
16 CO2 EMISSIONS ASSOCI. DER Total Floor Area Assumed number of occup CO2 emissions from appl CO2 emissions from cook Total CO2 emissions Residual CO2 emissions Additional allowable el Resulting CO2 emissions Net CO2 emissions	ants Table 12 for iances, equa ing, equation offset from 1 ectricity gen	electricity tion (L14) n (L16) biofuel CHP neration, kV	y displaced ∛h/m²/year	from grid		TY GENERATIO	DN TECHNOLOG	SIES		TFA N EF	19.9600 40.6000 1.4224 0.5190 3.7718 41.6910 0.0000 0.0000 0.0000 41.6910	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7		





### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

LCULATION OF				(Version	9.92, Januar								
Overall dwel													
								Area	Stor	ey height		Volume	
ound floor al floor are	o (1)	a) (1b) (1a	-) - (1 d) - (1 -	) (1m)		0.6000		(m2) 40.6000	(1b) x	(m) 2.5000	(2b) =	(m3) 101.5000	
al ling volume		a) + (1D) + (1C	c)+(10)+(1e	)(111)	4	0.0000		(	3a)+(3b)+(3c)	+(3d)+(3e)	(3n) =	101.5000	(4) (5)
Ventilation	rate												
					main heating		econdary heating		other	tot	al n	13 per hour	
nber of chimn nber of open	flues				0 0	+ +	0 0	+ +	0 =		0 * 40 = 0 * 20 =	0.0000 0.0000	(6b)
aber of inter aber of passi aber of fluel	ve vents										2 * 10 = 0 * 10 = 0 * 40 =	20.0000 0.0000 0.0000	(7b)
			and Free	- (60) - (6)		7.0) -				20 0000	Air change	es per hour	
Eiltration du essure test asured/design		eys, Ilues	anu Iañs	- (oa)+(6b)	++(/a)+(/b)+(	(0) =				20.0000	/ (5) =	0.1970 Yes 5.0000	
filtration ra mber of sides	te											0.4470	(18) (19)
elter factor Filtration ra	te adiuster	d to inclus	de shelter	factor					(20) = 1 -	$[0.075 \times 1) = (18)$		0.8500	
													(=+)
nd speed nd factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
j infilt rate		0.4750	0.4655	0.4180	0.4085	0.3610	0.3610	0.3515		0.4085	0.4275	0.4465	
fective ac	0.6174	0.6128	0.6083	0.5874	0.5834	0.5652	0.5652	0.5618		0.5834	0.5914	0.5997	
Heat losses	and heat lo	oss paramet	ter										
Heat losses	and heat lo	oss paramet	ter			Net			A x W/		-value kJ/m2K	A x K kJ/K	
Heat losses ement R Opaque door R Opening Typ	and heat lo	oss paramet	ter	Gross m2	Openings m2	Net 2. 8.	Area m2 .1000 .0500	U-value W/m2K 1.0000 1.3258	W/ 2.100 10.672	К 0 3			(26) (27)
Heat losses ement R Opaque door R Opening Typ cernal Wall eltered Wall	e (Uw = 1.4	oss paramet	ter	Gross	Openings	Net 2. 8. 39. 15.	Area m2 1000 0500 9500 1500	U-value W/m2K 1.0000	W/ 2.100	K 0 3 0			(26) (27) (29a) (29a)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area	e (Uw = 1.4	40)	ter	Gross m2 48.0000	Openings m2 8.0500	Net 2. 8. 39. 15.	Area m2 1000 0500 9500 1500 2500	U-value W/m2K 1.0000 1.3258 0.1800	W/ 2.100 10.672 7.191 2.727	K 0 3 0 0			(26) (27) (29a)
Heat losses ement & Opaque door & Opening Typ eernal Wall eltered Wall eltered Wall cal net area oric heat los ermal mass pa ermal bridges	e (Uw = 1.4 of external s, W/K = St rameter (Th (Sum(L x F	40) l elements um (A x U) MP = Cm / J	Aum(A, m2)	Gross m2 48.0000 17.2500 m2K	Openings m2 8.0500 2.1000	Net 2. 8. 39. 15.	Area m2 1000 0500 9500 1500 2500	U-value W/m2K 1.0000 1.3258 0.1800 0.1800	W/ 2.100 10.672 7.191 2.727	K 0 3 0 0		kJ/K 250.0000 2.1200	(26) (27) (29a) (31) (33) (35) (36)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric he	e (Uw = 1.4 of external s, W/K = St rameter (TR (Sum(L x H at loss	40) l elements um (A x U) MP = Cm / 1 Psi) calcul	Aum(A, m2) TFA) in kJ/i lated using	Gross m2 48.0000 17.2500 m2K Appendix K)	Openings m2 8.0500 2.1000	Net 2. 8. 39. 15.	Area m2 1000 0500 9500 1500 2500	U-value W/m2K 1.0000 1.3258 0.1800 0.1800	W/ 2.100 10.672 7.191 2.727	K 0 3 0 0 3		kJ/K 250.0000	(26) (27) (29a) (31) (33) (35) (36)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric he ntilation hea	e (Uw = 1.4 of external s, W/K = Su rameter (TM (Sum(L x H at loss t loss cald Jan	40) 1 elements um (A x U) MP = Cm / 7 Psi) calcul culated mor Feb	Aum(A, m2) TFA) in kJ/i lated using nthly (38)m Mar	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr	Openings m2 8.0500 2.1000	Net 2. 8 39 15. 65.	-Area m2 1000 0500 9500 1500 (26)(3 Jul	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug	W/ 2.100 10.672 7.191 2.727 = 22.690 Sep	K 0 3 0 0 3 (33) 0Ct	kJ/m2K + (36) = Nov	kJ/K 250.0000 2.1200 24.8103 Dec	(26) (27) (29a) (31) (33) (35) (36) (37)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric he ntilation hea 8)m at transfer c	e (Uw = 1.4 of external s, W/K = Su rameter (TM (Sum(L x H at loss calc Jan 20.6786 oeff 45.4889	40) l elements um (A x U) MP = Cm / 7 Psi) calcul culated mor Feb 20.5259 45.3363	Aum(A, m2) TFA) in kJ/i lated using nthly (38)m	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2	Openings m2 8.0500 2.1000 25)m x (5) May	Net 2. 8 39. 15. 65.	EArea m2 1000 0500 9500 1500 2500 (26)(3	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32)	<pre></pre>	K 0 0 3 3 (33)	kJ/m2K + (36) =	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (38)
Heat losses ement R Opaque door R Opening Typ tternal Wall teltered Wall tal net area bbric heat loss ermal bridges tal fabric he entilation hea (8)m tat transfer c rerage = Sum(3	<pre>and heat ld     d     e (Uw = 1.4     of external     s, W/K = Si     rameter (Th         (Sum(L x I         t loss         t loss cald         Jan         20.6786         oeff         45.4889     9)m / 12 =</pre>	40) l elements um (A x U) MP = Cm / 1 Psi) calcul culated mor Feb 20.5259 45.3363	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 45.1866	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524	Net 2. 8 39 15 65. 5. 5. 43.7403	Jul Jul Jul Jul Jul Jul 18.9299 43.7403	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug 18.8166 43.6269	<pre>w, 2.100 10.672 7.191 2.727 = 22.690 \$ep 19.1657 43.9760</pre>	K 0 3 0 3 (33) Oct 19.5420 44.3524	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (38)
Heat losses eement RR Opaque door RR Opening Typ tternal Wall teltered Wall ttal net area bbric heat los mermal mass pa eermal bridges ttal fabric he entilation hea (8) m tat transfer c	e (Uw = 1.4 of external s, W/K = Su rameter (TM (Sum(L x H at loss calc Jan 20.6786 oeff 45.4889	40) l elements um (A x U) MP = Cm / 7 Psi) calcul culated mor Feb 20.5259 45.3363	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420	Net 2. 8 39 15 65. 65. Jun 18.9299	Jul Jul Jul Jul Jul Jul 18.9299	U-value W/m2K 1.0000 0.1800 0.1800 30) + (32) Aug 18.8166	<pre>w, w, 2,100 10,672 7,191 2.727 = 22.690 Sep 19,1657 43.9760 Sep</pre>	K 0 3 0 0 3 (33) 0 ct 19.5420	kJ/m2K + (36) = Nov 19.8080	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric he ntilation hea 8) m at transfer c erage = Sum(3 P P (average)	e (Uw = 1.4 of external s, W/K = St (Sum(L x I at loss t loss calc Jan 20.6786 oeff 45.4889 9)m / 12 = Jan	40) l elements um (A x U) MP = Cm / T Psi) calcul culated mor Feb 20.5259 45.3363 Feb	Aum(A, m2) TFA) in kJ/i lated using mthly (38)m Mar 20.3763 45.1866 Mar	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May	Net 2. 8. 39. 15. 65. Jun 18.9299 43.7403 Jun	.Area m2 1000 15500 2500 (26)(3 Jul 18.9299 43.7403 Jul	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug 18.8166 43.6269 Aug	<pre>www. 2.100 10.672 7.191 2.727 = 22.690 \$\$\$ 19.1657 43.9760 \$</pre>	<pre>K     0     3     0     (33)</pre>	kJ/m2K + (36) = Nov 19.8080 44.6184 Nov	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832 Dec 1.1058 1.0956	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40)
Heat losses ement R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal mass pa ermal bridges tal fabric he ntilation hea 8)m at transfer c erage = Sum(3 P P (average)	and heat ld e (Uw = 1.4 of external s, W/K = Su rameter (TK (Sum(L X I at loss t loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204	40) l elements um (A x U) MP = Cm / 1 Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167	Aum(A, m2) IFA) in kJ/; lated using nthly (38)m Mar 20.3763 45.1866 Mar 1.1130	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924	Net 2 8 39 15 65 65 43.7403 Jun 1.0773	Jul Jul Jul Jul Jul Jul 18.9299 43.7403 Jul 1.0773	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746	<pre>w, w, 2.100 10.672 7.191 2.727 = 22.690 19.1657 43.9760 Sep 1.0832</pre>	<pre>K 0 3 0 0 3 (33) 0 0 (33) 0 0 19.5420 44.3524 0 0 t 1.0924</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832 Dec 1.1058 1.0956	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40) (40)
Heat losses mement R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal bridges tal fabric he ntilation hea 8)m at transfer c erage = Sum(3 P P (average) ys in month	and heat 1d e (Uw = 1.4 of external s, W/K = Su rameter (Th (Sum(L x I at loss t loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31	40) l elements um (A x U) MP = Cm / T Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167 28	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 45.1866 Mar 1.1130 31	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31	Net 2 8 39 15 65 65 43.7403 Jun 1.0773 30	Jul Jul Jul Jul Jul 18.9299 43.7403 Jul 1.0773 31	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31	<pre>w, w, 2.100 10.672 7.191 2.727 = 22.690 19.1657 43.9760 Sep 1.0832</pre>	<pre>K 0 3 0 0 3 (33) 0 0 (33) 0 0 19.5420 44.3524 0 0 t 1.0924</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832 Dec 1.1058 1.0956	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (39) (40) (40)
Heat losses menent & Opaque door & Opening Typ ternal Wall altered Wall tal net area pric heat los ermal mass pa ermal bridges tal fabric he htilation hea B)m at transfer c erage = Sum(3 P P (average) ys in month Water heatin	and heat 10 e (Uw = 1.4 of external s, W/K = Su rameter (TK) (Sum(L X I at loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31 g energy re	40) l elements um (A x U) MP = Cm / T Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167 28 equirements	Aum(A, m2) IFA) in kJ/i lated using Mar 20.3763 45.1866 Mar 1.1130 31 s (kWh/year	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31	Net 2 8 39 15 65 65 43.7403 Jun 1.0773 30	Area m2 1000 1500 2500 (26)(3 Jul 18.9299 43.7403 Jul 1.0773 31	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31	<pre>w, w, 2.100 10.672 7.191 2.727 = 22.690 19.1657 43.9760 Sep 1.0832</pre>	<pre>K 0 3 0 0 3 (33) 0 0 (33) 0 0 19.5420 44.3524 0 0 t 1.0924</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832 Dec 1.1058 1.0956	(26) (27) (29a) (31) (33) (35) (36) (37) (38) (39) (40) (40) (41)
Heat losses mement R Opaque door R Opening Typ ternal Wall tal net area bric heat los ermal bridges tal fabric he ntilation hea 8)m at transfer c erage = Sum (3 P P (average) ys in month Water heatin sumed occupan	and heat 1d e (Uw = 1.4 of external s, W/K = Su rameter (T) at loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31 g energy re- cy ot water us	40) l elements um (A x U) MP = Cm / 7 Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167 28 equirements se (litres/	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 45.1866 Mar 1.1130 31 s (kWh/year /day)	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31	Net 2. 8 39 15. 65. 43.7403 Jun 1.0773 30	Jul Jul Jul Jul 18.9299 43.7403 Jul 1.0773 31	U-value W/m2K 1.0000 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31	<pre>www 2.100 10.672 7.191 2.727 = 22.690 \$\$\$\$ 19.1657 43.9760 \$</pre>	K 0 3 0 0 3 (33) 0 ct 19.5420 44.3524 0 ct 1.0924 31	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990     30</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4892 Dec 1.1058 1.0956 31	(26) (27) (29a) (31) (33) (35) (37) (38) (39) (40) (41) (42)
Heat losses Heat losses Heat losses R Opaque door R Opening Typ ternal Wall eltered Wall tal net area bric heat los ermal bridges tal fabric he ntilation hea 8)m at transfer c erage = Sum(3 P	and heat 1d e (Uw = 1.4 of external s, W/K = Su rameter (T) (Sum(L X I at loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31 g energy re cy ot water us Jan use	40) l elements um (A x U) MP = Cm / 1 Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167 28 equirements se (litres/ Feb	Aum(A, m2) TFA) in kJ/; lated using nthly (38)m Mar 20.3763 45.1866 Mar 1.1130 31 s (kWh/year /day) Mar	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31	Net 2. 8 39 18.9299 43.7403 Jun 1.0773 30 Jun	Jul Jul Jul 18.9299 43.7403 Jul 1.0773 Jul Jul Jul Jul	U-value W/m2K 1.0000 0.1800 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31	<pre>www 2.100 10.672 7.191 2.727 = 22.690 19.1657 43.9760 Sep 1.0832 30 Sep</pre>	K 0 3 0 0 3 (33) 0 0 19.5420 44.3524 0 0 ct 1.0924 31 0 0 ct	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990     30</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832 Dec 1.1058 1.0956 31 1.4224 67.9814 Dec	(26) (27) (29a) (31) (33) (35) (37) (39) (39) (40) (40) (41) (41)
Heat losses Heat losses Heat losses R Opaque door R Opening Typ ternal Wall tal net area oric heat los ermal mass pa ermal bridges tal fabric hean htilation hea B)m at transfer c erage = Sum(3 P P (average) ys in month Water heatin burded occupan erage daily h ily hot water ergy conte	and heat 10 e (Uw = 1.4 of external s, W/K = Su rameter (TK (Sum(L X 1 at loss t loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31 g energy re- cy ot water us Jan use 74.7795 110.8958	40) l elements um (A x U) MP = Cm / 7 Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167 28 equirements se (litres/	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 45.1866 Mar 1.1130 31 s (kWh/year /day)	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31	Net 2. 8 39 15. 65. 43.7403 Jun 1.0773 30	Jul Jul Jul Jul 18.9299 43.7403 Jul 1.0773 31	U-value W/m2K 1.0000 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31	<pre>www 2.100 10.672 7.191 2.727 = 22.690 \$ep 19.1657 43.9760 \$ep 1.0832 30 \$ep 66.6217</pre>	<pre>K 0 3 0 0 3 (33) 0 0 (33) 0 0 19.5420 44.3524 0 0 0 1.0924 31 0 0 0 69.3410 90.6008</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990     30     Nov     72.0602     98.8979</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.8965 44.4832 Dec 1.1058 1.0956 31 1.4224 67.9814 Dec 74.7795 107.3967	(26) (27) (29a) (31) (33) (35) (36) (37) (39) (40) (40) (40) (41) (41) (42) (44) (44)
Heat losses ment & Opaque door & Opaque door & Opaning Typ ternal Wall tal net area oric heat los ermal bridges tal fabric he at transfer c transfer c erage = Sum(3) P (average) ys in month Water heatin water heatin under docupan erage daily h ily hot water ergy content	and heat 1d e (Uw = 1.4 of external s, W/K = Su rameter (T) at loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31 g energy re 	<pre>40) 40) 40) 40) 40) 40) 41 elements 10 elements 20.5259 45.3363 Feb 1.1167 28 equirements se (litres/ Feb 72.0602 96.9902</pre>	Aum(A, m2) TFA) in kJ// lated using nthly (38)m Mar 20.3763 45.1866 Mar 1.1130 31 s (kWh/year /day) Mar 69.3410 100.0852	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30 ) Apr 66.6217	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31 31 May 63.9025	Net 2. 8 39 15 65. 43.7403 Jun 1.0773 30 Jun 1.0773 30	Jul Jul Jul Jul 18.9299 43.7403 Jul 1.0773 31 Jul Jul 61.1832	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31	<pre>www 2.100 10.672 7.191 2.727 = 22.690 Sep 19.1657 43.9760 Sep 1.0832 30 Sep 66.6217 77.7420</pre>	<pre>K 0 3 0 0 3 (33) 0 0 (33) 0 0 19.5420 44.3524 0 0 0 1.0924 31 0 0 0 69.3410 90.6008</pre>	<pre>kJ/m2K + (36) =     Nov     19.8080     44.6184     Nov     1.0990     30     Nov     72.0602</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.9965 44.4832 Dec 1.1058 1.0956 31 1.4224 67.9814 Dec 74.7795 107.3967 1069.6114	(26) (27) (29a) (31) (33) (36) (37) (40) (40) (40) (41) (41) (42) (43) (44)
Heat losses Heat losses Heat losses R Opaque door R Opening Typ ternal Wall tal net area oric heat los ermal bridges tal fabric hean htilation hea 3)m at transfer c erage = Sum (3 P P (average) ys in month Water heatin sumed occupan erage daily h	and heat 1d e (Uw = 1.4 of external s, W/K = Su rameter (TK (Sum(L X 1 at loss cald Jan 20.6786 oeff 45.4889 9)m / 12 = Jan 1.1204 31 g energy re 	40) l elements um (A x U) MP = Cm / 1 Psi) calcul culated mor Feb 20.5259 45.3363 Feb 1.1167 28 equirements se (litres/ Feb 72.0602 96.9902 = 0.15 x (4 14.5485	Aum(A, m2) IFA) in kJ/; lated using mar 20.3763 45.1866 Mar 1.1130 31 s (kWh/year /day) Mar 69.3410 100.0852 45)m 15.0128	Gross m2 48.0000 17.2500 m2K Appendix K) = 0.33 x (2 Apr 19.6735 44.4838 Apr 1.0957 30 ) Apr 66.6217 87.2567 13.0885	Openings m2 8.0500 2.1000 25)m x (5) May 19.5420 44.3524 May 1.0924 31 31 May 63.9025 83.7249 12.5587	Net 2, 8, 39, 15, 65, 65, 10, 18,9299 43,7403 Jun 1.0773 30 Jun 61,1832 72,2482	Area m2 1000 1500 2500 (26)(3 Jul 18.9299 43.7403 Jul 1.0773 31 Jul 61.1832 66.9486	U-value W/m2K 1.0000 1.3258 0.1800 30) + (32) Aug 18.8166 43.6269 Aug 1.0746 31 Aug 63.9025 76.8245	<pre>www 2.100 10.672 7.191 2.727 = 22.690 Sep 19.1657 43.9760 Sep 1.0832 30 Sep 66.6217 77.7420</pre>	<pre>K 0 3 0 0 3 (33) 0 Cct 19.5420 44.3524 Oct 1.0924 31 0ct 69.3410 90.6008 Total = S</pre>	<pre>kJ/m2K + (36) =     Nov 19.8080 44.6184     Nov 1.0990     30     30     Nov     72.0602     98.8979 um(45) m =</pre>	kJ/K 250.0000 2.1200 24.8103 Dec 20.0861 44.9965 44.4832 Dec 1.1058 1.0956 31 1.4224 67.9814 Dec 74.7795 107.3967 1069.6114	(26) (27) (29a) (31) (33) (35) (36) (37) (40) (40) (40) (41) (41) (42) (44) (45) (45) (45) (46) (47)







### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder co	ontains dedi	icated solar	storage										
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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 red	quired for v	water heatin	ng calculate	ed for each	month								
	157.4907	139.0759	146.6801	132.3485	130.3198	117.3400	113.5435	123.4194	122.8338	137.1957	143.9897	153.9916	(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 inpu	it (sum of r	months) = Su	1m (63) m =	0.0000	(63)
Output from w,	/h												
	157.4907	139.0759	146.6801	132.3485	130.3198	117.3400	113.5435	123.4194	122.8338	137.1957	143.9897	153.9916	(64)
								Total pe	er year (kWh	n/year) = Su	1m (64) m =	1618.2288	(64)
Heat gains fro	om water hea	ating, kWh/r	nonth					-	-	-			
-	74.1488	65.9178	70.5542	65.0863	65.1144	60.0960	59.5363	62.8201	61.9227	67.4007	68.9570	72.9853	(65)

	_
5. Internal gains (see Table 5 and 5a)	
	-
Metabolic gains (Table 5), Watts	

necaborro garm	0 (10010 0))	macco											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186	71.1186 (6	56)
Lighting gains	(calculated	d in Append	ix L, equat	ion L9 or 1	19a), also s	ee Table 5							
	11.0571	9.8208	7.9868	6.0465	4.5199	3.8159	4.1232	5.3594	7.1934	9.1337	10.6604	11.3644 (6	ŝ7)
Appliances gair	ns (calculat	ted in Appe	ndix L, equ	ation L13 d	or L13a), al	so see Tabl	Le 5						
	123.0453	124.3222	121.1046	114.2548	105.6082	97.4815	92.0524	90.7756	93.9932	100.8430	109.4896	117.6163 (6	58)
Cooking gains	(calculated	in Appendi	x L, equati	on L15 or 1	L15a), also	see Table 5	5						
	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119	30.1119 (6	59)
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 (7	70)
Losses e.g. eva	aporation (1	negative va	lues) (Tabl	.e 5)									
	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949	-56.8949 (7	/1)
Water heating o	gains (Table	e 5)											
	99.6623	98.0920	94.8310	90.3977	87.5194	83.4667	80.0219	84.4356	86.0037	90.5923	95.7736	98.0985 (7	12)
Total internal	gains												
	281.1004	279.5706	271.2580	258.0346	244.9830	232.0997	223.5332	227.9062	234.5260	247.9046	263.2593	274.4148 (7	73)

6. Solar gain	s												
[Jan]			Area m2		Solar flux Table 6a W/m2	Speci	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		
North South			4.9 3.1		10.6334 46.7521		0.6300 0.6300		.7000 .7000	0.770		15.9560 44.8644	
Solar gains Total gains	60.8205 341.9209	103.9692 383.5398	145.4106 416.6686	189.0114 447.0461	222.3485 467.3316	226.1073 458.2069	215.7076 439.2407	189.5621 417.4683	160.0701 394.5960	115.5489 363.4535	72.8635 336.1228	52.0688 326.4836	1 7

			ig season)										
Temperature d						'hl (C)						21.0000	(85)
Utilisation f	factor for ga	ins for liv	ring area, n	il,m (see I	'able 9a)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9809	62.1896	62.3955	63.3813	63.5692	64.4588	64.4588	64.6263	64.1132	63.5692	63.1902	62.7988	
alpha	5.1321	5.1460	5.1597	5.2254	5.2379	5.2973	5.2973	5.3084	5.2742	5.2379	5.2127	5.1866	
util living a	irea												
	0.9908	0.9824	0.9625	0.9063	0.7831	0.5926	0.4350	0.4756	0.7139	0.9214	0.9808	0.9926	(86)
MIT	20.0211	20.1781	20.4080	20.6890	20.8912	20.9803	20.9968	20.9949	20.9491	20.7045	20.3216	19.9968	(87)
Th 2	20.4398	20.4417	20.4435	20.4522	20.4538	20.4613	20.4613	20.4627	20.4584	20.4538	20.4505	20.4471	(88)
util rest of	house												
	0.9893	0.9796	0.9565	0.8917	0.7531	0.5478	0.3830	0.4220	0.6707	0.9062	0.9773	0.9914	(89)
MIT 2	19.5190	19.6762	19.9043	20.1829	20.3689	20.4488	20.4598	20.4602	20.4234	20.2021	19.8266	19.5009	(90)
Living area f	raction								fLA =	Living area	(4) =	0.8670	(91)
MIT	19.9543	20.1114	20.3410	20.6217	20.8218	20,9096	20.9254	20.9238	20.8792	20.6377	20.2558	19.9308	(92)
Temperature a												0.6000	
adjusted MIT	20.5543	20.7114	20.9410	21.2217	21.4218	21.5096	21.5254	21.5238	21.4792	21.2377	20.8558	20.5308	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9810	0.9619	0.9116	0.8041	0.6329	0.4847	0.5262	0.7487	0.9271	0.9799	0.9916	(94)
Useful gains	338.3790	376.2461	400.7845	407.5184	375.7697	289.9891	212.8864	219.6917	295.4354	336.9718	329.3730	323.7389	(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	e W												
	739.3918	716.8283	652.5423	548.1167	431.1832	302.2298	215.4363	223.5363	324.5085	471.8071	613.7609	733.1965	(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												
	298.3535	228.8712	187.3078	101.2308	41.2276	0.0000	0.0000	0.0000	0.0000	100.3175	204.7593	304.6365	(98)
Space heating												1466.7042	(98)
Space heating	per m2									(98)	/ (4) =	36.1257	(99)

8c. Space cooling requirement

Not applicable





### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individu											
Fraction of space heat from second Fraction of space heat from main sy Efficiency of main space heating sy Efficiency of secondary/supplement. Space heating requirement	ary/suppleme ystem(s) ystem 1 (in	ntary system %)								0.0000 1.0000 88.5000 0.0000 1657.2929	(202) (206) (208)
Jan Feb Space heating requirement	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
298.3535 228.8712 Space heating efficiency (main heat		101.2308	41.2276	0.0000	0.0000	0.0000	0.0000	100.3175	204.7593	304.6365	(98)
88.5000 88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating s 337.1226 258.6116		114.3851	46.5849	0.0000	0.0000	0.0000	0.0000	113.3531	231.3664	344.2220	(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 157.4907 139.0759 Efficiency of water heater	146.6801	132.3485	130.3198	117.3400	113.5435	123.4194	122.8338	137.1957	143.9897	153.9916 74.8000	
(217)m 81.4734 81.1142	80.4461	79.0896	77.1195	74.8000	74.8000	74.8000	74.8000	78.9744	80.7319	81.5816	
Fuel for water heating, kWh/month 193.3032 171.4569 Water heating fuel used	182.3334	167.3400	168.9843	156.8717	151.7961	164.9992	164.2164	173.7218	178.3554	188.7578 2062.1362	
Annual totals kWh/year Space heating fuel - main system Space heating fuel - secondary										1657.2929 0.0000	(211)
Electricity for pumps and fans: central heating pump main heating flue fan Total electricity for the above, k Electricity for lighting (calculate Total delivered energy for all use	ed in Append	ix L)								39.0000 45.0000 84.0000 195.2718 3998.7009	(230c) (230e) (231) (232)
12a. Carbon dioxide emissions - In											
Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting						Energy kWh/year 1657.2929 0.0000 2062.1362 84.0000 195.2718		ion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190	k	Emissions g CO2/year 357.9753 0.0000 445.4214 803.3967 43.5960 101.3461	(263) (264) (265) (267)
Total CO2, kg/m2/year Emissions per m2 for space and wate Fuel factor (electricity) Emissions per m2 for lighting Emissions per m2 for pumps and fam. Target Carbon Dioxide Emission Rate	s	9.7881 * 1.	55) + 2.496	2 + 1.0738,	rounded to			0.3190		101.3461 948.3388 19.7881 1.5500 2.4962 1.0738 34.2400	(272) (272a) (272b) (272c)





<b>Property Reference</b>	E1052-05			Issued on Date	12/01/2021					
Assessment	E1052-05-ASHP			Prop Type Ref						
Reference										
Property	Flat 5, Alliance House, 29	High Holborn,	London, WC1	/ 6AZ						
SAP Rating		86 B	DER	16.24	TER	26.59				
Environmental		87 B	% DER <ter< th=""><th></th><th>38.92</th><th></th></ter<>		38.92					
CO <sub>2</sub> Emissions (t/ye	ar)	1.10	DFEE	40.34	TFEE	52.85				
General Requireme	nts Compliance	Pass	% DFEE <tfee< th=""><th></th><th>23.67</th><th></th></tfee<>		23.67					
Assessor Details	Mr. Jason Doherty, Doherty E jason@doherty-energy.co.uk		, Tel: 01480451	.569,	9, Assessor ID L143-0001					
Client										





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

	PLIANCE REPORT - Approv	ed Document L1A, 2013 Edit:	ion, England	
DWELLING AS DES	IGNED			
Top-floor flat,	total floor area 81 $\rm m^2$			
It is not a com	ers items included with: plete report of regulat:			
la TER and DER	eating:Electricity			
Dwelling Carbon	ioxide Emission Rate (T Dioxide Emission Rate	(DER) 16.24 kgCO□/m²OK		
1b TFEE and DFE				
Dwelling Fabric	nergy Efficiency (TFEE) Energy Efficiency (DFE)	E)40.3 kWh/m²/yrOK		
2 Fabric U-valu Element	es Average	Highest		
External wall Floor	Average 0.19 (max. 0.30) (no floor)	0.19 (max. 0.70)	OK	
Floor Roof Openings	0.09 (max. 0.20) 1.08 (max. 2.00)	0.09 (max. 0.35) 1.20 (max. 3.30)	OK OK	
2a Thermal brid	ging			
		r thermal transmittances fo	or each junction	
	ity y at 50 pascals:	3.00 (design value)		
		10.0		0K
4 Heating effic Main heating sy NIBE F205P		Heat pump with radiators	or underfloor - Electri	.c
Secondary heati				
		None		
	lation	No cylinder		
5 Cylinder insu	lation ge	No cylinder	nostat	ок
5 Cylinder insu Hot water stora 6 Controls	lation ge ontrols:	No cylinder	nostat	ok
5 Cylinder insu Hot water stora 	lation ge ontrols:	No cylinder Programmer and room therr		0K
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f	lation ge ontrols: ols:	No cylinder Programmer and room therr No cylinder ergy fittings:100%		
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum	lation ge ontrols: ols: 	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75%		ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Continuous extr	ontrols: ols: 	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75%		ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 	ontrols: ols: gets ixed lights with low-end ntilation act system wer:	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7		ок ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Continuous extr Specific fan po Maximum 9 Summertime tee Overheating ris	lation ge ontrols: ols: 	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65		ок ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 	ontrols: ols: gets ixed lights with low-end ntilation act system wer: mperature k (Thames Valley):	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7 Slight Average		0K
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Continuous extr Specific fan po Maximum 9 Summertime te Overheating ris Based on: Overshading: Windows facing	lation ge ontrols: ols: ghts ixed lights with low-end ntilation act system wer: mperature k (Thames Valley): North: South:	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7 Slight Average 11.18 m², No overhang 7.14 m², No overhang		0K
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Continuous extr Specific fan po Maximum 9 Summertime te Overheating ris Based on: Overshading: Windows facing	lation ge ontrols: ols: 	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7 Slight Average 11.18 m², No overhang 7.14 m², No overhang 3.00 ach Light-coloured curtain ou		ок ок ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Continuous extr Specific fan po Maximum 9 Summertime te Overheating ris Based on: Overshading: Windows facing Windows facing Mir change rate Blinds/curtains	lation ge ontrols: ols: ghts ixed lights with low-end net system wer: mperature k (Thames Valley): North: South: :	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7 Slight Average 11.18 m², No overhang 7.40 verhang 3.00 och Light-coloured curtain or		ок ок ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 	lation ge ontrols: ols: ghts ixed lights with low-end net system wer: mperature k (Thames Valley): North: South: :	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7 Slight Average 11.18 m², No overhang 7.14 m², No overhang 3.00 ach Light-coloured curtain ou		ок ок ок
5 Cylinder insu Hot water stora 6 Controls Space heating c Hot water contr 	<pre>dation ge ontrols: ols:</pre>	No cylinder Programmer and room therr No cylinder ergy fittings:100% 75% 0.65 0.7 Slight Average 11.18 m², No overhang 7.14 m², No overhang 3.00 ach Light-coloured curtain or 0.09 W/m²K		ок ок ок





### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions						
		Area	Chow	ey height		Volume
		(m2)	5101	(m)		(m3)
Ground floor		40.6000 (1b)	х	2.7000 (2b)	=	109.6200 (1b) - (3b)
First floor Total floor area TFA = $(1a) + (1b) + (1c) + (1d) + (1e) \dots (1n)$	81.2000	40.6000 (1c)	х	2.5000 (2c)	=	101.5000 (1c) - (3c) (4)
Dwelling volume	01.2000	(3a) + (3)	o)+(3c)	+(3d)+(3e)(3n	) =	211.1200 (5)

### \_\_\_\_\_

2. Ventilation rate												
				main heating	s	econdary heating		other	tota	l m	3 per hour	
Number of chimneys				0	+	0	+	0 =		0 * 40 =	0.0000	
Number of open flues				0	+	0	+	0 =		0 * 20 =	0.0000	
Number of intermittent fa	ns									0 * 10 =	0.0000	
Number of passive vents										0 * 10 =	0.0000	
Number of flueless gas fi	res									0 * 40 =	0.0000	(7c)
											s per hour	
Infiltration due to chimn	eys, flues	and fans =	= (6a)+(6b)	+(7a)+(7b)+(	(7c) =				0.0000	/ (5) =	0.0000	(8)
Pressure test											Yes	
Measured/design AP50											3.0000	(1.0)
Infiltration rate											0.1500	
Number of sides sheltered											2	(19)
Shelter factor								(20) = 1 -	[0.075 x	(19)] =	0.8500	(20)
Infiltration rate adjuste	d to includ	e shelter fa	actor					(2)	1) = (18) x	(20) =	0.1275	(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	
Wind factor 1.2750 Adj infilt rate	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Mechanical extract venti		ntralised										
If mechanical ventilation											0.5000	
If exhaust air heat pump	using Appen	dix N, (23b)	) = (23a) x	Fmv (equati	lon (N5)),	otherwise (	(23b) = (23)	a)			0.5000	(23b)
Effective ac 0.5000	0.5000	0.5000	0.5000	0.5000								

## 3. Heat losses and heat loss parameter

Element				Gross	Openings	Net	Area	U-value	AxU		value	A x K	
Window (Uw = 1.	20)			m2	m2	18	m2 3200	W/m2K 1.1450	W/K 20.9771		J/m2K	kJ/K	(27)
Door	.20)						2000	0.5500	2.3100				(26)
External Wall				99.8400	18.3200		5200	0.1900	15.4888		.0000	4891.2000	
Sheltered Wall				25.8800	4.2000		6800	0.1800	3.9024		.0000	1300.8000	
External Roof 1	1			40.6000	1.2000		6000	0.0900	3.6540		.0000	365.4000	
Total net area		1 elements		10.0000			3200	0.0000	0.0010	-		000.1000	(31)
Fabric heat los			······································			2001		30) + (32) =	46.3323				(33)
Party Floor 1		(				40.	6000				.0000	1624.0000	
Internal Wall 1	1						5000				.0000	202.5000	
Internal Floor							6000				3.0000	730.8000	
Internal Ceilir							6000				3.0000	730.8000	
	2												()
Heat capacity C	Cm = Sum(A	x k)						(28)	(30) + (32)	+ (32a)	.(32e) =	9845.5000	(34)
				o									0.5
Thermal mass pa	arameter (1	'MP = Cm / 'I	'FA) in kJ/π	IZK .								121.2500	(35)
Thermal mass pa Thermal bridges												121.2500 6.1570	
	s (Sum(L x									(33)	+ (36) =		(36)
Thermal bridges Total fabric he	s (Sum(L x eat loss	Psi) calcul	ated using	Appendix K)						(33)	+ (36) =	6.1570	(36)
Thermal bridges	s (Sum(L x eat loss at loss cal	Psi) calcul	ated using thly (38)m	Appendix K) = 0.33 x (2	?5)m x (5)	Tup	T+1 ]	au c	Son			6.1570 52.4893	(36)
Thermal bridges Total fabric he Ventilation hea	s (Sum(L x eat loss at loss cal Jan	Psi) calcul culated mon Feb	ated using thly (38)m Mar	Appendix K) = 0.33 x (2 Apr	25)m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	6.1570 52.4893 Dec	(36) (37)
Thermal bridges Total fabric he Ventilation hea (38)m	s (Sum(L x eat loss at loss cal Jan 34.8348	Psi) calcul	ated using thly (38)m	Appendix K) = 0.33 x (2	?5)m x (5)	Jun 34.8348	Jul 34.8348	Aug 34.8348	Sep 34.8348			6.1570 52.4893	(36) (37)
Thermal bridges Total fabric he Ventilation hea	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff	Psi) calcul culated mon Feb 34.8348	ated using thly (38)m Mar 34.8348	Appendix K) = 0.33 x (2 Apr 34.8348	25)m x (5) May 34.8348	34.8348	34.8348	34.8348	34.8348	Oct 34.8348	Nov 34.8348	6.1570 52.4893 Dec 34.8348	(36) (37) (38)
Thermal bridges Total fabric he Ventilation hea (38)m Heat transfer c	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff 87.3241	Psi) calcul culated mon Feb 34.8348 87.3241	ated using thly (38)m Mar	Appendix K) = 0.33 x (2 Apr	25)m x (5) May					Oct	Nov	6.1570 52.4893 Dec 34.8348 87.3241	(36) (37) (38) (39)
Thermal bridges Total fabric he Ventilation hea (38)m	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff 87.3241	Psi) calcul culated mon Feb 34.8348 87.3241	ated using thly (38)m Mar 34.8348	Appendix K) = 0.33 x (2 Apr 34.8348	25)m x (5) May 34.8348	34.8348	34.8348	34.8348	34.8348	Oct 34.8348	Nov 34.8348	6.1570 52.4893 Dec 34.8348	(36) (37) (38) (39)
Thermal bridges Total fabric he Ventilation hea (38)m Heat transfer c	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff 87.3241	Psi) calcul culated mon Feb 34.8348 87.3241	ated using thly (38)m Mar 34.8348	Appendix K) = 0.33 x (2 Apr 34.8348	25)m x (5) May 34.8348	34.8348	34.8348	34.8348	34.8348	Oct 34.8348	Nov 34.8348	6.1570 52.4893 Dec 34.8348 87.3241	(36) (37) (38) (39)
Thermal bridges Total fabric he Ventilation hea (38)m Heat transfer c	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff 87.3241 39)m / 12 =	Psi) calcul culated mon Feb 34.8348 87.3241	ated using thly (38)m Mar 34.8348 87.3241	Appendix K) = 0.33 x (2 Apr 34.8348 87.3241	25)m x (5) May 34.8348 87.3241	34.8348 87.3241	34.8348 87.3241	34.8348 87.3241	34.8348 87.3241	Oct 34.8348 87.3241	Nov 34.8348 87.3241	6.1570 52.4893 Dec 34.8348 87.3241 87.3241	(36) (37) (38) (39) (39)
Thermal bridges Total fabric he Ventilation hea (38)m Heat transfer c Average = Sum(3	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff 87.3241 39)m / 12 = Jan	Psi) calcul culated mon Feb 34.8348 87.3241 Feb	ated using thly (38)m Mar 34.8348 87.3241 Mar	Appendix K) = 0.33 x (2 Apr 34.8348 87.3241 Apr	25)m x (5) May 34.8348 87.3241 May	34.8348 87.3241 Jun	34.8348 87.3241 Jul	34.8348 87.3241 Aug	34.8348 87.3241 Sep	Oct 34.8348 87.3241 Oct	Nov 34.8348 87.3241 Nov	6.1570 52.4893 Dec 34.8348 87.3241 87.3241 Dec	(36) (37) (38) (39) (39) (40)
Thermal bridges Total fabric he Ventilation hea (38)m Heat transfer c Average = Sum(3 HLP	s (Sum(L x eat loss at loss cal Jan 34.8348 coeff 87.3241 39)m / 12 = Jan	Psi) calcul culated mon Feb 34.8348 87.3241 Feb	ated using thly (38)m Mar 34.8348 87.3241 Mar	Appendix K) = 0.33 x (2 Apr 34.8348 87.3241 Apr	25)m x (5) May 34.8348 87.3241 May	34.8348 87.3241 Jun	34.8348 87.3241 Jul	34.8348 87.3241 Aug	34.8348 87.3241 Sep	Oct 34.8348 87.3241 Oct	Nov 34.8348 87.3241 Nov	6.1570 52.4893 Dec 34.8348 87.3241 87.3241 Dec 1.0754	(36) (37) (38) (39) (39) (40)

#### 

Jan Feb Mar Apr May Jun Jul Aug Sep Daily hot water use



Dec

Oct

Nov



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468	(44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755	(45)
Energy conten	t (annual)									Total = St	um (45) m =	1466.7819	(45)
Distribution	loss (46)m	$= 0.15 \times (4)$	15)m										
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913	(46)
Water storage	loss:												
Store volume												150.0000	
		ared loss fa	actor is kno	own (kWh/da	ay):							1.6800	
Temperature												0.5400	
Enter (49) or		5)										0.9072	(55)
Total storage													
	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	(56)
If cylinder c													
	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat re	quired for	water heatir	ng calculate	ed for each	month								
	180.1971	158.4064	165.3723	146.8731	142.9370	126.2916	119.9313	133.4743	133.8253	152.3661	162.8368	175.3987	(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 inp	ut (sum of m	months) = Si	1m (63) m =	0.0000	(63)
Output from w	/h												
	180.1971	158.4064	165.3723	146.8731	142.9370	126.2916	119.9313	133.4743	133.8253	152.3661	162.8368	175.3987	(64)
								Total p	er year (kWl	h/year) = Si	1m (64)m =	1797.9099	(64)
Heat gains fr	om water he	ating, kWh/r	nonth										
	50.5646	44.2241	45.6353	39.7860	38.1756	32.9426	30.5262	35.0292	35.4476	41.3108	45.0939	48.9691	(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	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	(66)
Lighting gain	s (calculate	ed in Append	dix L, equat	tion L9 or	L9a), also :	see Table 5							
	19.7819	17.5701	14.2890	10.8177	8.0863	6.8268	7.3766	9.5884	12.8696	16.3409	19.0722	20.3317	(67)
Appliances ga	ins (calcula	ated in Appe	endix L, equ	ation L13	or L13a), a	lso see Tabi	Le 5						
	221.9302	224.2332	218.4298	206.0752	190.4797	175.8222	166.0300	163.7271	169.5304	181.8850	197.4805	212.1381	(68)
Cooking gains	(calculated	l in Appendi	x L, equat:	ion L15 or :	L15a), also	see Table 5	5						
	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	(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. e	vaporation (	(negative va	alues) (Tabi	le 5)									
	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	(71)
Water heating	gains (Tabl	.e 5)											
	67.9631	65.8097	61.3378	55.2583	51.3113	45.7536	41.0298	47.0823	49.2328	55.5252	62.6305	65.8187	(72)
Total interna	l gains												
	369.9538	367.8915	354.3351	332.4297	310.1559	288.6812	274.7150	280.6763	291.9113	314.0297	339.4617	358.5670	(73)

6. Solar gair	15												
[Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab		Acce: facto Table	or	Gains W	
North South			11.18 7.14		10.6334 46.7521		0.7200 0.7200		.7000 .7000	0.77		41.5219 116.5904	
Solar gains Total gains	158.1123 528.0661	270.2955 638.1870	378.0660 732.4011	491.4839 823.9136	578.2202 888.3761	588.0161 876.6973	560.9620 835.6770	492.9349 773.6113	416.1990 708.1103	300.4085 614.4382	189.4220 528.8837	135.3596 493.9265	

7. Mean inter			ng season)									
Temperature d Utilisation f	uring heating	ng periods	in the livin	ng area from	n Table 9, 1							21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185	31.3185
alpha	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879	3.0879
util living a	rea											
2	0.9719	0.9504	0.9130	0.8399	0.7205	0.5691	0.4362	0.4838	0.6914	0.8786	0.9551	0.9767 (86)
Tweekday	18.4125	18.7414	19.1950	19.7123	20.1284	20.3586	20.4338	20.4212	20.2573	19.7109	18.9488	18.3231
Tweekend	19.7801	19.9682	20.2287	20.5294	20.7779	20.9226	20.9746	20.9646	20.8542	20.5246	20.0853	19.7291
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623 (88)
util rest of !												
	0.9694	0.9461	0.9055	0.8260	0.6964	0.5320	0.3886	0.4352	0.6576	0.8650	0.9506	0.9747 (89)
Tweekday	18.4125	18.7414	19.1950	19.7123	20.1284	20.3586	20.4338	20.4212	20.2573	19.7109	18.9488	18.3231
Tweekend	19.3013	19.4876	19.7445	20.0375	20.2732	20.4036	20.4461	20.4390	20.3462	20.0367	19.6051	19.2507
MIT 2	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623	20.4623 (90)
Living area f										Living area		0.4089 (91)
MIT Temperature a	20.6821 diustment	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821 (92) 0.0000
adjusted MIT	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821	20.6821 (93)
8. Space heat	ing require	nent										
Utilisation Useful gains	Jan 0.9704 512.4497	Feb 0.9479 604.9598	Mar 0.9086 665.4795	Apr 0.8319 685.3985	May 0.7065 627.6413	Jun 0.5475 479.9837	Jul 0.4084 341.2819	Aug 0.4555 352.3630	Sep 0.6718 475.7362	Oct 0.8708 535.0606	Nov 0.9525 503.7549	Dec 0.9755 (94) 481.8388 (95)





#### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014 11.7000 14.1000 Ext temp. Heat loss rate W 4.3000 4.9000 6.5000 8.9000 14.6000 16.6000 16.4000 10.6000 7.1000 4.2000 (96) Month fracti 1 ori Space 1378.1613 1238.4428 784.3574 531.1176 574.7796 1439.2882 (97) 1.0000 (97a) 1028.8649 356.4694 373.9342 880.4140 1186.0483 Space heating kWh 0.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 1.0000 1.0000 519.5914 426.2847 247.2958 116.5968 0.0000 0.0000 0.0000 0.0000 256.9429 491.2512 712.3424 (98) Space heating per m2 3453.3761 (98) 42.5293 (99) (98) / (4) = 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) Fraction of space heat from main system(s) Efficiency of main space heating system 1 (in %) Efficiency of secondary/supplementary heating system, % Space heating requirement 0.0000 (201) 1.0000 (202) 305.6515 (206) 100.0000 (208) 1129.8411 (211) Jan Space heating requirement 683.0709 519.5914 426.2847 Space heating efficiency (main heating system 1) 305.6515 305.6515 305.6515 Conting system) Apr May Jun Jul Aug Sep Oct Nov Dec 247.2958 116.5968 0.0000 0.0000 0.0000 0.0000 256.9429 491.2512 712.3424 (98) 305.6515 0.0000 0.0000 305.6515 305.6513 305 Space heating fuel (main heating system) 223.4803 169.9947 139 Water heating requirement 0.0000 0.0000 0 305.6515 0.0000 0.0000 305.6515 305.6515 305.6515 (210) 139 4676 80 9078 38 1470 0 0000 0 0000 0 0000 0 0000 84 0640 160.7227 233.0571 (211) 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 180.1971 158.4064 165.3723 146.8731 Efficiency of water heater (217)m 186.5800 186.5800 186.5800 186.5800 142.9370 126.2916 119.9313 133.4743 133.8253 152.3661 162.8368 175.3987 (64) 186.5800 (216) 186.5800 (217) 186.5800 186.5800 186.5800 186.5800 186.5800 186.5800 186.5800 Fuel for water heating, kWh/month 96.5790 84.9000 Water heating fuel used 88.6334 94.0072 (219) 963.6134 (219) 78.7185 76.6090 67.6876 64.2787 71.5373 71.7254 81.6626 87.2745 Annual totals kWh/year Space heating fuel - main system Space heating fuel - secondary 1129.8411 (211) 0.0000 (215) Electricity for pumps and fans: [MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.8450) mechanical ventilation fans (SFP = 0.8450) Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) Total delivered energy for all uses 98.3906 (230a) 98.3906 (231) 349.3548 (232) 2541.2000 (238) 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Emissions kg CO2/year 586.3876 (261) Emission factor kg CO2/kWh Energy kWh/year 1129.8411 Space heating - main system 1 0.5190 586.3876 (261) 0.0000 (263) 500.1154 (264) 1086.5029 (265) 51.0647 (267) 181.3152 (268) Water heating (other fuel) Space and water heating Pumps and fans 0.0000 0.5190 963.6134 0.5190 98.3906 0.5190 Emergy for lighting Total CO2, kg/year Dwelling Carbon Dioxide Emission Rate (DER) 349.3548 0.5190 1318.8828 (272) 16.2400 (273) 16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES 16.2400 ZC1 81.2000 2.4852 DER Total Floor Area TFA Total Floor Area Assumed number of occupants CO2 emission factor in Table 12 for electricity displaced from grid CO2 emissions from appliances, equation (L14) CO2 emissions from cooking, equation (L16) Total CO2 emissions Residual CO2 emissions offset from biofuel CHP Additional collowable alcontacity concerning (MMP/m2/upon Ν EF 0.5190 16.1960 ZC2 2.2001 ZC3 34.6360 ZC4 0.0000 ZC5 Additional allowable electricity generation, $kWh/m^2/year$ Resulting CO2 emissions offset from additional allowable electricity generation Net CO2 emissions 0.0000 206 0.0000 ZC7 34.6360 ZC8





#### **CALCULATION OF TARGET EMISSIONS** 09 Jan 2014

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

1. Overall dwelling dimensions						
		Area	Stor	ey height		Volume
		(m2)		(m)		(m3)
Ground floor		40.6000 (1b)	х	2.7000 (2b)	=	109.6200 (1b) - (3b)
First floor		40.6000 (1c)	х	2.5000 (2c)	=	101.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)(1n)	81.2000					(4)
Dwelling volume		(3a)+(31	o)+(3c)	+(3d)+(3e)(3n	) =	211.1200 (5)

2. Ventilation	rate												
					main heating	s	econdary heating		other	tota	l m3	per hour	
Number of chimne	eys				ō	+	ō	+	0 =		0 * 40 =	0.0000	(6a)
Number of open :					0	+	0	+	0 =		0 * 20 =	0.0000	
Number of intern		ns									3 * 10 =	30.0000	
Number of passiv											0 * 10 =	0.0000	
Number of fluele	ess gas fi	res									0 * 40 =	0.0000	(7c)
										1	Air changes	per hour	
Infiltration due	e to chimn	eys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =				30.0000	/ (5) =	0.1421	(8)
Pressure test												Yes	
Measured/design												5.0000	(1.0)
Infiltration rat												0.3921	
Number of sides	sheltered											2	(19)
Shelter factor									(20) = 1 -	[0.075 x	(19)] =	0.8500	(20)
Infiltration rat	te adjuste	d to includ	e shelter f	actor					(2	1) = (18) x	(20) =	0.3333	(21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(0.0)
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	
Wind factor Adj infilt rate	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)
Auj inilit fate	0.4249	0.4166	0.4083	0.3666	0.3583	0.3166	0.3166	0.3083	0.3333	0.3583	0.3749	0.3916	(22b)
Effective ac	0.5903	0.5868	0.5833	0.5672	0.5642	0.5501	0.5501	0.5475	0.5555	0.5642	0.5703	0.5767	
DITCOULVE NO	0.0000	0.0000	0.0000	5.5072	0.0042	0.0001	0.0001	0.04/0	0.0000	0.0042	0.0700	0.0/0/	(20)

Element				Gross	Openings	Net	Area	U-value	АхU		value	АхК	
				m2	m2		m2	W/m2K	W/K		J/m2K	kJ/K	
TER Opaque doo							2000	1.0000	4.2000				(26)
TER Opening Ty	pe (Uw = 1.	40)					1000	1.3258	21.3447				(27)
External Wall				99.8400	16.1000		7400	0.1800	15.0732				(29a
Sheltered Wall				25.8800	4.2000		6800	0.1800	3.9024				(29a
External Roof				40.6000			6000	0.1300	5.2780				(30)
Total net area			Aum(A, m2)			166.	3200						(31)
Fabric heat lo	ss, W/K = S	um (A x U)					(26)(	30) + (32) =	49.7983				(33)
Thermal mass p	arameter (T	MP = Cm / 1	rFA) in kJ/m	12K								250.0000	(35)
Thermal bridge												4.3940	(36)
Fotal fabric h			2							(33)	+ (36) =	54.1923	(37)
Ventilation he	at loss cal	culated mor	nthly (38)m	= 0.33 x (2	25)m x (5)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.1250	40.8807	40.6413	39.5168	39.3064	38.3269	38.3269	38.1456	38.7042	39.3064	39.7320	40.1770	(38)
Heat transfer	coeff												
	95.3173	95.0730	94.8336	93.7091	93.4987	92.5192	92.5192	92.3378	92.8965	93.4987	93.9243	94.3693	(39)
Average = Sum(	39)m / 12 =											93.7081	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1739	1.1709	1.1679	1.1541	1.1515	1.1394	1.1394	1.1372	1.1440	1.1515	1.1567	1.1622	(40)
HLP (average) Days in month												1.1540	

4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 2.4852 (42) 93.2243 (43) Feb Mar Jan Apr May Jun Jul Aug Sep Oct Nov Dec 
 Jan
 Feb
 Mar
 Apr
 ...,

 Daily hot water use
 102.5468
 98.8178
 95.0888
 91.3599
 87.6309

 Energy contex
 152.0739
 133.0048
 137.2491
 119.6571
 114.8138

 Energy content (annual)
 Distribution loss
 (46) m = 0.15 x (45) m
 22.8111
 19.9507
 20.5874
 17.9486
 17.2221

 Water storage loss:
 103.000
 110.507
 10.5874
 17.9486
 17.2221
 95.0888 98.8178 124.2429 135.6208 Total = Sum(45)m = 102.5468 (44) 147.2755 (45) 1466.7819 (45) 83.9019 83.9019 87.6309 91.3599 91.8081 105.3511 106.6093 99.0756 17.2221 13.7712 18.6364 20.3431 22.0913 (46) 14.8613 15.8027 15.9914 Water storage loss: 150.0000 (47) 1.3938 (48) 0.5400 (49) a) If manufacturer declared loss factor is known (kWh/day): Temperature factor from Table 2b

30

31

31

30

31

30

31

28

31

30

31



31 (41)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or	(54) in (55	5)										0.7527	(55)
Total storage	loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder o	ontains ded:	icated solar	storage										
-	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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 re	quired for w	water heatin	ng calculat	ed for each	month								
	198.6688	175.0905	183.8440	164.7489	161.4087	144.1674	138.4030	151.9460	151.7012	170.8378	180.7127	193.8704	(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 inpu	ut (sum of m	months) = Si	um (63) m =	0.0000	(63)
Output from w	r/h												
-	198.6688	175.0905	183.8440	164.7489	161.4087	144.1674	138.4030	151.9460	151.7012	170.8378	180.7127	193.8704	(64)
								Total pe	er year (kWl	h/year) = Si	um (64) m =	2015.3993	(64)
Heat gains fr	om water hea	ating, kWh/r	nonth					-	-	-			
-	87.8405	77.8927	82.9112	75.8594	75.4515	69.0161	67.8021	72.3052	71.5211	78.5867	81.1674	86.2450	(65)

5. Internal ga	ins (see Ta	ble 5 and	5a)										
Metabolic gair	s (Table 5)	, Watts											
-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618	124.2618 (66)	
Lighting gains	(calculate	d in Appen	dix L, equa	tion L9 or	L9a), also	see Table 5							
	19.9431	17.7133	14.4054	10.9058	8.1522	6.8825	7.4367	9.6665	12.9744	16.4740	19.2276	20.4974 (67)	
Appliances gai	ns (calcula	ted in App	endix L, eq	uation L13	or L13a), a	lso see Tab	le 5						
	221.9302	224.2332	218.4298	206.0752	190.4797	175.8222	166.0300	163.7271	169.5304	181.8850	197.4805	212.1381 (68)	
Cooking gains													
	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262	35.4262 (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. ev													
	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)	
Water heating	-												
	118.0652	115.9117	111.4398	105.3603	101.4133	95.8557	91.1319	97.1844	99.3348	105.6273	112.7325	115.9207 (72)	
Total internal													
	423.2170	421.1367	407.5536	385.6199	363.3238	341.8388	327.8771	333.8565	345.1182	367.2648	392.7192	411.8347 (73)	

[Jan]		A	ea	Solar flux	 g		FF	Acce	Gains	
			m2	Table 6a W/m2	fic data Table 6b	Specific or Tab		fact Table	W	
North South		9.83 6.27		10.6334 46.7521	0.6300 0.6300		.7000 .7000	0.77 0.77	31.9446 89.5860	

7. Mean inter	nal temperat	ure (heatin	g season)										
Temperature d	uring heatin	ng periods i	n the livin	ig area from	Table 9, 1	'h1 (C)						21.0000	(85)
Utilisation f	actor for ga	ains for liv	ing area, n	il,m (see I	able 9a)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1591	59.3111	59.4609	60.1744	60.3098	60.9483	60.9483	61.0680	60.7008	60.3098	60.0365	59.7534	
alpha	4.9439	4.9541	4.9641	5.0116	5.0207	5.0632	5.0632	5.0712	5.0467	5.0207	5.0024	4.9836	
util living a	rea												
	0.9967	0.9928	0.9827	0.9504	0.8630	0.6941	0.5254	0.5776	0.8189	0.9645	0.9930	0.9975	(86)
MIT	19.7922	19.9557	20.2057	20.5281	20.8007	20.9525	20.9905	20.9849	20.8884	20.5428	20.1093	19.7642	(87)
Th 2	19.9410	19.9434	19.9458	19.9569	19.9590	19.9688	19.9688	19.9706	19.9650	19.9590	19.9548	19.9504	(88)
util rest of	house												
	0.9956	0.9904	0.9766	0.9322	0.8145	0.6025	0.4079	0.4575	0.7419	0.9479	0.9902	0.9966	(89)
MIT 2	18.3412	18.5809	18.9440	19.4078	19.7657	19.9376	19.9653	19.9645	19.8779	19.4373	18.8138	18.3071	(90)
Living area f	raction								fLA =	Living area	(4) =	0.4089	(91)
MIT	18.9344	19.1430	19.4599	19.8659	20.1889	20.3525	20.3845	20.3817	20.2910	19.8893	19.3435	18.9029	(92)
Temperature a	djustment											0.0000	
adjusted MIT	18.9344	19.1430	19.4599	19.8659	20.1889	20.3525	20.3845	20.3817	20.2910	19.8893	19.3435	18.9029	(93)

8. Space heat:	ing require	ement											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9879	0.9730	0.9303	0.8264	0.6383	0.4562	0.5069	0.7687	0.9465	0.9879	0.9955	(94)
	541.5567	621.2849	679.3290	710.2878	667.6673	506.8189	346.3534	361.3522	511.2254	566.1595	531.8245		
Useful gains												513.5292	
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												
	1394.9137	1354.1245	1229.0325	1027.6016	793.6991	532.2214	350.1365	367.6646	575.1255	868.5369	1149.9642	1387.4990	(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												
	634.8976	492.4682	408.9794	228.4659	93.7677	0.0000	0.0000	0.0000	0.0000	224.9687	445.0606	650.2335	(98)
Space heating												3178.8417	(98)
Space heating	per m2									(98	) / (4) =	39.1483	(99)

8c. Space cooling requirement

Not applicable





#### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual											
Fraction of space heat from secondar Fraction of space heat from main sys Efficiency of main space heating sys Efficiency of secondary/supplementar Space heating requirement	y/supplements tem(s) tem 1 (in st	ntary syste %)								0.0000 1.0000 93.5000 0.0000 3399.8307	(202) (206) (208)
Jan Feb Space heating requirement	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
634.8976 492.4682	408.9794	228.4659	93.7677	0.0000	0.0000	0.0000	0.0000	224.9687	445.0606	650.2335	(98)
Space heating efficiency (main heati 93.5000 93.5000	93.5000	1) 93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
	437.4112	244.3486	100.2863	0.0000	0.0000	0.0000	0.0000	240.6083	476.0007	695.4369	(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 198.6688 175.0905	183.8440	164.7489	161.4087	144.1674	138.4030	151.9460	151.7012	170.8378	180.7127	193.8704	
Efficiency of water heater (217)m 87.6974 87.4254	86.8871	85.6862	83.4244	79.8000	79.8000	79.8000	79.8000	85.5490	87.1263	79.8000 87.7962	
Fuel for water heating, kWh/month 226.5389 200.2743 Water heating fuel used	211.5896	192.2700	193.4789	180.6609	173.4373	190.4085	190.1017	199.6960	207.4145	220.8186 2386.6892	
Annual totals kWh/year Space heating fuel - main system Space heating fuel - secondary										3399.8307 0.0000	
Electricity for pumps and fans: central heating pump main heating flue fan Total electricity for the above, kWr Electricity for lighting (calculated Total delivered energy for all uses		ix L)								30.0000 45.0000 75.0000 352.2012 6213.7211	(230e) (231) (232)
10. Outer divide mission todi											
12a. Carbon dioxide emissions - Indi	vidual hea	ting system	s including	micro-CHP		Energy	Emiss	ion factor		Emissions	
Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans						kWh/year 3399.8307 0.0000 2386.6892 75.0000		kg CO2/kWh 0.2160 0.0000 0.2160 0.5190	k	g CO2/year 734.3634 0.0000 515.5249 1249.8883 38.9250	(261) (263) (264) (265) (267)
Energy for lighting Total CO2, kg/m2/year Emissions per m2 for space and water Fuel factor (electricity) Emissions per m2 for lighting Emissions per m2 for pumps and fans Target Carbon Dioxide Emission Rate	-	5.3927 * 1.	55) + 2.251	1 + 0.4794,	rounded to	352.2012 2 d.p.		0.5190		182.7924 1471.6057 15.3927 1.5500 2.2511 0.4794 26.5900	(272) (272a) (272b) (272c)





Appendix B – Water Calculations

#### Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

29 High Holbron - Studio

1

### **Project Details**

Adress/Reference Number of Bedrooms

# Appliance/Useage Details Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate	Quantity	Total per
	Litres/Min	(No.)	Fitting type
Mixer Taps	3.00	-	1 3.00
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No	.)		1
Total Flow (I/s)			3.00
Maximum Flow (I/s)			3.00
Average Flow (I/s)			3.00
Weighted Average Flow	(I/s)		2.10
Flow for Calculation (I/s	)		3.00

### Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
	Overnow	(110.)	0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No	.)	0	
Total Capacity (I)			0.00
Maximum Capacity (I)			0.00
Average Capacity (I)			0.00
Weighted Average Capa	acity (I)		0.00
Capacity for Calculation	ъ (I)		0.00

#### Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
			0.00
			0.00
Total No. of Fittings (No	.)	0	
Total Consumption (I)			1.25
<b>Maximum Consumption</b>	(I)		1.25
Average Consumption (	l/s)		1.25
Weighted Average Cons	sumption (I)		0.88
<b>Consumption for Calcul</b>	ation (I/s)		1.25

### **Kitchen Taps**

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Kitchen Tap	8.00	1	8.00
			0.00
			0.00
Total No. of Fittings (No	).)	1	
Total Flow (I/s)			8.00
Maximum Flow (I/s)			8.00
Average Flow (I/s)			8.00
Weighted Average Flow	(I/s)		5.60
Flow for Calculation (I/s	a)		8.00

#### E1052 Case Reference E1052 Occupancy for Calculation Purpose Showers Shower fitting Flow Rate Quantity Total per Litres/Min Fitting type 8.00 Туре (No.) Thermostatic Shower 8.00 0.00 0.00 0.00 0.00 0.00 Total No. of Fittings (No.) Total Flow (I/s) Maximum Flow (I/s) Average Flow (I/s) Weighted Average Flow (I/s) Flow for Calculation (I/s) 8 00 8.00 8.00 5.60 8.00 WCs Part Flush Quantity Full Flush WC Type Dual WC Volume Volume (No) 3.00 4.50 Total number of fittings Average effective flushing volume N/a Washing Machines Washing Machine L per Kg Quantity Total per Dry Load (No.) Fitting type 0.00 Туре 0.00 Total No. of Fittings (No.) Total Consumption (I) 8.17 Maximum Consumption (I) Average Consumption (I/s) Weighted Average Consumption (I) Consumption for Calculation (I/s) 8.17 8.17 5.72 8.17 **Other Fittings** Waste Disposal Y/N Ν Water softner Consumption beyond 4% l/p/d Use of grey water and harvested rainwater Total Grey water from WHB taps (I) Total Availble Grey Water Supply (I) Possible Demand (I) 0 89.60 65.21 Grey/Rain Installed Capacity (I) Figure for Calculation lit/person/day 0.00 0.00

Water Use Assessment

Installation Type	Unit	Capacity/	Use Factor	Fixed use	Total Use	
		Flow Rate		(l/p/day)	(l/p/day)	
WC Single Flush	Volume (I)	0.00	4.42	0.00	0.0	D
WC Dual Flush	Full Flush (I)	4.50	1.46	0.00	6.5	7
	Pt Flush (I)	3.00	2.96			<u> </u>
WC's (Multiple)	Volume (I)	0.00	4.42	0.00		
Taps Exc. Kitchen	Flow Rate	3.00	1.58			
Bath (shower present)	(l/s)	0.00	0.11	0.00	0.0	D
Shower (bath present)	(l/s)	0.00	4.37	0.00	0.0	D
Bath Only	(I)	0.00	0.50	0.00	0.0	D
Shower Only	(l/s)	8.00	5.60	0.00	44.8	D
Kitchen Taps	(l/s)	8.00	0.44		13.8	8
Washing Machines	(l/kgdry)	8.17	2.10	0.00	17.1	6 << Note - these may be default values.
Dishwashers	(l/place)	1.25	3.60	0.00	4.5	O << You can change them by entering
Waste Disposal	(l/s)	0.00	3.08	0.00	0.0	0 the actual applicances in the
Water Softner	(l/s)	0.00	1.00	0.00	0.0	Oappropriate sections above
<b>Total Calculated Water</b>	Use (l/p/day)				102.1	1
Grey/RainWater Reused	I (I)				0.0	D
Normalisation Factor	(Factor)				0.9	1
<b>Total Consumption CS</b>	H (l/p/day)				92.9	2
External Water Use Allo	wance (I)				5.0	D
Total Comsumption Pa	rt G (l/p/day)				97.9	2
Assesment Result					PASS	

#### Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

29 High Holborn - 2 Bed

#### **Project Details**

Adress/Reference Number of Bedrooms

### Appliance/Useage Details

### Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate	Quantity	Total per
	Litres/Min	(No.)	Fitting type
Mixer Taps	3.00		9.00
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No	o.)	3	3
Total Flow (I/s)			9.00
Maximum Flow (I/s)			3.00
Average Flow (I/s)			3.00
Weighted Average Flow (I/s)			2.10
Flow for Calculation (I/s	;)		3.00
Bathe			

#### Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No	<b>)</b> .)	0	
Total Capacity (I)			0.00
Maximum Capacity (I)			0.00
Average Capacity (I)		0.00	
Weighted Average Capacity (I)		0.00	
Capacity for Calculation (I)			0.00

#### Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
			0.00
			0.00
Total No. of Fittings (No.)		0	
Total Consumption (I)			1.25
Maximum Consumption (I)			1.25
Average Consumption (I/s)			1.25
Weighted Average Consumption (I)			0.88
Consumption for Calculation (I/s)			1.25

### Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Kitchen Tap	8.00	1	8.00
			0.00
			0.00
Total No. of Fittings (No.) 1			
Total Flow (I/s)		8.00	
Maximum Flow (I/s)		8.00	
Average Flow (I/s)		8.00	
Weighted Average Flow (I/s)		5.60	
Flow for Calculation (I/s	a)		8.00

Capacity/ Flow Rate

0.00

0.00

0.00

3.50

3.00

0.00

0.00

8.00

8.00

8.17

0.00

0.00

4.42

1.46

2.96

4.42 1.58

0.11

4.37

0.50

5.60

0.44

2.10 3.60

3.08

1.00

0.00

10.36

0.00

0.00

0.00

0.00

Unit

Volume (I)

Full Flush (I)

Pt Flush (I)

Volume (I)

Flow Rate

(l/s)

(l/s)

(l/s)

(l/s)

(l/s)

(l/s)

(Factor)

Total Calculated Water Use (I/p/day)

Total Consumption CSH (I/p/day)

Total Comsumption Part G (I/p/day)

External Water Use Allowance (I)

Grey/RainWater Reused (I)

(l/kgdry)

(l/place)

(I)

#### E1052 Case Reference Occupancy for Calculation Purpose Showers Flow Rate Total per Shower fitting Quantity Fitting type 16.00 Туре Litres/Min (No.) Thermostatic Shower 8.00 0.00 0.00 0.00 0.00 0.00 Total No. of Fittings (No.) Total Flow (I/s) Maximum Flow (I/s) 16 00 8.00 Average Flow (I/s) 8.00 Weighted Average Flow (I/s) 5.60 Flow for Calculation (I/s) 8.00 WCs Part Flush Quantity Full Flush WC Type Dual WC Volume Volume (No) 4.50 3.00 Total number of fittings Average effective flushing volume 3.50 Washing Machines Washing Machine L per Kg Quantity Total per Dry Load Fitting type 0.00 Туре (No.) 0.00 Total No. of Fittings (No.) Total Consumption (I) 8.17 Maximum Consumption (I) 8.17 Average Consumption (I/s) Weighted Average Consumption (I) Consumption for Calculation (I/s) 8.17 5.72 8.17 **Other Fittings** Waste Disposal Y/N Ν Water softner Consumption beyond 4% l/p/d Use of grey water and harvested rainwater Total Grey water from WHB taps (I) Total Availble Grey Water Supply (I) 0 134.40 Possible Demand (I) 97.88 Grey/Rain Installed Capacity (I) 0.00 Figure for Calculation lit/person/day 0.00 Use Factor Fixed use Total Use (l/p/day) (l/p/day) 0.00 0.00 0.00 0.00 0.00 0.00 15.47 1.58 6.32 0.00 0.00 0.00 0.00 0.00

44.80 13.88 17.16 << Note - these may be default values. 4.50 << You can change them by entering

0.00

0.00

102.13

0.00

0.91

92.94

5.00

97.94

PASS

#### the actual applicances in the appropriate sections above

#### Water Use Assessment

Installation Type

WC Single Flush

WC Dual Flush

WC's (Multiple)

Bath Only

Shower Only

Dishwashers

Waste Disposal

Water Softner

Taps Exc. Kitchen

Kitchen Taps Washing Machines

Bath (shower present)

Shower (bath present)

Assesment	Result
Assesment	1/Coult

Normalisation Factor