

Sustainability & Energy Statement 99 Atbara Road, Teddington

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21st August 2024





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Executive Summary

This Sustainability and Energy Statement has been prepared in support of a planning application for the demolition of the bungalow and the construction of a new 4-bedroom, 2½-storey house at 99 Atbara Road, Teddington.

The methodology used has been based upon the 'Energy Assessment Guidance' published by the Mayor of London in June 2022 and uses the carbon factors for gas and electricity proposed for SAP 10.2.

In order to demonstrate the energy efficiency of the building a set of SAP calculations have been prepared for the proposed house for the 'Be Lean' scenario based on the notional systems specification set out in the Part L 2021 baseline. This is not the proposed strategy but purely demonstrates the reduction from the 'Be Lean' condition.

The TER & DER Worksheets for the proposed house for the Be Lean case are attached as Appendix 1.

The fabric standards of the house will exceed the requirements of the Building Regulations.

It is proposed to install an air source heat pump into the house to provide space heating and hot water.

It is also proposed to install a total of 6 x 400W photovoltaic panels on the southeast orientated front elevation. A Roof Plan showing the indicative location of the panels is attached as Appendix 3.

A further set of SAP calculations have been prepared based on the proposed specification and the DER Worksheets for the Be Green scenario are attached as Appendix 2.

The completed GLA Carbon Emissions Reporting Spreadsheet accompanies the planning application but the reductions in emissions can be summarised as follows:

	Total Emissions	% Reduction
	kg CO ₂ per year	
Be Lean		
Baseline (Building Regulations TER)	1,938	
Be Lean - after energy efficiency (DER)	1,557	19.66%
Be Clean	1,557	19.66%
Be Green (ASHP)		
Be Green Emissions	435	77.55%

The water efficiency measures incorporated into the house ensures it achieves a standard of 110 litres per person per day (including 5 l/p/d for external water use) and therefore meets the enhanced standard required by the Building Regulations and the planning policy.

The LBRuT Sustainable Construction Checklist is attached as Appendix 4.



1.0 Introduction

This report has been commissioned by Jamie and Beverley McDaid and provides a Sustainability and Energy Statement in support of a planning application for the demolition of the existing bungalow and the construction of a new 4-bedroom, 2¹/₂-storey house at 99 Atbara Road, Teddington.

The report describes the methodology used in assessing the development and the initiatives proposed.

The house has been designed and will be constructed to reduce energy demand and carbon dioxide emissions.

The objective is to reduce the energy demand to an economic minimum by making investments in the parts of the building that has the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once a cost-effective structure has been designed, low-carbon and renewable technologies have been considered to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.



2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled "A better quality of life: A strategy for sustainable development in the UK". This sets out four main objectives for sustainable development in the UK.

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

• National Planning Policy Framework - 2023

Paragraph 157 states;

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure."



Regional and Local Policies

The Development Plan comprises the London Plan (2021) and the London Borough of Richmond Local Plan (2018).

London Plan, published March 2021 – the following policies are relevant to the application:

Policy SI 1 Improving air quality

- A Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.
- B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:
 - 1) Development proposals should not:
 - a) lead to further deterioration of existing poor air quality
 - b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
 - c) create unacceptable risk of high levels of exposure to poor air quality.
 - 2) In order to meet the requirements in Part 1, as a minimum:
 - a) development proposals must be at least Air Quality Neutral
 - b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures
 - c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1
 - d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.
- C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:
 - 1) how proposals have considered ways to maximise benefits to local air quality, and
 - 2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.
- D In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.



E Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

Policy SI 2 Minimising greenhouse gas emissions

- A Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
 - 1) be lean: use less energy and manage demand during operation
 - be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
 - 3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
 - 4) be seen: monitor, verify and report on energy performance.
- *B* Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.
- C A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
 - 1) through a cash in lieu contribution to the borough's carbon offset fund, or
 - 2) off-site provided that an alternative proposal is identified and delivery is certain.
- D Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ringfenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.
- *E* Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
- F Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Policy SI 4 Managing heat risk

A Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.



- B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
 - 1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
 - 2) minimise internal heat generation through energy efficient design
 - manage the heat within the building through exposed internal thermal mass and high ceilings
 - 4) provide passive ventilation
 - 5) provide mechanical ventilation
 - 6) provide active cooling systems.

Policy SI 5 Water infrastructure

- A In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.
- B Development Plans should promote improvements to water supply infrastructure to contribute to security of supply. This should be done in a timely, efficient and sustainable manner taking energy consumption into account.
- C Development proposals should:
 - 1) through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)
 - 2) achieve at least the BREEAM excellent standard for the 'Wat 01' water category or equivalent (commercial development)
 - incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.
- D In terms of water quality, Development Plans should:
 - promote the protection and improvement of the water environment in line with the Thames River Basin Management Plan, and should take account of Catchment Plans
 - 2) support wastewater treatment infrastructure investment to accommodate London's growth and climate change impacts. Such infrastructure should be constructed in a timely and sustainable manner taking account of new, smart technologies, intensification opportunities on existing sites, and energy implications. Boroughs should work with Thames Water in relation to local wastewater infrastructure requirements.
- *E* Development proposals should:
 - 1) seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided



2) take action to minimise the potential for misconnections between foul and surface water networks. F Development Plans and proposals for strategically or locally defined growth locations with particular flood risk constraints or where there is insufficient water infrastructure capacity should be informed by Integrated Water Management Strategies at an early stage.

London Borough of Richmond

The London Borough of Richmond adopted its Local Plan on the 3rd July 2018.

The following policy is of particular relevance to the topic area of this Statement and has been edited for clarity and relevance to the application in question.

Local Plan (2018)

Policy LP 22 - Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

- Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
- 2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
- 3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

- 1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
- 2. All other new residential buildings should achieve a 35% reduction.
- 3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.



Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.*

- C. This should be achieved by following the Energy Hierarchy:
- 1. Be lean: use less energy
- 2. Be clean: supply energy efficiently
- 3. Be green: use renewable energy

Decentralised Energy Networks

D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:

1. All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

* As a result of revisions to the Building Regulations the LBRuT have published an update to the policy. This sets out a requirement for smaller residential schemes (below 10 units) to achieve a 35% reduction in emissions against a Building Regulations Part L (2021) baseline.

The update also sets out a requirement to follow the GLA Energy Assessment Guidance (2022) and to complete the 2022 Carbon Emissions Reporting Spreadsheet.



3.0 Assessment Methodology

The methodology used has followed that set out in the Energy Assessment Guidance published by the GLA in June 2022.

SAP calculations have been prepared using Part L 2021 to 'test' the Be Lean emissions. This uses the specification for building systems set out in the notional dwelling specification for new dwellings (Part L 2021 - Table 1.1).

Further SAP calculations have been prepared for the Be Green scenario, which uses the fabric specification established at the Be Lean stage but includes the actual building systems proposed.

Emission Factors

The CO_2 emission factors, where applicable, used throughout this report have been taken from SAP 10.2 as required by the GLA Energy Assessment Guidance.

	kg CO₂/kWh
Mains gas	0.210
Grid supplied and displaced electricity	0.136

4.0 Proposal

The accommodation schedule in detail is;

Unit Type	Number	Area	Total Area
		m ²	m²
4-Bedroom 21/2-storey detached house	1	230.2	230.2
Total	1		230.2



5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical.

Passive Design Measures

The passive design measures proposed include;

Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The location and design of the house is in context with surrounding development and the shape of the site. The house has been designed with multiple aspects but benefits predominantly from orientations towards the southeast (front) and northwest (rear). The house therefore benefits from access to direct sunlight throughout the day and from cross ventilation, which will assist in limiting summer overheating.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight whilst avoiding summer overheating and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

Building Envelope

U-values of the building envelope must meet Building Regulations Part L standards and further improvements to U-values will reduce the building's heating requirements.

The ground-floor will be insulated with 200mm 'Kingspan' PIR insulation or similar.

The external walls will be built using a timber frame system with an overall width of 352mm. This will be insulated with Kingspan ULTIMA insulation.



The (cold) roof will be insulated with 400mm of mineral wool and flat and sloping roofs will be insulated with 200mm PIR insulation.

Windows are proposed as double glazed with Low 'e' soft coat and argon filled.

It is proposed to set maximum limits for the elemental U-values as follows:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m ² K	W/m ² K	
Ground-Floor	0.18	0.11	39%
External Walls	0.26	0.15	42%
Low-level Walls at Second-floor	0.26	0.15	42%
Cold Roofs	0.16	0.10	38%
Flat Roof	0.16	0.13	19%
Sloping Ceilings	0.16	0.13	19%
Windows and Glazed Doors	1.60	1.20	25%
'g' Value for Windows and Glazed Doors		0.5	

Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building.

The Building Regulations set a minimum standard for air permeability of 8 m³ of air per hour per m² of envelope area, at 50Pa. It is proposed to achieve a 50% improvement over Building Regulations and the house will target a permeability of $4.0 \text{ m}^3/\text{hr/m}^2$.

Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy.

The thermal details for the building will be modelled at the detailed working drawing stage but for the purposes of this assessment the thermal details formulated by the Recognised Construction Details have been used. Any details not available on the RCD website will be modelled. These will enable the building to achieve the higher energy efficiency requirements of the Building Regulations.



The following table provides the values currently used within the modelled SAP calculations.

Reference	Location	PSI Values
		W/mK
E2	Other Lintels (including other steel lintels)	0.028
E3	Sill	0.024
E4	Jamb	0.019
E5	Ground Floor	0.046
E10	Eaves (Ceiling)	0.051
E14	Flat Roof	0.041
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079

Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. The ventilation to the En-Suite and Bathroom will be comprised of continuous extract ventilation as per System 3 criteria. This reduces the number of external penetrations required to the building envelope.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Part L of the Building Regulations requires all light fitting to have lamps with a minimum luminous efficacy of 80 light source lumens per circuit-watt.

Space Heating and Hot Water

The baseline SAP modelling has been based upon the use of a combination boiler installed to the house (as required by the GLA Guidance in order to test the efficiency of the building structure) but the proposed specification is based on the installation of an air source heat pump.



5.2 Establishing Carbon Dioxide Emissions (Be Lean)

The GLA Energy Assessment Guidance requires the energy efficiency of a building (Be Lean) to be tested using the building systems set out in Table 1.1 of Part L 2021.

SAP calculations have been prepared for the house and the baseline calculations are based on the fabric specification set out above but using the notional systems as required by the GLA Energy Assessment Guidance. These are not the proposed final option but are used to test the 'Be Lean' reductions only.

The TER & DER Worksheets for the 'Be Lean' scenario are attached as Appendix 1 but the emissions from the proposed house can be summarised as follows;

Unit Type	TER	DER
	kg CO ₂ /yr	kg CO ₂ /yr
4-Bedroom 21/2-storey detached house	8.42	9.61

Summary

The SAP calculations have allowed the GLA Carbon Reporting Spreadsheet to be populated.

This accompanies the planning application but from the spreadsheet the total TER emissions for the house are calculated as **1,938 kg CO₂ per year** with DER emissions of **1,557 kg CO₂ per year**.

The spreadsheet makes an allowance for the energy saving/ renewable technologies including within the TER calculation.

The reduction in emissions is therefore **381 kg CO₂ per year**, which equates to a reduction of **19.66%** for the 'Be Lean' case.

The energy efficiency measures incorporated into the development therefore meet the requirements of the Guidance.



5.3 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Atbara Road to be 4.8 m/s at 10m above ground level and 5.5 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the development.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.



CHP units are generally gas fuelled and generate electricity with heat being a by-product. The heat is usually used to meet the hot water load, which is fairly consistent throughout the year.

Historically CO₂ savings have been achieved because gas has been used to generate electricity and gas has had a lower emissions factor than electricity, However, with the de-carbonisation of the electricity grid the benefit of CHP is negated and consequently the use of a CHP would increase emissions rather than reduce them.

CHP is not proposed.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12° C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

Whilst the house has a private garden area it is unlikely there is sufficient space to install a horizontal collection network. Therefore, the installation of a ground source heat pump is likely to require one or more boreholes to service a system.

This will be cost prohibitive and is not proposed.

Solar

(i) Solar Water Heating

Solar hot water panels use the suns energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees

The installation of a heat pump reduces the emissions from the hot water demand significantly and the installation of solar hot water heating panels would only reduce further emissions marginally.



This does not represent good value when compared with only technologies and therefore solar hot water heating panels are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels. The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The Roof Plan attached as Appendix 3 demonstrates a total of 6 x 400W photovoltaic panels could be installed on the southeast orientated front elevation.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The installation of an air source heat pump is appropriate and the analysis set out in 5.4 below considers the use of this technology.



5.4 Establishing Carbon Dioxide Emissions (Be Green)

Further SAP calculations have been prepared for the proposed house based on the fabric specification set out above but with the actual systems proposed for installation.

This includes the installation of an air source heat pump and the installation of 6 x 400W photovoltaic panels (2.4 kW).

The DER Worksheets for the 'Be Green' scenario are attached as Appendix 2 and the results have been input into the GLA Carbon Emissions Reporting Spreadsheet.

The emissions rate from the proposed house can be summarised as follows;

Unit Type	DER
	kg CO ₂ /yr
4-Bedroom 2 ¹ / ₂ -storey detached house	1.89

Summary

The total emissions for the Be Green scenario are therefore calculated as 435 kg CO₂ per year.

The reduction in emissions is **1,503 kg CO₂ per year**, which equates to a reduction of **77.55%** for the 'Be Green' case.



5.5 Summary of Calculations

Be Lean

SAP calculations have been prepared using Part L 2021 of the Building Regulations.

Based on the Be Lean scenario the total CO₂ emissions are calculated as **1,938 kg CO₂ per year** (TER) and **1,557 kg CO₂ per year** (DER).

This equates to a reduction of **381 kg CO₂ per year** or **19.66%** of the total TER emissions and is therefore compliant with the GLA energy guidance.

The TER & DER Worksheets for the proposed house for the Be Lean scenario are attached as Appendix 1.

Be Green

A further set of calculations has been prepared for the proposed energy strategy.

These propose the installation of an air source heat pump into the proposed house and the installation of 6 x 400W photovoltaic panels. The panels will be installed on the southeast orientated front elevation and a Roof Plan showing the indicative location of the panels is attached as Appendix 3.

Based on the Be Green scenario the total CO₂ emissions are calculated as 435 kg CO₂ per year (DER).

This equates to a reduction of 1,503 kg CO₂ per year or 77.55% of the total TER emissions.

The DER Worksheets for the proposed house for the Be Green scenario are attached as Appendix 2.

Summary

The GLA Carbon Emissions Reporting Spreadsheet has been completed and (separately) accompanies this Statement



6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zones 2 and 3. Consequently, a Flood Risk Assessment has been prepared by STM Environmental and accompanies the application. This concludes that the overall flood risk to the development is acceptable and that the new development will provide betterment to the site and also increases storage potential of the flood plain.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of 110 litres per person per day is achieved.

Water efficient devices will be fully evaluated, and installed, wherever possible. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the house:

- water efficient taps
- water efficient toilets
- low output showers
- flow restrictors to manage water pressures to achieve optimum levels and
- water meters

Water consumption calculations have been carried out using the Water Efficiency Calculator provided by the BRE. Although not perfect this calculator gives a good indication of the probable water use in a dwelling, although this is largely dependent on the way on which occupants use their homes.



Below is a typical specification, which would achieve the 110 Litres per person per day target (including five litres per person per day allowance for external water use).

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	6/3 litres dual flush	17.64
Basin	2.0 litres/min.	4.74
Shower	9.0 litres/min	39.33
Bath	175 litres	19.25
Sink	5.0 litres/min	12.56
Washing Machine	6.75 litres/kg	14.18
Dishwasher	1.25 litres/places	4.50
		112.20
	Normalisation Factor	0.91
Total Int	ernal Water Consumption	102.10
	External Water Use	5.00
	Total Water Consumption	107.10



7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials to will have a zero ozone depleting potential

Construction waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.



Appendix 1 – TER & DER Worksheets for the Proposed House for the Be Lean scenario



Property Reference				T 230 - Be Lean				Drop Torres	of	Issued on Da		01/07/2024	
Assessment Refer Property	ence			T 230 - Be Lean	ndon, TW11 9PA			Prop Type R	er	Atbara 4BH DE	-1 230 - Be Lea	an	
			-,	.,			DER			TED			
SAP Rating Environmental					92 A 90 B		% DER < TER	9.6	1	TER		8.42	
CO ₂ Emissions (t/y	(ear)				90 В 1.79		DFEE	35.	23	TFEE	:	39.53	
Compliance Check	•				See BREL		% DFEE < TF		.20			10.87	
% DPER < TPER					-14.74		DPER	50	.84	TPER	२	44.31	
Assessor Details			Dall								ssor ID	DF00 00	24
Client		Mr. Ivan	1 Ball							Asse	ISSOF ID	DE88-00	U1
AP 10 WORKSHEET ALCULATION OF DI	FOR New B	uild (As I	Designed)	(Version 10	.2, February								
. Overall dwell:													
round floor irst floor econd floor otal floor area welling volume	TFA = (la)+(1b)+(1d	c)+(1d)+(1e	≥)(ln)	23	0.1900		Area (m2) 102.5800 73.6900 53.9200 (3	(1b) x (1c) x (1d) x		(2c) = (2d) =	176.8560	(1b) - (3) (1c) - (3) (1d) - (3) (4)
. Ventilation ra	ate										m	3 per hour	
umber of open cl umber of open f umber of chimme umber of flues a umber of blocke umber of interm umber of passiv umber of fluele	lues ys / flues attached to attached to d chimneys ittent ext: e vents	o solid fu o other he ract fans	uel boiler	fire							$\begin{array}{cccccc} 0 & \ast & 80 & = \\ 0 & \ast & 20 & = \\ 0 & \ast & 10 & = \\ 0 & \ast & 20 & = \\ 0 & \ast & 35 & = \\ 0 & \ast & 20 & = \\ 4 & \ast & 10 & = \\ 0 & \ast & 10 & = \\ 0 & \ast & 40 & = \end{array}$	$\begin{array}{c} 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 40.0000\\ 0.0000\\ 0.0000\\ \end{array}$	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
nfiltration due ressure test ressure Test Mer asured/design i nfiltration rate umber of sides :	thod AP50 e	ys, flues	and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	(6g)+(7a)+(7b)+(7c) =		40.0000	Air change / (5) = B	0.0742 Yes lower Door 4.0000 0.2742	(8)
helter factor nfiltration rate	e adjusted	to includ	de shelter	factor						- [0.075 x (21) = (18)		0.8500 0.2331	
ind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000		May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000					
dj infilt rate	1.2750 0.2972 0.5442	0.2914	1.2250 0.2855 0.5408	0.2564	1.0750 0.2506 0.5314				0.2331	0.2506	0.2622		(22b)
Heat losses an	nd heat lo	ss paramet	ter										
.ement				Gross	Openings	Net	Area	U-value	A		-value	AxK	
ndows & Glazed ors tchen ound Floor ternal Walls w Level Walls , at Roof over G ld Roof over G ld Roof over S ta Roof over S tal net area o bric heat loss.	&Dormer Ch round Floo: irst Floor econd Floo: f external	eeks r r elements	Aum(A, m2)	m2 218.4100 28.8400 28.8900 19.7700 26.8300 32.6100	m2 38.0600 2.1600 6.0000	36. 3. 6. 102. 180. 26. 22. 19. 26. 32.	.6800 .8900 .7700 .8300 .6100 .9300	W/m2K 1.1450 1.2000 1.1450 0.1100 0.1500 0.1500 0.1300 0.1300 0.1300 30) + (32)	41.75 4.50 6.8 11.22 27.05 4.00 2.9 1.9 3.48	595 000 702 338 525 020 757 770 879 393	kJ/m2K	kJ/K	(27) (26a) (27a) (28a) (29a) (30) (30) (30) (30) (31) (33)
ermal mass para st of Thermal I. K1 Elemen	ameter (TM Bridges nt	P = Cm / 5	IFA) in kJ.	/m2K el lintels)				2-		Psi-value 0.0280 0.0240	Tot 0.69 0.41	89	(35)



E4 Jamb E5 Ground floor E10 Eaves (insul E6 Intermediate E11 Eaves (insul E12 Gable (insul E14 Flat roof E16 Corner (norm E17 Corner (inve Thermal bridges (Sum(L x	ation at ce floor withi ation at ra ation at ce al) rted - inte	n a dwellin fter level) eiling level ernal area g	g) reater than		rea)		44 15 67 7 13 15 46	.5000 .1500 .5600 .8800 .8000 .4200 .8600 .9600 .8800	0.0190 0.0460 0.0510 0.0180 0.0290 0.0410 0.0370 -0.0790	1.35 2.03 0.79 0.00 0.14 0.38 0.65 1.73 -1.80	09 36 00 04 92 03 75	(36)
Point Thermal bridges Total fabric heat loss	- ,		11.	,				(33) + (36)	(36a) = + (36a) =	0.0000 114.5534	
Ventilation heat loss ca Jan	lculated mo Feb	onthly (38)m Mar			Jun	Jul	200	Con	Oct	Nov	Dec	
(38)m 96.7670 Heat transfer coeff	96.4621	96.1632	Apr 94.7592	May 94.4965	93.2736	93.2736	Aug 93.0472	Sep 93.7446	94.4965	95.0279	95.5834	(38)
211.3204 Average = Sum(39)m / 12	211.0155	210.7166	209.3126	209.0499	207.8270	207.8270	207.6006	208.2981	209.0499	209.5813	210.1368 209.3113	(39)
Jan HLP 0.9180	Feb 0.9167	Mar 0.9154	Apr 0.9093	May 0.9082	Jun 0.9028	Jul 0.9028	Aug 0.9019	Sep 0.9049	Oct 0.9082	Nov 0.9105	Dec 0.9129	(40)
HLP (average) Days in mont 31	28	31	30	31	30	31	31	30	31	30	0.9093	
-												
4. Water heating energy	requirement	s (kWh/year)									
Assumed occupancy											3.0412	(42)
Hot water usage for mixe 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for bath 86.7689	85.4803	83.6656	80.3197	77.8143	75.0362	73.5356	75.3376	77.2996	80.2723	83.6871	86.4756	(42b)
Hot water usage for othe 45.7747 Average daily hot water	44.1102	42.4456 /day)	40.7811	39.1166	37.4520	37.4520	39.1166	40.7811	42.4456	44.1102	45.7747 122.0618	
Jan Dailu bat watar waa	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use 132.5436 Energy conte 209.9167 Energy content (annual)	129.5904 184.5350	126.1112 193.8283	121.1008 165.7809	116.9308 157.4114	112.4882 138.3174	110.9876 134.2299	114.4541 141.7181	118.0807 145.6053	122.7179 166.5270 Total = S	127.7973 182.0706 um(45)m =	132.2503 207.0720 2027.0125	
Distribution loss (46)m 31.4875	= 0.15 x (27.6803	45)m 29.0742	24.8671	23.6117	20.7476	20.1345	21.2577	21.8408	24.9791	27.3106	31.0608	(46)
Water storage loss: Total storage loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains ded 0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Primary loss 0.0000 Combi loss 50.9589 Total heat required for	0.0000 46.0274 water heati	0.0000 50.9589 ng calculat	0.0000 49.3151 ed for each	0.0000 50.9589 month	0.0000 49.3151	0.0000 50.9589	0.0000 50.9589	0.0000 49.3151	0.0000 50.9589	0.0000 49.3151	0.0000 50.9589	
260.8756 WWHRS 0.0000	230.5624 0.0000	244.7872 0.0000	215.0959 0.0000	208.3703 0.0000	187.6324 0.0000	185.1888 0.0000	192.6770 0.0000	194.9204 0.0000	217.4859 0.0000	231.3857 0.0000	258.0309 0.0000	
PV diverter -0.0000 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	-0.0000	-0.0000 0.0000	-0.0000 0.0000	
FGHRS 0.0000 Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
260.8756		244.7872	215.0959	208.3703	187.6324	185.1888		194.9204 er year (kW	217.4859 h/year) = S	231.3857 um(64)m =	258.0309 2627.0125	(64)
12Total per year (kWh/ye Electric shower(s)											2627	
0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by insta	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000	
Heat gains from water he 82.5370	72.8648	77.1876	67.4509	65.0790	58.3193	57.3712	59.8610	60.7425	68.1100	72.8672	81.5912	(65)
5. Internal gains (see T												
Metabolic gains (Table 5), Watts											
					Jun 152.0588		Aug 152.0588	Sep 152.0588	Oct 152.0588	Nov 152.0588	Dec 152.0588	(66)
	225.7358	203.8904	210.6868	203.8904	210.6868	203.8904	203.8904	210.6868	203.8904	210.6868	203.8904	(67)
	403.0438	392.6127	370.4061	342.3743	316.0283	298.4276	294.2882	304.7193	326.9259	354.9578	381.3037	(68)
	38.2059	38.2059	38.2059	38.2059	38.2059	38.2059	38.2059	38.2059	38.2059		38.2059	
Pumps, fans 3.0000 Losses e.g. evaporation	(negative v			3.0000	0.0000	0.0000	0.0000	0.0000	3.0000		3.0000	
Water heating gains (Tab	le 5)				-121.6471							
Total internal gains	108.4297		93.6818		80.9990	77.1118	80.4583	84.3646	91.5456		109.6655	
785.3494	808.8270	771.8676	746.3924	705.3541	676.3318	648.0475	647.2546	668.3884	693.9796	/38.4667	/66.4773	(73)
6 Solar gaing												
6. Solar gains												

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	3.4600	11.2829	0.5000	0.7000	0.7700	9.4689 (
East	1.3700	19.6403	0.5000	0.7000	0.7700	6.5263 (
Southeast	8.9100	36.7938	0.5000	0.7000	0.7700	79.5159 (
South	1.3700	46.7521	0.5000	0.7000	0.7700	15.5354 (
Southwest	2.1600	36.7938	0.5000	0.7000	0.7700	19.2766 (
lorthwest	19.2000	11.2829	0.5000	0.7000	0.7700	52.5442 (
Northwest	6.0000	26.0000	0.5000	0.7000	1.0000	49.1400 (

Solar gains 232.0073 434.7795 692.5487 1009.5808 1260.2324 1305.6835 1236.2851 1042.5083 802.0907 507.5795 285.2815 193.6698 (83)



Total gains 1017.3567 1243.6065 1464.4163 1755.9732 1965.5865 1982.0153 1884.3325 1689.7629 1470.4791 1201.5591 1023.7482 960.1471 (84)

7. Mean inter	nal temperat	ure (heatin	ng season)										
Temperature d						'h1 (C)						21.0000	(85)
Utilisation f				nil,m (see 1	Table 9a)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.6454	75.7547	75.8622	76.3710	76.4670	76.9169	76.9169	77.0008	76.7430	76.4670	76.2731	76.0715	
alpha	6.0430	6.0503	6.0575	6.0914	6.0978	6.1278	6.1278	6.1334	6.1162	6.0978	6.0849	6.0714	
util living a	rea												
-	0.9996	0.9985	0.9939	0.9644	0.8544	0.6507	0.4823	0.5576	0.8495	0.9878	0.9989	0.9997	(86)
MIT	19.7785	19.9516	20.2217	20.5913	20.8710	20.9803	20.9973	20.9938	20.9083	20.5191	20.0794	19.7490	(87)
Th 2	20.1522	20.1533	20.1544	20.1596	20.1606	20.1651	20.1651	20.1659	20.1633	20.1606	20.1586	20.1566	(88)
util rest of	house												
	0.9995	0.9981	0.9917	0.9515	0.8100	0.5744	0.3924	0.4605	0.7866	0.9816	0.9984	0.9996	(89)
MIT 2	18.6965	18.9192	19.2649	19.7309	20.0502	20.1537	20.1642	20.1636	20.0968	19.6485	19.0872	18.6619	
Living area f										Living area		0.1093	
MIT	18.8148	19.0320	19.3695	19.8249	20.1399	20.2440	20.2552	20.2543	20.1855	19.7436	19.1956	18.7806	
Temperature a												0.0000	
adjusted MIT	18.8148	19.0320	19.3695	19.8249	20.1399	20.2440	20.2552	20.2543	20.1855	19.7436	19.1956	18.7806	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9971	0.9888	0.9451	0.8088	0.5819	0.4022	0.4710	0.7885	0.9773	0.9976	0.9994	(94)
Useful gains	1016.4930	1239.9495	1448.0816	1659.5888	1589.7426	1153.2780	757.9089	795.8320	1159.4700	1174.2359	1021.2928	959.5723	(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 rat	e W												
	3067.2644	2982.0702	2711.8096	2286.7243	1764.3573	1172.9840	759.6445	800.1515	1267.5990	1911.4692	2535.0156	3063.9317	(97)
Space heating													
	1525.7739	1170.7051	940.2136	451.5376	129.9133	0.0000	0.0000	0.0000	0.0000	548.5015	1089.8804	1565.6435	(98a)
Space heating		t – total p	er year (kW	h/year)								7422.1689	
Solar heating													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating		on – total	per year (k	Wh/year)								0.0000	
Space heating													
	1525.7739	1170.7051	940.2136	451.5376	129.9133	0.0000	0.0000	0.0000	0.0000	548.5015	1089.8804	1565.6435	(98c)
Space heating		t after sol	ar contribu	tion – tota	l per year	(kWh/year)						7422.1689	
Space heating	per m2									(98c) / (4) =	32.2437	(99)

9a. Energy requiremen	s - Individua	al heating s	ystems, inc	luding micro	o-CHP							
Fraction of space hea Fraction of space hea Efficiency of main sp Efficiency of main sp Efficiency of seconda	from seconda from main s ace heating s ace heating s	ary/suppleme ystem(s) ystem 1 (in ystem 2 (in	ntary system %) %)								0.0000 1.0000 89.5000 0.0000 0.0000	(202) (206) (207)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	39 1170.7051		451.5376	129.9133	0.0000	0.0000	0.0000	0.0000	548.5015	1089.8804	1565.6435	(98)
Space heating efficie 89.50	89.5000	89.5000	1) 89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (m 1704.77	ain heating sy 54 1308.0504		504.5112	145.1546	0.0000	0.0000	0.0000	0.0000	612.8509	1217.7435	1749.3223	(211)
Space heating efficies 0.00	ncy (main heat		2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating fuel (m	ain heating s	ystem 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
0.00 Space heating fuel (s	econdary)									0.0000	0.0000	
0.00	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 requires	nent											
260.87 Efficiency of water h	230.5624	244.7872	215.0959	208.3703	187.6324	185.1888	192.6770	194.9204	217.4859	231.3857	258.0309 89.5000	
(217)m 89.50	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	
Fuel for water heatin 291.48	1 257.6117	273.5052	240.3307	232.8159	209.6452	206.9149	215.2816	217.7881	243.0010	258.5315	288.3026	(219)
Space cooling fuel re (221)m 0.00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa 3.48		3.4822	3.3699	3.4822	3.3699	3.4822	3.4822	3.3699	3.4822	3.3699	3.4822	
Lighting 42.36		30.6009	22.4195	17.3175	14.1485	15.7976	20.5343	26.6720	34.9951	39.5269	43.5418	
Electricity generated												
(233a)m -33.84 Electricity generated	L1 -50.3571 by wind turb	-76.3159 ines (Append		-101.7319 tive quanti:		-95.0469	-87.6463	-75.4092	-59.5457	-38.0970	-28.9497	(233a)
(234a)m 0.00 Electricity generated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m 0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or n (235c)m 0.00		y generated 1 0.0000	by micro-CH1 0.0000	P (Appendix 0.0000	N) (negativ 0.0000	ve if net ge 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated (233b)m -11.84	by PVs (Apper 18 -25.4915		ative quant: -79.5473		-108 2549	-107 0944	-89.9372	-64.8842	-37.1330	-16.0149	-9.3290	(233h)
Electricity generated	by wind turb:				ty)	0.0000	0.0000					
(234b)m 0.00 Electricity generated	by hydro-eled	ctric genera	tors (Append	dix M) (neg		ity)		0.0000	0.0000	0.0000	0.0000	
(235b)m 0.00 Electricity used or n		0.0000 generated	0.0000 by micro-CHI	0.0000 P (Appendix	0.0000 N) (negativ	0.0000 ve if net ge	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235b)
(235d)m 0.00 Annual totals kWh/yea	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Space heating fuel -	nain system 1										8292.9261	
Space heating fuel - : Space heating fuel - :											0.0000	
Efficiency of water h											89.5000	(210)
Water heating fuel us Space cooling fuel											2935.2095 0.0000	
Electricity for pumps	and fance											
central heating pumps											41.0000	(230c)
Total electricity for	the above, ki										41.0000	(231)
Electricity for light	ing (calculate	ed in Append	ix L)								341.9050	(232)



Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses			-1542.1382 0.0000 0.0000 0.0000 -0.0000 0.0000 10068.9024	(234) (235a) (235) (236) (237)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP	Energy kWh/year	kg CO2/kWh	Emissions kg CO2/year	
Total CO2 associated with community systems	8292.9261 2935.2095 41.0000 341.9050	0.2100 0.2100 0.1387	1/41.5145 0.0000 616.3940 2357.9085	(261) (373) (264) (265) (267)
	-833.8309 -708.3073		-111.3240 -88.6984 -200.0223 2212.9208 9.6100	(272)
13a. Primary energy - Individual heating systems including micro-CHP				
Total CO2 associated with community systems	kWh/year 8292.9261	kg CO2/kWh 1.1300 1.1300 1.5128	Primary energy kWh/year 9371.0065 0.0000 3316.7867 12687.7933 62.0248 524.4253	(275) (473) (278) (279) (281)
Energy saving/generation technologies PV Unit electricity used in dwelling	-833.8309 -708.3073	1.4934	-1245.2145 -325.5594 -1570.7739 11703.4694 50.8400	(283) (286)
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS	Area (m2) 102.5800 73.6900	(1c) x 2.4000 (2c)	= 176.8560	(1b) - (3b) (1c) - (3c)
Second floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) 230.1900 Dwelling volume		(1d) x 2.1100 (2d) 3a)+(3b)+(3c)+(3d)+(3e)(3		(1d) - (3d) (4) (5)
<pre>2. Ventilation rate </pre>		0 * 0 * 0 * 0 * 4 * 0 * 0 *	$\begin{array}{rrrr} 20 &=& 0.0000\\ 10 &=& 0.0000\\ 20 &=& 0.0000\\ 35 &=& 0.0000\\ 20 &=& 0.0000\\ 10 &=& 0.0000\\ 10 &=& 0.0000\\ 10 &=& 0.0000\\ \text{changes per hour}\\) &=& 0.0742\\ && \text{Yess}\\ && \text{Blower Door}\\ 5.0000\\ && 0.3242 \end{array}$	(6b) (6c) (6d) (6f) (7a) (7b) (7c) (8) (17)
Shelter factor Infiltration rate adjusted to include shelter factor		$(20) = 1 - [0.075 \times (19)]$ $(21) = (18) \times (20)$		
Jan Feb Mar Apr May Jun Jul Wind speed 5.1000 5.0000 4.9000 4.4000 4.3000 3.8000 3.8000 Wind factor 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 Adj infilt rate	Aug 3.7000 0.9250	4.0000 4.3000 4	ov Dec .5000 4.7000 .1250 1.1750	



	0.3514 0.5617	0.3445 0.5593	0.3376 0.5570	0.3032 0.5460	0.2963 0.5439	0.2618 0.5343	0.2618 0.5343	0.2549 0.5325	0.2756 0.5380	0.2963 0.5439	0.3100 0.5481	0.3238 0.5524	
3. Heat losses													
Element TER Semi-glazed TER Opening Typ Kitchen Ground Floor		.20)		Gross m2	Openings m2	3 36 6	tArea m2 .7500 .4700 .0000 .5800	U-value W/m2K 1.0000 1.1450 2.0221 0.1300	A x 7 W/3.750 41.759 12.132 13.335	K 0 5 4	-value kJ/m2K	A x K kJ/K	
External Walls Low Level Walls Flat Roof over Cold Roof over Sloping Ceiling Flat Roof over Total net area Fabric heat los	s &Dormer C Ground Flo First Floo gs Second Flo of externa	por por al elements		218.4100 28.8400 28.8900 19.7700 26.8300 32.6100	38.0600 2.1600 6.0000	180 26 22 19 26 32	.3500 .6800 .8900 .7700 .8300 .6100 .9300	0.1800 0.1800 0.1100 0.1100 0.1100 0.1100 0.1100 30) + (32)	32.463 4.802 2.517 2.174 2.951 3.587	0 4 9 7 3 1			(29a (29a (30) (30) (30) (30) (31) (33)
Thermal mass pa	arameter (1	TMP = Cm /	TFA) in kJ/1	n2K								250.0000	(35)
E3 Sil: E4 Jank E5 Grou E10 Eav E6 Inte E11 Eav E12 Gak E14 Fla E16 Con E17 Con	ment er lintels 1 b ves (insula ermediate f ves (insula ble (insula at roof rner (norma rner (inver	(normal) ation at ce floor within ation at ra ation at ce al) rted - inte) 3) reater than	external ar	ea)		24 17 71 44 15 67 7 13 15 46	ength P .9600 .2400 .5000 .5600 .8800 .8800 .4200 .8600 .9600 .8800	si-value 0.0500 0.0500 0.1600 0.0600 0.0000 0.0400 0.0600 0.0800 0.0900 -0.0900	Tot 1.24 0.86 3.57 7.06 0.93 0.00 0.31 0.80 1.26 4.22 -2.05	80 20 50 40 36 00 20 52 88 64 92	
Thermal bridges Point Thermal k		Psi) calcu	lated using	Appendix K)						(36a) =	18.2358 0.0000	(36)
Total fabric he									(3	3) + (36)		137.7095	(37)
Ventilation hea	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(20)
(38)m Heat transfer o		99.4656	99.0477	97.0851	96.7179	95.0085	95.0085	94.6919	95.6669	96.7179	97.4607	98.2373	
Average = Sum(3	237.6014 39)m / 12 =		236.7572	234.7946	234.4274	232.7180	232.7180	232.4014	233.3764	234.4274	235.1702	235.9468 234.7928	
HLP	Jan 1.0322	Feb 1.0303	Mar 1.0285	Apr 1.0200	May 1.0184	Jun 1.0110	Jul 1.0110	Aug 1.0096	Sep 1.0138	Oct 1.0184	Nov 1.0216	Dec 1.0250	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.0200	
			s (kWh/year										
Assumed occupar	ncy e for mixer 0.0000	r showers 0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 83.6871	3.0412 0.0000 86.4756	(42a
Assumed occupan Hot water usage Hot water usage	ncy e for mixer 0.0000 e for baths 86.7689	r showers 0.0000 s 85.4803 r uses	0.0000 83.6656	0.0000 80.3197	0.0000	0.0000	0.0000	0.0000	77.2996		83.6871	0.0000 86.4756	(42a (42b
Assumed occupan Hot water usage Hot water usage Hot water usage	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747	r showers 0.0000 s 85.4803 r uses 44.1102	0.0000 83.6656 42.4456	0.0000	0.0000	0.0000	0.0000 73.5356	0.0000		80.2723		0.0000	(42a (42b (42c
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan	r showers 0.0000 s 85.4803 r uses 44.1102	0.0000 83.6656 42.4456	0.0000 80.3197	0.0000	0.0000	0.0000 73.5356	0.0000	77.2996	80.2723	83.6871	0.0000 86.4756 45.7747	(42a (42b (42c
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy conte	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167	r showers 0.0000 s 85.4803 r uses 44.1102 use (litres Feb 129.5904	0.0000 83.6656 42.4456 /day) Mar 126.1112	0.0000 80.3197 40.7811 Apr 121.1008	0.0000 77.8143 39.1166 May 116.9308	0.0000 75.0362 37.4520 Jun 112.4882	0.0000 73.5356 37.4520 Jul 110.9876	0.0000 75.3376 39.1166 Aug 114.4541	77.2996 40.7811	80.2723 42.4456 Oct 122.7179 166.5270	83.6871 44.1102 Nov 127.7973 182.0706	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720	(42a (42b (42c (43) (44) (45)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot waten Energy conte Energy content Distribution 10	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875	r showers 0.0000 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283	0.0000 80.3197 40.7811 Apr 121.1008	0.0000 77.8143 39.1166 May 116.9308	0.0000 75.0362 37.4520 Jun 112.4882	0.0000 73.5356 37.4520 Jul 110.9876	0.0000 75.3376 39.1166 Aug 114.4541	77.2996 40.7811 Sep 118.0807	80.2723 42.4456 Oct 122.7179 166.5270	83.6871 44.1102 Nov 127.7973	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720	(42a (42b (42c (43) (44) (45)
Assumed occupant Hot water usage Hot water usage Average daily h Daily hot water Energy content Distribution 10 Water storage 3	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss:	r showers 0.0000 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m	0.0000 80.3197 40.7811 Apr 121.1008 165.7809	0.0000 77.8143 39.1166 May 116.9308 157.4114	0.0000 75.0362 37.4520 Jun 112.4882 138.3174	0.0000 73.5356 37.4520 Jul 110.9876 134.2299	0.0000 75.3376 39.1166 Aug 114.4541 141.7181	77.2996 40.7811 Sep 118.0807 145.6053	80.2723 42.4456 Oct 122.7179 166.5270 Total = S	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m =	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125	(42a (42b (42c (43) (44) (45) (46)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily M Daily hot water Energy conte Energy content Distribution 10 Water storage 1 Total storage 2 If cylinder con	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres) Feb 129.5904 184.5350 = 0.15 x (^ 27.6803 0.0000 icated sola 0.0000	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000	(42a (42b (42c (43) (44) (45) (46) (56) (57)
Assumed occupant Hot water usage Hot water usage Average daily h Daily hot water	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000 50.9589	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres. Feb 129.5904 184.5350 = 0.15 x (. 27.6803 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 0.0000 50.9589	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 49.3151	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 50.9589	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000	(42a (42b (42c (43) (44) (45) (46) (56) (57) (59)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy conter Energy content Distribution 10 Water storage 1 Total storage 1 If cylinder con Primary loss Combi loss Total heat regn	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: 0.0000 ntains dedi 0.0000 0.0000 50.9589 uired for W	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 0.0000 46.0274 water heati 230.5624	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 50.9589 ng calculat. 244.7872	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 49.3151 ed for each 215.0959	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 50.9589 month 208.3703	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 0.0000 50.9589 192.6770	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 0.0000 49.3151 194.9204	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 0.0000 50.9589	(42a (42b (42c (43) (44) (45) (46) (56) (57) (59) (61) (62)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy conter Energy content Distribution 10 Water storage 1 Total storage 1 If cylinder con Primary loss Combi loss Total heat requ WWHRS PV diverter	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000 50.9589 uired for w 260.8756 0.0000 -0.0000	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 icated sola: 0.0000 46.0274 water heati; 230.5624 0.0000	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 r storage 0.0000 storage 0.0000 storage 0.0000 r storage 0.0000 storage 0.0000 -0.0000	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 49.3151 ed for each 215.0959 0.0000 -0.0000	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324 0.0000 -0.0000	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 0.0000 -0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 50.9589 192.6770 0.0000 -0.0000	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 -0.0000	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 0.0000 -0.0000	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 0.0000 -0.0000	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 0.0000 50.9589 258.0309 0.0000	(42a (42b (42c (43) (44) (45) (46) (56) (57) (61) (63a (63b
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy conter Energy content Distribution 10 Water storage : If cylinder con Primary loss Combi loss Total heat requ WWHRS PV diverter Solar input FGRS	ncy e for mixer 0.0000 for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000 0.008589 uired for w 260.8756 0.0000 -0.0000 0.0000 0.0000	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.0000 0.00000	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 0.0000 50.9589 ng calculat. 244.7872 0.0000	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 0.0000 49.3151 ed for each 215.0959 0.0000	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 50.9589 month 208.3703 0.0000	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 0.0000 49.3151 187.6324 0.0000	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 0.0000 50.9589 185.1888 0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 0.0000 50.9589 192.6770 0.0000	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 -0.0000	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 0.0000 50.9589 217.4859 0.0000	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 0.0000	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 0.0000 0.0000 0.0000 50.9589 258.0309 0.0000	(42a (42b (42c (43) (44) (45) (46) (56) (57) (59) (61) (63a (63b
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy content Distribution 1 Water storage : Total storage : If cylinder con Primary loss Combi loss Total heat requ WWHRS PV diverter Solar input FGRS Output from w/h	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000 50.9589 uired for w 260.8756 0.0000 h 260.8756	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres) Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 0.0000 0.0000 0.0000 46.0274 water heatil 230.5624	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 r storage 0.0000 50.9589 ng calculat. 244.7872 0.0000 -0.0000 0.0000 0.0000	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 49.3151 ed for each 215.0959 0.0000 -0.0000 0.0000	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 50.9589 month 208.3703 0.0000 -0.0000 0.0000 0.0000	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324 0.0000 -0.0000 0.0000 0.0000	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 0.0000 -0.0000 0.0000 0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 0.0000 50.9589 192.6770 0.0000 0.0000 0.0000	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 -0.0000 0.0000	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 0.0000 -0.0000 0.0000 217.4859	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 0.0000 -0.0000 0.0000 231.3857	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 50.9589 258.0309 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(42a (42b (42c (43) (44) (45) (46) (57) (59) (61) (63b (63c (63b (63c) (63d) (63d) (63d) (64)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy content Distribution for Water storage : If cylinder con Primary loss Combi loss Total heat requ WHRS PV diverter Solar input FGHRS Output from w/h 12Total per year	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000 50.9589 wired for w 260.8756 0.0000 h 260.8756 ar (kWh/yea	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres) Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 0.0000 0.0000 0.0000 46.0274 water heatil 230.5624	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 r storage 0.0000 50.9589 ng calculath 244.7872 0.0000 -0.0000 0.0000 0.0000	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 49.3151 ed for each 215.0359 0.0000 -0.0000 0.0000 0.0000	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 50.9589 month 208.3703 0.0000 -0.0000 0.0000 0.0000	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324 0.0000 -0.0000 0.0000 0.0000	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 0.0000 -0.0000 0.0000 0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 0.0000 50.9589 192.6770 0.0000 0.0000 0.0000	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 -0.0000 0.0000 0.0000	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 0.0000 -0.0000 0.0000 217.4859	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 0.0000 -0.0000 0.0000 231.3857	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 50.9589 258.0309 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(42a (42b (42c (43) (44) (45) (46) (56) (57) (59) (61) (52) (63a (63b (53c) (63c) (63c) (63c) (63c) (64) (64)
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Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy conter Distribution lo Water storage 1 Total storage 1 If cylinder con Primary loss Combi loss Total heat requ WWHRS PV diverter Solar input FGHRS Output from w/h 12Total per yea Electric shower Heat gains from 5. Internal gai	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss 0.0000 ntains dedi 0.0000 50.9589 uired for w 260.8756 0.0000 0.0000 b 260.8756 ar (kWh/yea r(s) 0.0000 m water hea 82.5370	r showers 0.0000 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 46.0274 0.0000 46.0274 230.5624 0.0000 0.0000 230.5624 ar) 0.0000 ating, kWh/n 72.8648	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 50.9589 ng calculat. 244.7872 0.0000 0.0000 244.7872 0.0000 nonth 77.1876	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 49.3151 ed for each 215.0959 0.0000 0.0000 215.0959 0.0000 Tot 67.4509	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 50.9589 month 208.3703 0.0000 0.0000 208.3703 0.0000 208.3703 0.0000 al Energy us 65.0790	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324 0.0000 0.0000 0.0000 187.6324 0.0000 187.6324 0.0000 ed by inst 58.3193	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 0.0000 0.0000 185.1888 0.0000 185.1888 0.0000 antaneous e 57.3712	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 50.9589 192.6770 0.0000 192.6770 Total pr 0.0000 192.6770 Total pr 0.0000 lectric shor 59.8610	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 0.0000 194.9204 er year (kWh 0.0000 wer(s) (kWh/	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 /year) = S 0.0000 year) = Su	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 1.0000 -0.0000 0.0000 0.0000 0.0000 0.0000 0.31.3857 um(64)m = 0.00000 m(64a)m =	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 2027.0120 2027.0125 31.0608 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 258.0309 2627.0125 2627 0.0000 0.0000	(42a (42b (42c (43) (44) (45) (46) (56) (57) (51) (53a (63b (63c (63b (63c) (64) (64) (64) (64)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy conte Energy content Distribution lo Water storage : If cylinder con Primary loss Combi loss Total heat requ WWHRS PV diverter Solar input FGHRS Output from w/h 12Total per yes Electric shower Heat gains from	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 3.14875 loss: loss 0.0000 ntains dedi 0.0000 50.9589 uired for w 260.8756 0.0000 h 260.8756 0.0000 h 260.8756 0.0000 n 0.0000 h 260.8756 0.0000 m water hee 82.5370	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 icated sola: 0.0000 46.0274 0.0000 46.0274 0.0000 230.5624 0.0000 230.5624 ar) 0.0000 ating, kWh/i 72.8648 able 5 and 1 , Watts	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 50.9589 ng calculat; 244.7872 0.0000 0.0000 244.7872 0.0000 244.7872 0.0000 0.0000 244.7872 0.0000 77.1876	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 0.0000 49.3151 ed for each 215.0959 0.0000 0.0000 0.0000 215.0959 0.0000 Tot 67.4509	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 208.3703 0.0000 208.3703 0.0000 al Energy us 65.0790	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324 0.0000 0.0000 0.0000 187.6324 0.0000 ed by inst 58.3193	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 5.1888 0.0000 0.0000 185.1888 0.0000 antaneous e 57.3712	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 50.9589 192.6770 0.0000 -0.0000 0.0000 192.6770 Total pr 0.0000 lectric show 59.8610	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 0.0000 194.9204 er year (kWh 0.0000 wer(s) (kWh/ 60.7425	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 /year) = S 0.0000 217.4859 /year) = Su 68.1100	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 0.0000 -0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 231.3857 um(64)m = 72.8672	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 50.9589 258.0309 0.0000 0.0000 0.0000 0.0000 258.0309 2627.0125 2627 0.0000 0.0000 81.5912	(42a (42b (42c (43) (44) (45) (46) (56) (57) (51) (53a (63b (63c (63b (63c) (64) (64) (64) (64)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy content Distribution 10 Water storage : If cylinder con Primary loss Combi loss Total heat requ WWHRS PV diverter Solar input FGRRS Output from w/h 12Total per year Electric showed Heat gains from 	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: 0.0000 ntains dedi 0.0000 m water hea 82.5370 	r showers 0.0000 8 85.4803 r uses 44.1102 use (litres. Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 120.0000 0.0000 0.0000 0.0000 0.0000 230.5624 ar) 0.0000 230.5624 ar) 0.0000 ating, kWh/n 72.8648 able 5 and 3 0.00000 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.0000 0.0000 0.00000	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 244.7872 0.0000 0.0000 244.7872 0.0000 month 77.1876 5a) Mar 152.0588	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 49.3151 ed for each 215.0959 0.0000 -0.0000 215.0959 0.0000 Tot 67.4509	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 208.3703 0.0000 208.3703 0.0000 al Energy us 65.0790	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 49.3151 187.6324 0.0000 -0.0000 0.0000 187.6324 0.0000 187.6324 0.0000 187.6324 0.0000 187.6324	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 0.0000 -0.0000 185.1888 0.0000 185.1888 0.0000 185.1888 0.0000 185.1888	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 50.9589 192.6770 0.0000 192.6770 Total pr 0.0000 192.6770 Total pr 0.0000 lectric shor 59.8610	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 0.0000 194.9204 er year (kWh 0.0000 wer(s) (kWh/	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 /year) = S 0.0000 year) = Su	83.6871 44.1102 Nov 127.7973 182.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 1.0000 -0.0000 0.0000 0.0000 0.0000 0.0000 0.31.3857 um(64)m = 0.00000 m(64a)m =	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 2027.0120 2027.0125 31.0608 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 258.0309 2627.0125 2627 0.0000 0.0000	(42a (42b (42c (43) (44) (45) (46) (57) (61) (63) (63) (63) (63) (63) (63) (64) (64) (64) (64) (64)
Assumed occupant Hot water usage Hot water usage Hot water usage Average daily h Daily hot water Energy content Distribution 10 Water storage : If cylinder con Primary loss Combi loss Total heat requ WHRS PV diverter Solar input FGHRS Output from w/h 12Total per yea Electric showen Heat gains from 5. Internal gains	ncy e for mixer 0.0000 e for baths 86.7689 e for other 45.7747 hot water u Jan r use 132.5436 209.9167 (annual) oss (46)m 31.4875 loss: loss: loss: loss: loss: loss: loss: 0.0000 ntains dedi 0.0000 50.9589 uired for w 260.8756 ar (kWh/yea r(s) 0.0000 m water hea 82.5370 m water hea 82.5370 m tains (see Ta 52.0588 (calculate 203.8904	r showers 0.0000 85.4803 r uses 44.1102 use (litres) Feb 129.5904 184.5350 = 0.15 x (27.6803 0.0000 46.0274 xater heati 230.5624 0.0000 230.5624 ar) 0.0000 ating, kWh/i 72.8648 ating, ating, atin	0.0000 83.6656 42.4456 /day) Mar 126.1112 193.8283 45)m 29.0742 0.0000 r storage 0.0000 50.9589 ng calculat. 244.7872 0.0000 244.7872 0.0000 244.7872 0.0000 month 77.1876 5a) Mar 152.0588 dix L, equa 203.8904	0.0000 80.3197 40.7811 Apr 121.1008 165.7809 24.8671 0.0000 49.3151 ed for each 215.0959 0.0000 215.0959 0.0000 215.0959 0.0000 c.0000 215.0959 0.0000 c.0000 215.0959 0.0000 215.0959 0.0000 215.0959 2210.6868	0.0000 77.8143 39.1166 May 116.9308 157.4114 23.6117 0.0000 0.0000 0.0000 0.0000 50.9589 month 208.3703 0.0000 -0.0000 208.3703 0.0000 208.3703 0.0000 208.3703 0.0000 al Energy us 65.0790	0.0000 75.0362 37.4520 Jun 112.4882 138.3174 20.7476 0.0000 0.0000 0.0000 49.3151 187.6324 0.0000 -0.0000 187.6324 0.0000 187.6324 0.0000 187.6324 0.0000 187.6324 0.0000 ed by inst 58.3193	0.0000 73.5356 37.4520 Jul 110.9876 134.2299 20.1345 0.0000 0.0000 50.9589 185.1888 0.0000 -0.0000 185.1888 0.0000 185.1888 0.0000 185.1888 0.0000 185.1888 0.0000 185.1888 0.0000 185.1888 0.0000	0.0000 75.3376 39.1166 Aug 114.4541 141.7181 21.2577 0.0000 0.0000 50.9589 192.6770 0.0000 0.0000 192.6770 Total pr 0.0000 192.6770 Total pr 0.0000 lectric shot 59.8610	77.2996 40.7811 Sep 118.0807 145.6053 21.8408 0.0000 0.0000 49.3151 194.9204 0.0000 0.0000 0.0000 194.9204 er year (kWh 0.0000 wer(s) (kWh/ 60.7425	80.2723 42.4456 Oct 122.7179 166.5270 Total = S 24.9791 0.0000 0.0000 50.9589 217.4859 0.0000 0.0000 217.4859 /year) = S 0.0000 year) = Su 68.1100	83.6871 44.1102 Nov 127.7973 128.0706 um(45)m = 27.3106 0.0000 0.0000 49.3151 231.3857 0.0000 0.0000 231.3857 um(64)m = 72.8672 Nov	0.0000 86.4756 45.7747 122.0618 Dec 132.2503 207.0720 2027.0125 31.0608 0.0000 0.0000 50.9589 258.0309 0.0000 0.0000 258.0309 2627.0125 2627 0.0000 0.0000 81.5912 Dec	(42a (42b (42c (43)) (44) (45) (56) (57) (61) (63a (63b (63c (63c (63c (64a) (64a) (64a) (64a) (64a) (64a)



Pumps, fans	38.2059 3.0000	38.2059 3.0000	38.2059 3.0000	38.2059 3.0000	38.2059 3.0000	38.2059	38.2059	38.2059	38.2059	38.2059 3.0000	38.2059 3.0000	38.2059 3.0000	
Losses e.g. e	vaporation	(negative v	alues) (Tab	le 5)									
-	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	-121.6471	(71)
Water heating	gains (Tab	le 5)											
	110.9369	108.4297	103.7468	93.6818	87.4718	80.9990	77.1118	80.4583	84.3646	91.5456	101.2045	109.6655	(72)
Total interna	l gains												
	785.3494	808.8270	771.8676	746.3924	705.3541	676.3318	648.0475	647.2546	668.3884	693.9796	738.4667	766.4773	(73)

_____ 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
lortheast	3.4600	11.2829	0.6300	0.7000	0.7700	11.9308 (7
last	1.3700	19.6403	0.6300	0.7000	0.7700	8.2232 (7
outheast	8.9100	36.7938	0.6300	0.7000	0.7700	100.1900 (7
outh	1.3700	46.7521	0.6300	0.7000	0.7700	19.5746 (7
outhwest	2.1600	36.7938	0.6300	0.7000	0.7700	24.2885 (7
lorthwest	19.2000	11.2829	0.6300	0.7000	0.7700	66.2057 (8
lorthwest	6.0000	26.0000	0.6300	0.7000	1.0000	61.9164 (8

Solar gains 292.3292 547.8222 872.6114 1272.0718 1587.8928 1645.1612 1557.7192 1313.5604 1010.6343 639.5502 359.4547 244.0239 (83) Total gains 1077.6786 1356.6492 1644.4790 2018.4642 2293.2469 2321.4930 2205.7667 1960.8151 1679.0227 1333.5298 1097.9214 1010.5012 (84)

7.	Mean	internal	temperature	(heating	season)				

Temperature du Utilisation fa						'h1 (C)						21.0000 (85)
	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	67.2783	67.3992	67.5182	68.0826	68.1892	68,6901	68.6901	68.7837	68.4963	68.1892	67.9738	67.7501
alpha	5.4852	5.4933	5.5012	5.5388	5.5459	5.5793	5.5793	5.5856	5.5664	5.5459	5.5316	5.5167
util living an	rea											
	0.9994	0.9978	0.9908	0.9512	0.8250	0.6211	0.4608	0.5367	0.8294	0.9837	0.9984	0.9996 (86)
MIT	19.6242	19.8266	20.1411	20.5607	20.8625	20.9773	20.9964	20.9920	20.8961	20.4627	19.9640	19.5924 (87)
Th 2	20.0566	20.0581	20.0596	20.0667	20.0680	20.0742	20.0742	20.0753	20.0718	20.0680	20.0653	20.0625 (88)
util rest of h	nouse											
	0.9992	0.9970	0.9875	0.9340	0.7742	0.5399	0.3657	0.4332	0.7592	0.9755	0.9977	0.9995 (89)
MIT 2	18.4280	18.6882	19.0902	19.6159	19.9539	20.0616	20.0730	20.0725	19.9989	19.5055	18.8700	18.3915 (90)
Living area fi	raction								fLA =	Living area	/ (4) =	0.1093 (91)
MIT	18.5587	18.8126	19.2050	19.7191	20.0532	20.1616	20.1739	20.1729	20.0969	19.6101	18.9895	18.5227 (92)
Temperature ad	djustment											0.0000
adjusted MIT	18.5587	18.8126	19.2050	19.7191	20.0532	20.1616	20.1739	20.1729	20.0969	19.6101	18.9895	18.5227 (93)

8. Space heating requirement -----

	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9955	0.9833	0.9261	0.7733	0.5478	0.3760	0.4444	0.7613	0.9697	0.9965	0.9991	(94)
Useful gains	1076.3049	1350.5766	1617.0400	1869.2637	1773.3048	1271.8161	829.4648	871.3986	1278.3056	1293.1795	1094.1258	1009.5934	(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 rat	e W												
	3387.8803	3299.7238	3008.0104	2540.2607	1958.2203	1294.2879	831.7128	876.8363	1399.5381	2112.2135	2796.0582	3379.3976	(97)
Space heating													
	1719.8121	1309.8269	1034.8820	483.1179	137.5771	0.0000	0.0000	0.0000	0.0000	609.3613	1225.3914	1763.1343	(98a)
Space heating		t – total p	er year (kW	h/year)								8283.1030	
Solar heating													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating		on – total	per year (k	Wh/year)								0.0000	
Space heating	kWh												
	1719.8121	1309.8269	1034.8820	483.1179	137.5771	0.0000	0.0000	0.0000	0.0000	609.3613	1225.3914	1763.1343	(98c)
Space heating	requiremen	t after sol	ar contribu	tion - tota	l per year	(kWh/year)						8283.1030	
Space heating	per m2									(98c) / (4) =	35.9838	(99)

9a. Energy rec	9a. Energy requirements - Individual heating systems, including micro-CHP													
Traction of space heat from main system(s) 9 Efficiency of main space heating system 1 (in %) 9 Efficiency of main space heating system 2 (in %) 0														
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating														
			1034.8820	483.1179	137.5771	0.0000	0.0000	0.0000	0.0000	609.3613	1225.3914	1763.1343	(98)	
Space heating	efficiency 92.4000	(main heat 92.4000	92.4000	1) 92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(010)	
Space heating				92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)	
	1861.2685			522.8549	148.8930	0.0000	0.0000	0.0000	0.0000	659.4819	1326.1811	1908.1541	(211)	
Space heating	efficiency	(main heat	ing system	2)									. ,	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating			0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	(015)	
	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	t												
	260.8756	230.5624	244.7872	215.0959	208.3703	187.6324	185.1888	192.6770	194.9204	217.4859	231.3857	258.0309	(64)	
Efficiency of												80.3000		
(217)m	87.6634	87.4974	87.1153	86.0606	83.5128	80.3000	80.3000	80.3000	80.3000	86.4643	87.4130	87.7009	(217)	
Fuel for water	297.5877	kWh/month 263.5078	280.9922	249.9355	249.5069	233.6643	230.6212	239.9465	242.7402	251.5326	264.7039	204 21 60	(01.0)	
Space cooling			280.9922	249.9355	249.3069	233.0043	230.6212	239.9465	242.7402	231.3326	264.7039	294.2169	(219)	
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041		
-														



Lighting 42.3644 33.9863 30.6009 22.4195 17.3175 14.1485	15 7976	20.5343	26.6720	34.9951	39.5269	43.5418	(232)
Electricity generated by PVs (Appendix M) (negative quantity)							
(233a)m -86.7327 -117.8434 -163.2339 -176.5059 -184.3999 -169.7705 Electricity generated by wind turbines (Appendix M) (negative quantity)	-167.3635	-160.6469	-148.2872	-131.0217	-93.6281	-75.4885	(233a)
(234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative guanti	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negativ (235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	e if net g 0.0000		0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m -63.4646 -131.5332 -257.9996 -382.7633 -501.7931 -502.8807	-497.2409	-423.2159	-312.9724	-186.8406	-84.2821	-50.3648	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quanti (235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity used or net electricity generated by micro-CHP (Appendix N) (negative	0.0000		0.0000	0.0000	0.0000	0.0000	(235b)
(235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - main system 1						8964.3972	(211)
Space heating fuel - main system 2						0.0000	
Space heating fuel - secondary Efficiency of water heater						0.0000 80.3000	(215)
Water heating fuel used Space cooling fuel						3098.9557 0.0000	
						0.0000	(221)
Electricity for pumps and fans: Total electricity for the above, kWh/year						86.0000	(231)
Electricity for lighting (calculated in Appendix L)						341.9050	
Energy saving/generation technologies (Appendices M ,N and Q)							
PV generation Wind generation						-5070.2735	
Hydro-electric generation (Appendix N)						0.0000	
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features						0.0000	(235)
Energy saved or generated						-0.0000	(236)
Energy used Total delivered energy for all uses						0.0000 7420.9844	
iotal activited energy for all uses						/120.0011	(230)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP							
		Energy	Truites	ion factor		Emissions	
		kWh/year		kg CO2/kWh	k	g CO2/year	
Space heating - main system 1 Total CO2 associated with community systems		8964.3972		0.2100		1882.5234 0.0000	
Water heating (other fuel) Space and water heating		3098.9557		0.2100		650.7807 2533.3041	(264)
Pumps, fans and electric keep-hot		86.0000		0.1387		11.9293	
Energy for lighting		341.9050		0.1443		49.3475	(268)
Energy saving/generation technologies							
PV Unit electricity used in dwelling PV Unit electricity exported		-1674.9223		0.1354 0.1262		-226.8430	
Total		5575.5515		0.1202		-655.5045	
Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)						1939.0763 8.4200	
Le larget oursen stokiae Barbston Adee (TBA)						0.4200	(2,3)
12. Deimanu anargu Individual bacting sustana including miara CUD							
13a. Primary energy - Individual heating systems including micro-CHP							

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

kWh/year	kg CO2/kWh	Primary energy kWh/year
8964.3972	1.1300	10129.7688 (275)
		0.0000 (473)
3098.9557	1.1300	3501.8200 (278)
		13631.5888 (279)
86.0000	1.5128	130.1008 (281)
341.9050	1.5338	524.4253 (282)
-1674.9223	1.5006	-2513.3747
-3395.3513	0.4634	-1573.5329
		-4086.9075 (283)
		10199.2073 (286)
		44.3100 (287)
	kWh/year 8964.3972 3098.9557 86.0000 341.9050 -1674.9223	8964.3972 1.1300 3098.9557 1.1300 86.0000 1.5128 341.9050 1.5338 -1674.9223 1.5006



Appendix 2 – DER Worksheets for the Proposed House for the Be Green scenario



Property Reference		Att	oara 4BH DE	T 230 - Be Greer	1					Issued on Da		01/07/2024	
Assessment Refer	ence			T 230 - Be Gree				Prop Type R	ef A	Atbara 4BH DE	7 230 - Be Gre	en	
Property		99,	, Atbara Roa	d, Teddington, Lo	ondon, TW11 9PA	\							
SAP Rating					89 B		DER	1.8	9	TER		8.35	
Environmental					98 A		% DER < TER					77.37	
CO ₂ Emissions (t/y					0.35		DFEE	35.	23	TFEE		39.53	
Compliance Check					See BREL		% DFEE < TFI					10.87	
% DPER < TPER					51.09		DPER	21.	49	TPER		43.94	
Assessor Details		Mr. Ivan	Ball							Asses	sor ID	DE88-00	01
AP 10 WORKSHEET ALCULATION OF D	FOR New B WELLING EM	uild (As D ISSIONS FO	esigned) R REGULAT	(Version 10 IONS COMPLIAN).2, February NCE								
. Overall dwell: round floor irst floor econd floor otal floor area welling volume	ing charac	teristics				0.1900		Area (m2) 102.5800 73.6900 53.9200	(1b) x (1c) x		2c) = 2d) =	176.8560	(1b) - (3b (1c) - (3c (1d) - (3c (4) (5)
. Ventilation ra												3 per hour	(6.5)
umber of open cl umber of open f umber of chimney umber of flues a umber of flues a umber of blocked umber of interm umber of flueled	lues ys / flues attached to attached to d chimneys ittent ext e vents	o solid fu o other he ract fans	el boiler	fire							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
nfiltration due ressure test ressure Test Med easured/design A nfiltration rate umber of sides s	chod AP50	ys, flues .	and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			/ (5) =	s per hour 0.0742 Yes lower Door 4.0000 0.2742 2	(17)
helter factor nfiltration rate	e adjusted	to includ	e shelter	factor					(20) = 1 - (2	[0.075 x 21) = (18) x		0.8500 0.2331	
ind speed	Jan 5.1000		Mar 4.9000		May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000		Oct 4.3000	Nov 4.5000		
dj infilt rate	1.2750 0.2972 0.5442	0.2914			0.2506	0.9500 0.2214 0.5245	0.2214		0.2331	0.2506	0.2622		(22b)
. Heat losses an	nd heat lo	ss paramet	er										
ement				Gross m2	Openings m2		Area m2	U-value W/m2K	A x W/		value J/m2K	A x K kJ/K	
indows & Glazed bors	Doors (Uw	= 1.20)		-		36.	4700 7500	1.1450 1.2000	41.759 4.500	95			(27) (26a)
tchen cound Floor cternal Walls ow Level Walls a Lat Roof over G old Roof over F:	round Floo irst Floor econd Floo	r		218.4100 28.8400 28.8900 19.7700 26.8300 32.6100	38.0600 2.1600 6.0000	6. 102. 180. 26. 22. 19. 26. 32.	0000 5800 3500 6800 8900 7700 8300 6100 9300	1.1450 0.1100 0.1500 0.1500 0.1300 0.1000 0.1300 0.1300	6.870 11.283 27.052 4.002 2.975 1.977 3.487 4.239	12 88 55 57 70 99 93			(27a) (28a) (29a) (29a) (30) (30) (30) (30) (31)
loping Ceilings lat Roof over Se otal net area of abric heat loss,							(20) ••• (50) + (52)	= 108.148	30			(33)
at Roof over Se tal net area of bric heat loss, ermal mass para	, W/K = Sum ameter (TM	m (A x U)		/m2K			(20)(50) + (52)	= 108.148	10		250.0000	
at Roof over Se tal net area of bric heat loss, ermal mass para st of Thermal H K1 Elemen	, W/K = Sum ameter (TM Bridges ht	m (A x U) P = Cm / T	FA) in kJ	/m2K el lintels)			(20)(1	Length B	su Psi-value 0.0280	Tot 0.69	al	



E10 Ea E6 Int E11 Ea E12 Ea E14 F1 E16 Cc E17 Cc Thermal bridge Point Thermal	wind floor wes (insula wes (insula ble (insula ble (insula at roof orner (norma orner (inver se (Sum(L x bridges	ation at ce floor withi ation at ra ation at ce al) rted - inte	ciling level n a dwellin ffter level) illing level ernal area g llated using	g) reater than		rea)		44 15 67 7 13 15 46	.5000 .1500 .8800 .8800 .4200 .8600 .9600 .8800	0.0190 0.0460 0.0510 0.0180 0.0290 0.0410 0.0370 -0.0790	1.35 2.03 0.77 0.00 0.14 0.38 0.65 1.73 -1.80 (36a) =	809 936 900 94 992 903 875 975 6.4054 0.0000	
Total fabric h									(33) + (36)	+ (36a) =	114.5534	(37)
Ventilation he (38)m Heat transfer	Jan 96.7670	Feb 96.4621	Mar 96.1632	= 0.33 x (Apr 94.7592	25)m x (5) May 94.4965	Jun 93.2736	Jul 93.2736	Aug 93.0472	Sep 93.7446	Oct 94.4965	Nov 95.0279	Dec 95.5834	(38)
Average = Sum(211.3204	211.0155	210.7166	209.3126	209.0499	207.8270	207.8270	207.6006	208.2981	209.0499	209.5813	210.1368 209.3113	
HLP	Jan 0.9180	Feb 0.9167	Mar 0.9154	Apr 0.9093	May 0.9082	Jun 0.9028	Jul 0.9028	Aug 0.9019	Sep 0.9049	Oct 0.9082	Nov 0.9105	Dec 0.9129	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9093 31	
4. Water heati		requirement	s (kWh/year) 								2 0 4 1 0	(40)
Assumed occupa Hot water usag	e for mixer											3.0412	
Hot water usag		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usag			83.6656	80.3197	77.8143	75.0362	73.5356	75.3376	77.2996	80.2723	83.6871	86.4756	
Average daily	45.7747 hot water u	44.1102 use (litres	42.4456 /day)	40.7811	39.1166	37.4520	37.4520	39.1166	40.7811	42.4456	44.1102	45.7747 122.0618	
Daily bat yata	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wate Energy conte	132.5436	129.5904 184.5350	126.1112 193.8283	121.1008 165.7809	116.9308 157.4114	112.4882 138.3174	110.9876 134.2299	114.4541 141.7181	118.0807 145.6053	122.7179 166.5270	127.7973 182.0706	132.2503 207.0720	
Energy content Distribution 1		= 0.15 x (45) m							Total = S	um(45)m =	2027.0125	
Water storage	31.4875 loss:	27.6803	29.0742	24.8671	23.6117	20.7476	20.1345	21.2577	21.8408	24.9791	27.3106	31.0608	
Store volume a) If manufac Temperature Enter (49) or Total storage	factor from (54) in (55	n Table 2b	actor is kn	own (kWh/d	lay):							300.0000 1.4000 0.7800 1.0920	(48) (49)
If cylinder co	33.8520	30.5760	33.8520	32.7600	33.8520	32.7600	33.8520	33.8520	32.7600	33.8520	32.7600	33.8520	(56)
-	33.8520 106.3213 0.0000	30.5760 96.0322 0.0000	33.8520 106.3213 0.0000	32.7600 102.8916 0.0000	33.8520 106.3213 0.0000	32.7600 36.0948 0.0000	33.8520 37.2980 0.0000	33.8520 37.2980 0.0000	32.7600 36.0948 0.0000	33.8520 106.3213 0.0000	32.7600 102.8916 0.0000	33.8520 106.3213 0.0000	(59)
Total heat rec	uired for w	water heati				207.1722	205.3799	212.8681	214.4601	306.7003	317.7222	347.2453	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 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	(63c)
FGHRS Output from w/		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12Total per ve			334.0010	501.4525	291.3041	201.1722	203.3799			h/year) = S		3405.8000	
Electric showe		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains fro						sed by inst						0.0000	
			149.5050	137.4354	137.3963	74.8664	74.4698	76.9596	77.2896	140.4273	142.8518	153.9085	(65)
5. Internal ga													
Metabolic gair	is (Table 5)	, Watts							_			_	
(66)m		152.0588	Mar 152.0588					Aug 152.0588	Sep 152.0588	Oct 152.0588	Nov 152.0588	Dec 152.0588	(66)
Lighting gains	203.8904	225.7358	203.8904	210.6868	203.8904	210.6868	203.8904	203.8904	210.6868	203.8904	210.6868	203.8904	(67)
Appliances gai	ns (calcula 398.9044	403.0438	endix L, eq 392.6127	uation L13 370.4061	or L13a), a 342.3743	1so see Tab 316.0283	1e 5 298.4276	294.2882	304.7193	326.9259	354.9578	381.3037	(68)

 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 398.9044 403.0438 392.6127 370.4061 342.3743 316.0283 298.4276 294.282 304.7193 326.9259 354.9578 381.3037 (68)

 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 38.2059

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	3.4600	11.2829	0.5000	0.7000	0.7700	9.4689 (75
East	1.3700	19.6403	0.5000	0.7000	0.7700	6.5263 (76
Southeast	8.9100	36.7938	0.5000	0.7000	0.7700	79.5159 (77
South	1.3700	46.7521	0.5000	0.7000	0.7700	15.5354 (78
Southwest	2.1600	36.7938	0.5000	0.7000	0.7700	19.2766 (79
Northwest	19.2000	11.2829	0.5000	0.7000	0.7700	52.5442 (81



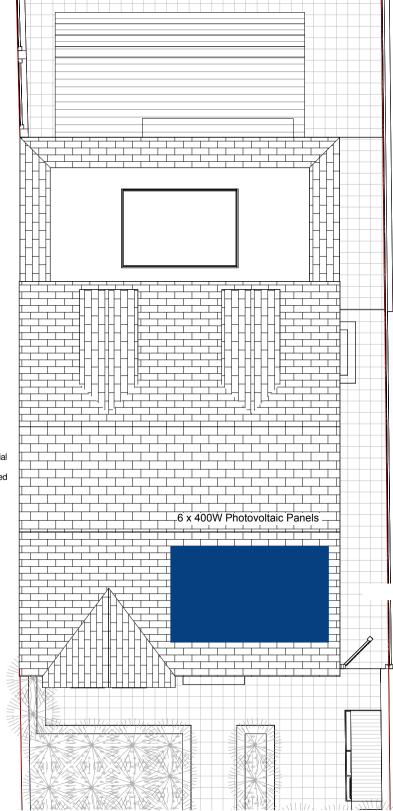
			6.0	000	26.0000		0.5000	0	.7000	1.00	00	49.1400	(82
Solar gains Total gains				1009.5808 1850.1739					802.0907 1493.4611	507.5795 1295.7598		193.6698 1054.3478	
. Mean intern	nal tempera	ture (heati	ng season)										
emperature du Vilisation fa	uring heati	ng periods	in the livi	ng area fro	m Table 9,							21.0000	(85
au	Jan 75.6454	Feb 75.7547	Mar 75.8622	Apr 76.3710	May 76.4670	Jun 76.9169	Jul 76.9169	Aug 77.0008	Sep 76.7430	Oct 76.4670	Nov 76.2731	Dec 76.0715	
alpha util living ar		6.0503	6.0575	6.0914	6.0978	6.1278	6.1278	6.1334	6.1162	6.0978	6.0849	6.0714	
	0.9994	0.9978	0.9916	0.9554	0.8331	0.6443	0.4767	0.5506	0.8425	0.9823	0.9982	0.9995	(8)
Living Non living 24 / 16	20.0668 19.0384 0	20.1964 19.2053 0	20.3979 19.4631 0	20.6696 19.8047 0	20.8657 20.0252	20.9353 20.0920 0	20.9474 20.0994 0	20.9450 20.0993 0	20.8838 20.0511 0	20.6198 19.7498 0	20.2926 19.3332 0	20.0449 19.0139 0	
24 / 9 16 / 9	3 28	0	0	0	0	0	0	0	0	0	0	0 10	
MIT Th 2	20.5226 20.1522	20.1964 20.1533	20.3979 20.1544	20.6696 20.1596	20.8657 20.1606	20.9353 20.1651	20.9474 20.1651	20.9450 20.1659	20.8838 20.1633	20.6198 20.1606	20.2926 20.1586	20.1785 20.1566	
util rest of h MIT 2	house 0.9991 19.7082	0.9971 19.2053	0.9887 19.4631	0.9400 19.8047	0.7862 20.0252	0.5683 20.0920	0.3877 20.0994	0.4544 20.0993	0.7785	0.9738	0.9974	0.9994 19.2198	
Living area fr MIT		19.3136	19.4031	19.8992	20.1170	20.1841	20.1921	20.1917		Living are 19.8448	a / (4) =	0.1093	(9:
Temperature ad adjusted MIT	djustment	19.3136	19.5652	19.8992	20.1170	20.1841	20.1921	20.1917	20.1421	19.8448	19.4380	0.0000 19.3246	
. Space heati													
Utilisation Useful gains Ext temp.	Jan 0.9990 1110.4851 4.3000	Feb 0.9961 1332.5842 4.9000	Mar 0.9859 1536.6716 6.5000	Apr 0.9342 1728.4087 8.9000	May 0.7835 1613.7808 11.7000	Jun 0.5701 1143.0403 14.6000	Jul 0.3906 745.0757 16.6000	Aug 0.4575 783.5347 16.4000	Sep 0.7766 1159.8456 14.1000	Oct 0.9694 1256.1400 10.6000	Nov 0.9965 1114.0790 7.1000	Dec 0.9992 1053.4795 4.2000	(95
	3274.8661	3041.4890	2753.0514	2302.2699	1759.5814	1160.5371	746.5265	787.1628	1258.5548	1932.6284	2585.8099	3178.2276	(9
pace heating	1610.2994 requiremen	1148.3841 t - total p			108.4756	0.0000	0.0000	0.0000	0.0000	503.3074	1059.6462	1580.8126 7329.0919	(9
olar heating	0.0000		0.0000	0.0000 Wh/vear)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(9
pace heating	KWII												
Space heating	1610.2994 requiremen			413.1800 tion - tota		0.0000 (kWh/year)	0.0000	0.0000	0.0000		1059.6462) / (4) =	1580.8126 7329.0919 31.8393	
Space heating Space heating Da. Energy req	1610.2994 requiremen per m2 quirements	t after sol - Individua	ar contribu 	tion - tota ystems, inc	l per year	(kWh/year) o-CHP			0.0000			7329.0919	
Space heating Space heating Da. Energy req Fraction of sp Fraction of sp Efficiency of	1610.2994 requiremen per m2 quirements pace heat f pace heat f main space main space	- Individua - Individua 	ar contribu l heating s 	<pre>tion - tota ystems, inc ntary syste %) %)</pre>	l per year luding micr	(kWh/year) o-CHP			0.0000			7329.0919 31.8393 0.0000 1.0000 371.7337 0.0000	(99 (20 (20 (20 (20
Space heating Space heating Da. Energy req Fraction of sp Ifficiency of Efficiency of	1610.2994 requiremen per m2 quirements pace heat f pace heat f main space secondary/ Jan	- Individua - Individua - om seconda rom main sy heating sy supplementa Feb	ar contribu l heating s 	<pre>tion - tota ystems, inc ntary syste %) %)</pre>	l per year luding micr	(kWh/year) o-CHP			0.0000 Sep			7329.0919 31.8393 0.0000 1.0000 371.7337	(9) (2) (2) (2) (2)
Dace heating pace heating Da. Energy req Traction of sp Traction of sp Difficiency of Efficiency of Efficiency of Space heating	1610.2994 requiremen per m2 quirements pace heat f main space secondary/ Jan requiremen 1610.2994	<pre>t after sol - Individua rom seconda rom main sy heating sy heating sy supplementa Feb t 1148.3841</pre>	ar contribu l heating s ry/suppleme stem 1 (in stem 2 (in ry heating Mar 904.9865	tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800	l per year luding micr m (Table 11	(kWh/year) 				(98c Oct) / (4) =	7329.0919 31.8393 0.0000 1.0000 371.7337 0.0000 0.0000 Dec	(9) (2) (2) (2) (2)
Space heating Da. Energy req Praction of sp Efficiency of Efficiency of Efficiency of Space heating Space heating	1610.2994 requiremen per m2 quirements pace heat f main space main space secondary/ Jan requiremen 1610.2994 efficiency 371.7337	 Individua Individua rom seconda rom seconda rom seconda yabeating sy heating sy<td>ar contribu l heating s ry/suppleme stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337</td><td><pre>tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1)</pre></td><td>l per year luding micr m (Table 11 May</td><td>(kWh/year) o-CHP) Jun</td><td> Jul</td><td>Aug</td><td>Sep</td><td>(98c Oct</td><td>) / (4) = Nov</td><td>7329.0919 31.8393 0.0000 1.0000 371.7337 0.0000 0.0000 Dec</td><td>(9 (2 (2 (2 (2 (2 (2 (2) (2) (9)</td>	ar contribu l heating s ry/suppleme stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337	<pre>tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1)</pre>	l per year luding micr m (Table 11 May	(kWh/year) o-CHP) Jun	 Jul	Aug	Sep	(98c Oct) / (4) = Nov	7329.0919 31.8393 0.0000 1.0000 371.7337 0.0000 0.0000 Dec	(9 (2 (2 (2 (2 (2 (2 (2) (2) (9)
Space heating Space heating Praction of sp officiency of ffficiency of ffficiency of Space heating Space heating Space heating	1610.2994 requirement per m2 quirements pace heat f main space main space main space main space main space main space acondary/ Jan requiremen 1610.2994 afficiency 371.7337 fuel (main 433.1863	 Individua Individua rom seconda rom seconda reb 1148.3841 (main heat 371.7337 heating sy 308.9266 	ar contribu l heating s -ry/suppleme stem (s) stem 1 (in stem 2 (in ry heating Mar 94.9865 ing system 371.7337 stem) 243.4502	<pre>tion - tota ystems, inc ntary syste %) %) Apr 413.1800 1) 371.7337 111.1495</pre>	l per year luding micr m (Table 11 May 108.4756	(kWh/year) 	Jul 0.0000	Aug 0.0000	Sep 0.0000	(98c Oct 503.3074) / (4) = Nov 1059.6462	7329.0919 31.8393 0.0000 1.0000 371.7337 0.0000 0.0000 Dec 1580.8126	(9 (2 (2 (2 (2 (2 (2 (2) (9) (2)
pace heating pace heating va. Energy req raction of sp ifficiency of ifficiency of ifficiency of pace heating space heating space heating space heating	1610.2994 requiremen per m2 quirements pace heat f main space main space main space secondary/ Jan requiremen 1610.2994 afficiency 371.7337 fuel (main 433.1863 efficiency 0.0000 fuel (main	<pre>t after sol - Individua rom seconda rom main sy heating sy heating sy supplementa Feb t 1148.3841 (main heat 371.7337 heating sy 308.9266 (main heat 0.0000 heating sy</pre>	ar contribu l heating s ry/suppleme stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2)	tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1) 371.7337 111.1495 2) 0.0000	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000	(kWh/year) o-CHP) Jun 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	Sep 0.0000 0.0000 0.0000 0.0000	0ct 503.3074 371.7337 135.3946 0.0000	Nov 1059.6462 371.7337 285.0552 0.0000	7329.0919 31.8393 0.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000	(9 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
A. Energy req Praction of sp Praction of sp Praction of sp Efficiency of Efficiency of Space heating Space heating Space heating Space heating Space heating	1610.2994 requirement per m2 quirements pace heat f main space secondary/ Jan requirement 1610.2994 efficiency 371.7337 fuel (main 433.1863 efficiency 0.0000 fuel (main 0.0000 fuel (seco	<pre>- Individua Individua rom seconda rom seconda rom main sy heating sy heating sy heating sy t 1148.3841 (main heat 371.7337 heating sy 308.9266 (main heat 0.0000 heating sy 0.0000</pre>	ar contribu l heating s ry/suppleme stem (s) stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2) 0.0000	tion - tota ystems, inc ntary syste %) %) Apr 413.1800 1) 371.7337 111.1495 2) 0.0000 0.0000	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000 0.0000	(kWh/year) o-CHP) Jun 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000	Sep 0.0000 0.0000 0.0000 0.0000 0.0000	(98c Oct 503.3074 371.7337 135.3946 0.0000 0.0000	Nov 1059.6462 371.7337 285.0552 0.0000 0.0000	7329.0919 31.8393 0.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000 0.0000	 (9) (2)
Space heating Space heating Pa. Energy req Fraction of sp Fraction of sp Fraction of sp Efficiency of Space heating Space heating Space heating Space heating Space heating Space heating Space heating	1610.2994 requirement per m2 quirements pace heat f pace heat f pace heat f pace heat f pace heat f fain space secondary/ Jan requiremen 1610.2994 efficiency 371.7337 fuel (main 433.1863 efficiency 0.0000 fuel (main 0.0000	<pre>- Individua - Individua rom main sy heating sy heating sy supplementa T T 1148.3841 (main heat 371.7337 heating sy 308.9266 (main heat 0.0000 heating sy 0.0000</pre>	ar contribu l heating s ry/suppleme stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2)	tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1) 371.7337 111.1495 2) 0.0000	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000	(kWh/year) o-CHP) Jun 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	Sep 0.0000 0.0000 0.0000 0.0000	0ct 503.3074 371.7337 135.3946 0.0000	Nov 1059.6462 371.7337 285.0552 0.0000	7329.0919 31.8393 0.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000	 (9) (2)
Space heating Space heating Praction of sp Efficiency of Efficiency of Space heating Space heating	1610.2994 requirement per m2 quirements pace heat f main space secondary/ Jan requiremen 1610.2994 efficiency 371.7337 fuel (main 0.0000 fuel (seco 0.0000 requiremen	<pre>- Individua - Individua rom main sy heating sy heating sy heating sy heating sy t 1148.3841 (main heat</pre>	ar contribu l heating s tem(s) stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2) 0.0000	tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1) 371.7337 111.1495 2) 0.0000 0.0000 0.0000	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000 0.0000 0.0000	(kWh/year) CHP) Jun 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Sep 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0ct 503.3074 371.7337 135.3946 0.0000 0.0000 0.0000	Nov 1059.6462 371.7337 285.0552 0.0000 0.0000	7329.0919 31.8393 0.0000 1.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000 0.0000 0.0000	(9 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
Space heating Praction of sp Spraction of sp Sprace heating Sprace heating Spr	1610.2994 requiremen per m2 quirements pace heat f main space main space main space main space main space main space main space secondary/ Jan requiremen 1610.2994 efficiency 371.7337 fuel (main 0.0000 fuel (main 0.0000 fuel (seco 0.0000 requiremen 350.0900 water heat	<pre>- Individua - Individua rom main sy heating sy heating sy supplementa Feb t 1148.3841 (main heat 371.7337 heating sy 308.9266 (main heat 0.0000 heating sy 0.0000 heating sy 0.0000 t 311.1432</pre>	ar contribu l heating s ry/suppleme stem (s) stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2) 0.0000	tion - tota ystems, inc ntary syste %) %) Apr 413.1800 1) 371.7337 111.1495 2) 0.0000 0.0000	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000 0.0000	(kWh/year) o-CHP) Jun 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000	Sep 0.0000 0.0000 0.0000 0.0000 0.0000	(98c Oct 503.3074 371.7337 135.3946 0.0000 0.0000	Nov 1059.6462 371.7337 285.0552 0.0000 0.0000 0.0000	7329.0919 31.8393 0.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000 0.0000	(9 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
pace heating praction of sp raction of sp raction of sp raction of sp fificiency of space heating space heating sp	1610.2994 requirement per m2 quirements pace heat f main space secondary/ Jan requiremen 1610.2994 efficiency 071.7337 fuel (main 433.1863 efficiency 0.0000 fuel (seco 0.0000 fuel (seco 0.0000 requiremen 350.0900 water heat 174.3693 r heating, 200.7750	<pre>t after sol - Individua rom seconda rom seconda rom seconda rom seconda rom seconda rom seconda rom seconda rom seconda rom seconda supplementa Feb t 1148.3841 (main heat 371.7337 heating sy 0.0000 ndarug sy 0.0000 t 311.1432 er 174.3693 kWh/month 178.4392</pre>	ar contribu l heating s ry/suppleme stem (s) stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2) 0.0000 334.0016	tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1) 371.7337 111.1495 2) 0.0000 0.0000 0.0000 301.4325	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000 0.0000 0.0000 297.5847	(kWh/year) -CHP) Jun 0.0000 0.0000 0.0000 0.0000 0.0000 207.1722	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 205.3799	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 212.8681	Sep 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 214.4601	0ct 503.3074 371.7337 135.3946 0.0000 0.0000 0.0000 306.7003	Nov 1059.6462 371.7337 285.0552 0.0000 0.0000 0.0000 317.7222	7329.0919 31.8393 0.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000 0.0000 0.0000 0.0000 347.2453 174.3693	(9 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
pace heating raction of sp fficiency of fficiency of pace heating pace heating pace heating pace heating pace heating pace heating pace heating pace heating pace heating fficiency of fficiency of 217)m pace cooling 221)m	1610.2994 requiremen per m2 quirements pace heat f main space main space secondary/ Jan requiremen 1610.2994 defficiency 371.7337 fuel (main 0.0000 fuel (main 0.0000 fuel (seco 0.0000 requiremen 350.0900 water heat 174.3693 r heating, 200.7750 fuel requi 0.0000	<pre>t after sol - Individua rom seconda rom main sy heating sy heating sy heating sy supplementa Feb t 1148.3841 (main heat 371.7337 heating sy 0.0000 mdary) 0.0000 t 311.1432 er 174.3693 kWh/month 178.4392 rement 0.0000</pre>	ar contribu l heating s ry/suppleme stem (s) stem 1 (in stem 2 (in ry heating Mar 904.9865 ing system 371.7337 stem) 243.4502 ing system 0.0000 stem 2) 0.0000 334.0016 174.3693 191.5484 0.0000	tion - tota ystems, inc ntary syste %) %) system, % Apr 413.1800 1) 371.7337 111.1495 2) 0.0000 0.0000 0.0000 301.4325 174.3693 172.8701 0.0000	l per year luding micr m (Table 11 May 108.4756 371.7337 29.1810 0.0000 0.0000 0.0000 297.5847 174.3693 170.6634 0.0000	(kWh/year) Jun 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 207.1722 174.3693 118.8123 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 205.3799 174.3693 117.7844 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 212.8681 174.3693 122.0789 0.0000	Sep 0.0000 0.0000 0.0000 0.0000 0.0000 214.4601 174.3693 122.9919 0.0000	(98c Oct 503.3074 371.7337 135.3946 0.0000 0.0000 306.7003 174.3693 175.8912 0.0000	Nov 1059.6462 371.7337 285.0552 0.0000 0.0000 317.7222 174.3693 182.2122 0.0000	7329.0919 31.8393 0.0000 371.7337 0.0000 Dec 1580.8126 371.7337 425.2541 0.0000 0.0000 0.0000 0.0000 347.2453 174.3693 174.3693 199.1436 0.0000	(9 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
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Space heating fuel - secondary Efficiency of water heater Water heating fuel used Space cooling fuel			0.0000 (215) 174.3693 1953.2106 (219) 0.0000 (221)
Electricity for pumps and fans: Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)			0.0000 (231) 341.9050 (232)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features			-1542.1382 (233) 0.0000 (234) 0.0000 (235a) 0.0000 (235)
Energy saved or generated Energy used Total delivered energy for all uses			-0.0000 (236) 0.0000 (237) 2724.5750 (238)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
Space heating - main system 1	Energy kWh/year 1971.5976	Emission factor kg CO2/kWh 0.1561	Emissions kg CO2/year 307.8052 (261)
Total CO2 associated with community systems Water heating (other fuel) Space and water heating	1953.2106	0.1422	0.0000 (373) 277.7365 (264) 585.5417 (265)
Pumps, fans and electric keep-hot Energy for lighting	0.0000 341.9050	0.0000 0.1443	0.0000 (267) 49.3475 (268)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)	-932.6398 -609.4983	0.1337 0.1231	-124,7102 -75.0064 -199,7166 (269) 435.1726 (272) 1.8900 (273)
13a. Primary energy - Individual heating systems including micro-CHP			
Space heating - main system 1 Total CO2 associated with community systems	Energy Pi		Primary energy kWh/year 3111.1225 (275) 0.0000 (473)
Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting	1953.2106 0.0000 341.9050	1.5259 0.0000 1.5338	2980.3614 (278) 6091.4839 (279) 0.0000 (281) 524.4253 (282)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy kWh/year Dwelling Primary energy Rate (DPER)	-932.6398 -609.4983	1.4942 0.4516	-1393.5126 -275.2221 -1668.7347 (283) 4947.1745 (286) 21.4900 (287)



Appendix 3 – Roof Plan showing the Indicative Location of Photovoltaic Panels



Roof material to be gray slate with red ridge tiles



Appendix 4 – LBRuT Sustainable Construction Checklist

LBRUT Sustainable Construction Checklist - June 2020

This document forms part of the Sustainable Construction Checklist SPD. This document **must** be filled out as part of the planning application for the following developments: all residential development providing **one or more new residential units (including conversions leading to one or more new units)**, and all other forms of development providing **100sqm or more of non-residential floor space**. Developments including new non-residential development of less than 100sqm floor space, extensions less than 100sqm, and other conversions are strongly encouraged to comply with this checklist. Where further information is requested, please either fill in the relevant section, or refer to the document where this information may be found in detail, e.g. Flood Risk Assessment or similar. **Further guidance** on completing the Checklist may be found in the Justification and Guidance section of this SPD.

Propert	y Name (if relevant):	99 Atbara Road, Tedo	dington			Application	n No. (if known):				
Addres	s (include. postcode)	99 Atbara Road, Tedo	dington								
Comple	eted by:	Ivan Ball									
E M	Desidential	indir Ball				Exa De alde attal					
	n-Residential development (m2)					For Residential Number of dwellings	1				
1	MINIMUM COMPLIANC	CE (RESIDENTIAL AND M	NON-RESIDENTIA	L)							
Energy	Assessment										
	Has an energy assessr	ment been submitted that uding the feasibility of CH				issions saving from energy effi	ficiency and rene	wable	TRUE		
			F/COTF and com	munity neating system	is? If yes, please set						
Carbon	Dioxide emissions red What is the on site cart	luction bon dioxide emissions re	duction against a l	Building Regulations	Part L (2013) baselin	e			71	7.55 %	
						nd Building Regulations 2013.					
		e reduction from efficienc							19	9.66 %	
		raft London Plan Policy 9 Jations 2013 from efficien									
		e CO2 emissions saved t							5	7.89 %	
	-		inougn renewable	energy installation?							
		ning carbon to be offset raft London Plan Policy 9).2.4 require Major	developments to ach	ieve Zero Carbon aft	er offsetting.			0.	435 Tonne	
						es issued for the cost per tonr	ne of CO22		FALSE		
			agn oncorrana pe		with outloth guidemin						
	What is the total predic The London Plan sets	cted cost of offset? this as £95/tonne per ye	ear over 30 years, i	this should be update	d based on As Build	calculations.			N/A	£	
1A	MINIMUM POLICY COI	MPLIANCE (NON-RESID	ENTIAL AND DOM	ESTIC REFURBISH	IENT)						
					,	policy requirements					
	nmental Rating of develo										
Non-Re	sidential new-build (100s BREEAM Level	sqm or more)		Please Select		Have you attached a pre	e-assessment to	support this?			FALSE
	nt required under Policy I ions and conversions for										
	BREEAM Domestic Ref	furbishment		Please Select		Have you attached a pre	e-assessment to	support this?			FALSE
Extensi	nt required under Policy I ions and conversions for	non-residential buildings									
	BREEAM Level nt required under Policy	LP 22		Please Select		Have you attached a pre	e-assessment to	support this?			FALSE
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Excelle											
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	f.	see Policy LP 10 Have you attached a Lighting Pollution Report?		
			Subtotal 16	
		give any additional relevant comments to the Energy Use and Pollution Section below posals include all electric systems on site. Therefore will be no on-site emissions.		
	3. TRAN	ISPORT		
	3.1 Prov a.	rision for the safe efficient and sustainable movement of people and goods Does your development provide opportunities for occupants to use innovative travel technologies?		FALSE
	Please e	explain:		
	b.	Does your development provide for 100% active provision for electric vehicle charging point(s) and have you successfully demonstrated that it would be able to operate satisfactorily in the future expectation of all vehicles being electrically powered?	2	TRUE
	с.	satisfaction with the future expectation of an vehicles being electrically doweled? For major developments ONLY: Has a Transport Assessment been produced for your development based on TfL's Best Practice Guidance?	-	
		If you have provided a Transport Assessment as part of your planning application, please tick here and move to Section 3 of this Checklist. See policy LP44	5	FALSE
	d. e.	For smaller developments ONLY: Have you provided a Transport Statement? Does your development provide cycle storage? (Standard space requirements are set out in the Council's Parking Standards - Local Plan Appendix 3)	5	TRUE
	с.	If so, for how many bicycles? Is this shown on the site plans?	2	TRUE
	f.	See Local Plan Appendix 3 Will the development create or improve links with local and wider transport networks? If yes, please provide details.	2	FALSE
			Subtotal 9	
		jive any additional relevant comments to the Transport Section below arging will be provided. Cycle storage is provided.		
	4 4.1 Mini	BIODIVERSITY mising the threat to biodiversity from new buildings, lighting, hard surfacing and people		
	a.	Does your development involve the loss of an ecological feature or habitat, including a loss of garden or other green space? (Indicate if yes) If so, please state how much in sqm?	-2 sqm	FALSE
	b.	Does your development involve the removal of any tree(s)? (Indicate if yes) If so, has a tree report been provided in support of your application? (Indicate if yes)		FALSE TRUE
	С.	Does your development plan to add (and not remove) any tree(s) on site? (Indicate if yes)		FALSE
	d.	Please indicate which features and/or habitats that your development will incorporate to improve on site biodiversity: Pond, reedbed or extensive native planting 6 Area provided:	sqm	FALSE
		An extensive green roof 5 Area provided: An intensive green roof 4 Area provided: Garden space 4 Area provided:	sqm sqm 89.86 sqm	FALSE FALSE TRUE
		Garden space 4 Area provided: Additional native and/or wildlife friendly planting to peripheral areas 3 Area provided: Additional planting to peripheral areas 2 Area provided:	89.86 sqm sqm sqm	TRUE
		A living wall 2 Area provided: Bat boxes 0.5	sqm	FALSE
		Bird boxes 0.5 Swift boxes 0.5		TRUE FALSE
		Other 0.5		FALSE
	e.	Does your development use at least 70% of available roof plate as green/brown roof	1	FALSE
		Policy LP 17 requires 70%	Subtotal 8	
		give any additional relevant comments to the Biodiversity Section below umed Bat boxes, Bird boxes and Swift boxes will be installed.		
	5	FLOODING AND DRAINAGE		
5.1	Mitigatir a.	ng the risks of flooding and other impacts of climate change in the borough Is your site located in a high flood risk zone (Zone 3)? (Indicate if yes)	-2	TRUE
		Have you submitted a Flood Risk Assessment? (Indicate if yes)		TRUE
	b.	Which of the following measures of the drainage hierarchy are incorporated onto your site? (tick all that apply) Store rainwater for later use Use of infiltration techniques such as porous surfacing materials to allow drainage on-site	5 3	TRUE
		Attenuate rainwater in ponds or open water features Store rainwater in tanks for gradual release to a watercourse	4 3	FALSE
		Discharge rainwater directly to watercourse Discharge rainwater to surface water drain	2 1	FALSE FALSE
		Discharge rainwater to combined sewer Have you submitted a Drainage Statement (Indicate if yes)	0	TRUE
	C.	See Policy LP 21 and Draft London Plan SL 13 Please give the change in area of permeable surfacing which will result from your development proposal: Please provide details of the permeable surfacing below please represent a loss in permeable area as a negative number	sqm	
	Please r		Subtotal 9	
	Rainwate	and any additionance of the comments of the recording and change occurrences with the provided to allow controlled release to the public sewer. A SuDS Strategy has been prepare to the planning application.	red and	
	6 6.1 Red	IMPROVING RESOURCE EFFICIENCY uce waste generated and amount disposed of by landfill though increasing level of re-use and recycling		
	a.	Will demolition be required on your site prior to construction? [Points will only be awarded if 10% or greater of demolition waste is reused/recycled]	1	TRUE
		If so, what percentage of demolition waste will be reused in the new development?	%	
		What percentage of demolition waste will be recycled? 80	%	
	b.	Does your site have any contaminated land? Have you submitted an assessment of the site contamination?	1 2	FALSE FALSE
		· · · · · · · · · · · · · · · · · · ·		

		Have you sub	Jace to remediate the contamination? omited a remediation plan? Jace to include compositing on site?	1 1	FALS FALS
. Wil	ill a waste manageme	ent plan and fac	silities be in place in line with Policy LP24	es .	
2 Reducin	ng levels of water w	aste			
			nservation be incorporated into the development? (Please tick all that apply):		
	-	Fitting of wate	er efficient taps, shower heads etc	1	TRU
			efficient A or B rated appliances	1	TRU
		Greywater sys	rvesting for internal use	4 4	FALS FALS
		Fit a water me		1	TRU
				· · · · · · · · · · · · · · · · · · ·	
				Subtotal 3	
lease give	any additional releva	ant comments to	o the Improving Resource Efficiency Section below		
AC	CCESSIBILITY				
.1 En:	nsure flexible adapta	able and long-te	erm use of structures		
. If ti	the development is i		it meet the requirements of the nationally described space standard for internal space and layout?	1	TRU
		If the standar	rds are not met, in the space below, please provide details of the functionality of the internal space and layout	1	
				J	
ND . Ifti	the development is .	residential will	it meet Building Regulation Requirement M4 (2) 'accessible and adaptable dwellings'?	2	TRU
	ule development is i		net, in the space below, please provide details of any accessibility measures included in the development.	2	INC
				1	
				1	
		For major resi	idential developments, are 10% or more of the units in the development to Building Regulation Requirement M4	1	FAL
		(3) 'wheelcha	ir user dwellings'?		
			-		EAL (
DR . Ifti	the development is ı		ir user dwellings'? , does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45	2	FALS
	the development is ı	non-residential	-	2	FALS
	the development is ı	non-residential	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45	2	FALS
	the development is ı	non-residential	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45	2	FALS
	the development is a	non-residential	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45	2	FALS
	the development is r	non-residential	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45	2	FALS
	the development is r	non-residential	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45	2 Subtotal 3	FALS
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lf ti	any additional releva	non-residential Please provid ant comments to Checklist- Scori	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45 le details of the accessibility measures specified in the Local Plan that will be included in the development to the Design Standards and Accessibility Section below ing Matrix for New Construction (Non-Residential and domestic refurb)	2 Subtotal 3 TOTAL 49	FAL
lease give	any additional releva nable Construction C Score	non-residential Please provid ant comments to Checklist- Scori Rating	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45 le details of the accessibility measures specified in the Local Plan that will be included in the development the Design Standards and Accessibility Section below the Design Standards and Accessibility Section below ing Matrix for New Construction (Non-Residential and domestic refurb) Significance		FAL
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lf ti	any additional releva hable Construction C Score 84 or more 75-83 56-74	non-residential Please provid ant comments to Checklist-Scori Rating A+ A B	, does it comply with requirements included in Richmond's Local Plan LP1, LP28.B, LP30 & LP45 led details of the accessibility measures specified in the Local Plan that will be included in the development be the Design Standards and Accessibility Section below ing Matrix for New Construction (Non-Residential and domestic refurb) Significance Project strives to achieve highest standard in energy efficient sustainable development Makes a major contribution towards achieving sustainable development Makes a major contribution towards achieving sustainable development Makes a major contribution towards achieving sustainable development		FAL
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