# The Residence at Plymouth Grove

## Energy Strategy

5 John Dalton Street

Manchester

M2 6ET

Web: www.**kingassociates**.uk

Submitted and prepared by: Merk Giannopoulos

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### Approvals

This document requires the following approvals.
Signed approval forms are filed in the Management section of the project files.

| Name | Signature | Title | Date of Issue | Issue |
|---|---|---|---|---|
| Ade Alabi | AA | Associate Director | 25.07.2023 | 1 |
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### Distribution

| Name | Organisation | Role |
|---|---|---|
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# 1.0 Introduction

King Associates were appointed by WUKPG to produce an energy strategy statement to support a full planning application for the proposed development at Plymouth Grove, Ardwick.

This report is prepared in conjunction with the proposed building layout drawings issued by DAY Architectural Ltd.

The development consists of a single building, which will accommodate 239 studios providing a total of 263 student bed spaces and associated access/ancillary spaces at the ground floor level.

This statement has been prepared to outline the potential energy strategy to reduce the need for fossil fuels in line with Manchester City Council's Core Strategy.

# 2.0 Policy and Legislation

There are a number of international and national policy drivers for increased energy efficiency and reduced Carbon Dioxide ($CO_2$) emissions, which have been introduced to address the issue of global warming and the implications of climate change. The government has made a commitment and developed national policies such as the UK climate change act and the NPPF.

At the local level, the current local plan in particular remains a material consideration. These policies and documents are described in further detail within the section below.

## Climate Change Act 2008

The Climate Change Act came into force on 26th November 2008 and was the world's first long term legally binding framework to mitigate against climate change. Within this framework, the Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad. The framework is there to ensure the net UK carbon account for the year 2050 is 100% lower than the 1990 baseline.

## National Planning Policy Framework

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied.

"At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking."

The NPPF provides significant emphasis on the encouragement of decentralised and renewable energy provision, the NPPF states that;

- To help increase the use and supply of renewable and low carbon energy, the developments should provide a positive strategy for energy from these sources that maximised the potential while ensuring that adverse impacts are addressed satisfactorily.
- Identify opportunities for the development to draw its energy supply from decentralised, renewable or low carbon energy supply systems.
- When determining planning applications, local authorities should:
    - not require applications for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

- approve the application if its impact are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

The current legislative framework sets out the requirement to comply with Part L1A of the English Building Regulations 2013 and the Manchester City Council Climate Change Action Plan, which sets a commitment to reduce $CO_2$ emissions by at least 50% by 2025, via a 13% year on year reduction from buildings.

## Manchester Core Strategy

Manchester's Core Strategy (CS) was adopted on 11th July 2012 and is the key Development Plan Document in the Local Development Framework (LDF).

**CS Policy DM 1**

Development Management requires all development to have regard to a number of development principles. Subject to scheme viability, developers will be required to demonstrate that new non-domestic development to achieve a BREEAM Rating of 'Very Good' or for domestic development to achieve the Code for Sustainable Homes (CfSH) standard. It should be noted that the CfSH is no longer accepted as an assessment methodology for domestic properties and has been withdrawn.

**CS Policy EN 4**

Reducing $CO_2$ Emissions by Enabling Low and Zero Carbon Development requires all development to follow the principle of the Energy Hierarchy, being designed:

- To reduce the need for energy through design features that provide passive heating, natural lighting and cooling.
- To reduce the need for energy through energy efficient features such as improved insulation and glazing; and,
- To meet residual energy requirements through the use of low or zero carbon energy generating technologies.

**CS Policy EN 6**

Target Framework for $CO_2$ Reductions from Low or Zero Carbon Energy Supplies requires applications for non-residential development of 10 or more units and all other development over 1,000$m^2$ to meet, as a minimum, the targets shown in the tables below, unless unviable.

| Target | % Minimum Requirements |
|---|---|
| Target One: Network development area | CHP/District heating anchor or connection or where not feasible a 15% increase on Part L 2010 |
| Target Two: Electricity intense buildings | +10% increase on Part L 2010 |
| Target Three: Micro generation area | +15% increase on Part L 2010 |

*Table 1 – Manchester's Target Framework for $CO_2$ Reductions*

The emission reductions targeted within policy EN6 relate to Building Regulation Part L 2010. As a consequence of the reduction in emission rates required by current building regulations (Part L 2013) relative to Part L 2010, the revised equivalent target $CO_2$ emission reductions for the residential and non-domestic elements of this scheme are presented below:

- Residential - 9% dwelling emission rate reduction over Part L 2013; and,
- Non-domestic - 6% building emission rate reduction over Part L 2013.

**Policy Response**

The build programme for the development will see the site constructed to the Building Regulation Part L 2021 – Volume 2. Building Regulations is Part L 2021 represents 31% improvement on Part L 2013. As a result, directly assessing for compliance with the current Building Regulations Part L 2021 would satisfy the 6% improvement that is required in Manchester's Core Strategy, over Building Regulations Part L 2013.

The development will apply the energy hierarchy in order to first minimise energy demand through fabric principles, while meeting the uplifted fabric standards as required by Part L 2021. This will include low fabric U-Values, not exceeding building regulations limiting U-Values, good air tightness targets, careful detailing to avoid thermal bridging, and maximising passive gains through form, layout and orientation. Following demand reduction, low/zero carbon technologies powered by non-fossil fuel energy sources shall be provided to meet the reduced energy demand before applying renewable energy technologies such as Solar PVs.

# 3.0 Energy Hierarchy

The energy hierarchy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The hierarchy, which is a widely accepted approach amongst many councils, seeks to ensure that developments meet the council's objectives of incorporating energy efficiency through the following process.

- Be Lean – create an energy efficient building
- Be Clean – address the efficiencies of the services strategy
- Be Green – include Low or Zero Carbon technology to further reduce efficiencies

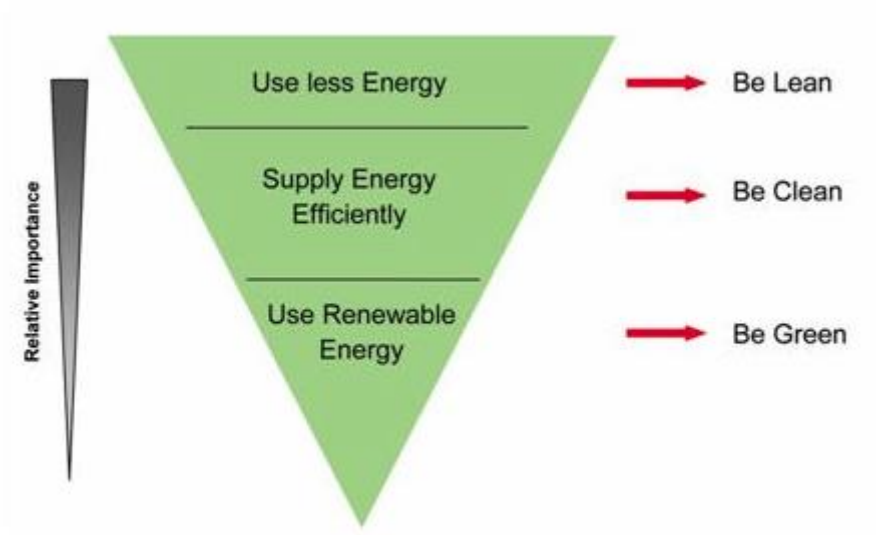



*Figure 1 – Energy Hierarchy*

It is considered that the above principles for carbon reduction form the most appropriate approach from both a practical and financial perspective. The industry is broadly in agreement that energy efficiency and low carbon technologies have the greatest impact in offsetting $CO_2$ emissions. Therefore, it is logical to encourage enhanced mitigation through energy efficiency and low carbon technologies in the first instance, with the application of renewable energy technologies as a secondary measure to reduce the primary energy requirements of a building.

### Carbon Offsetting

Once all measures of the energy hierarchy have been completed, and the Council are satisfied that no further $CO_2$ reductions can feasibly or viably be met on-site, a commitment to ensure the shortfall is met off-site. Carbon offsets represent the final step to achieving a net zero carbon development.

## 3.1 Be Lean

Central to the delivery of low carbon and energy efficient buildings is the 'fabric first' principle which recognises the most effective way of minimising carbon emissions. This is to reduce the demand for heat and power through a well-insulated, energy efficient building fabric. Below is the proposed fabric U-value and air permeability that has been applied to the energy analysis model.

| ***Element*** | **Part L 2021 Limiting U-Value** | **Proposed Building U-Value** | **Improvement (%)** |
|---|---|---|---|
| *Floors* ($W/m^2K$) | 0.18 | 0.10 | 44% |
| *Walls* ($W/m^2K$) | 0.26 | 0.15 | 42% |
| *Flat Roof* ($W/m^2K$) | 0.18 | 0.12 | 33% |
| *Windows* ($W/m^2K$) | 1.6 | 1.2 | 25% |
| *Doors* ($W/m^2K$) | 1.6 | 1.0 | 38% |
| *Air permeability* ($m^3/h.m^2$ @ 50Pa) | 8 | 3 | 63% |

*Table 2 – Building Fabric U value (W/(m2.K)) for new building development and improvement over 2021 Part L limiting value*

The following tables further demonstrates how the building can be serviced efficiently to reduce $CO_2$ emissions towards achieving compliance with the requirements for Planning and Building Regulations Part L.

**Proposed Systems**

| ***Services*** | **Servicing Strategy** | **System Parameters** |
|---|---|---|
| *Mechanical ventilation* | **All studios –** Mechanical Heat Recovery Ventilation (MVHR)<br><br>Amenity/ Admin areas/ Gym – MVHR<br><br>Cleaners Store/ Toilets – Extract only | MVHR<br>• SFP – 0.9 W/l/s.<br>• Heat exchanger efficiency – 82%.<br>Extract only<br>• SFP - 0.4 W/l/s. |
| *Space heating* | All Studios – Electric Panel heater.<br><br>Amenity/ Admin areas – VRF Heat Pump.<br><br>Toilets – Electric Panel heater. | Electric VRF System to communal/amenity areas SCoP – 4.03<br><br>Direct electric panel heating to back of house/studios Efficiency – 100%. |
| *Cooling* | All Studios – Selected South facing studios. | Electric VRF System to communal/amenity areas SEER – 6.4 |

| | | |
|---|---|---|
| | Amenity/ Admin areas/ Gym – VRF Heat Pump<br><br>Comms Room – DX Cooling. | |
| *Water heating* | Air Source Heat Pump. | Air Source Heat pump<br>SCoP – 3.2 |
| *Lighting* | LED Lighting throughout. | LED Lighting - 114 lm/W average luminaire efficacy |

*Table 3 – Building Services performance parameters.*

## 3.2 Be Clean

Once the initial heating and cooling demand has been reduced through implementing the 'Be Lean' stage of the Energy Hierarchy, the remaining energy demand should be met in an efficient way, further reducing energy consumption and carbon emissions.

To complete this step of the energy hierarchy, a review of various low carbon/ energy efficient technologies is required. The current compliant low carbon/ energy efficient technology options for the development are provided in the table below.

| Technology and feasibility | Rationale |
|---|---|
| Connection to existing district heat network<br>**Rejected** | • There is no existing district heat network in operation and that will be ready for connection within the next five years in Manchester. Manchester Civic Quarter Heat Network is still under development and the scope of connection would not include this development site will not be part of the planned initial connections.<br><br>• The site is too far away from existing District Heat networks. |
| Site wide CHP<br>**Rejected** | • The use of fossil fuel (gas) which now has a higher carbon factor than electricity from the grid, to power the CHP makes this technology unfeasible. As a result, the use CHP is likely to offer a 'negative benefit' and therefore has not been explored as part of the energy strategy. |

*Table 4 – Feasibility appraisal of Low carbon/ technology options*

The above options have not been considered in the energy assessment as they are not feasible.

## 3.3 Be Green

The final stage of the energy hierarchy is the generation of on-site low carbon renewable energy.

To complete this step of the energy hierarchy, a review of various low carbon/ renewable energy source is required. Generating low carbon energy onsite can reduce reliance on fossil fuels and minimises energy lost through transmission and contribute to security of supply and better connections between.

The current, compliant renewable energy options for the development are provided in the table below. Each technology is also assessed as either feasible or rejected based on its implications for the scheme in terms of their implementation, cost-effectiveness, site-related constraints, planning issues or others. The following sections will explore the feasible technologies in depth and explain why certain technologies have been rejected.

| Technology and feasibility | Rationale |
|---|---|
| Hydro<br>**Rejected** | • Small scale hydro would be inappropriate for integration into the proposed development due to the geographical location of the proposed site. |
| Wind Turbine<br>**Rejected** | • Turbulence created from surrounding buildings makes this an inefficient solution and planning issues are likely to be insurmountable or to significantly effect program times. |
| Fuel Cells<br>**Rejected** | • These are not yet fully commercially available. |
| Biomass Boilers<br>**Rejected** | • An efficient biomass heating strategy requires both efficient biomass boilers and large central plantroom containing biomass boilers with gas back up boilers.<br>• Energy efficient and more controllable (in terms of their moisture content and heat calorific values) wood pellets are limited in supply.<br>• The management of fuel deliveries, traffic routes and highway design will be problematic for this development. |

| | |
|---|---|
| Solar Hot Water (SHW)<br>**Rejected** | • Roof mounted SHW units could contribute to the hot water requirements in the dwellings through the use solar collectors that trap the thermal energy from the sun in order to heat water.<br><br>• This technology is technically feasible. However, it has been rejected in favour of Solar PVs which offer a more cost-effective means of reducing carbon emissions by using the same roof area. |
| Ground Source Heat Pumps (GSHP)<br>**Rejected** | • A ground source heat pump is not feasible to supply heating and hot water to the development. Due to the limited size of the site, there is not sufficient space to install an adequate looping system. |
| Air Source Heat Pumps (ASHP)<br>**Feasible** | • Air source heat pumps use the air temperature to reject to and extract heat from to provide energy within the building.<br><br>• Heat pump technology could potentially be used to provide heating and hot water to the individual dwellings. The use of this technology fits well with grid decarbonisation. |
| Solar PV<br>**Feasible** | • Roof mounted PV units are a practical solution given the large area of flat roof that is available. |

*Table 5 – Feasibility appraisal of renewable energy technologies*

### 3.3.1 Air Source Heat Pump

Air source heat pump (ASHP) system uses an external unit to extract heat from the air to efficiently provide heating/ domestic hot water. Heat pumps operate on electrical current to drive the compressor in the heat pump and thus eliminate gas consumption on site. This technology can also be coupled with other zero-carbon electricity generation technologies, contributing to a very low carbon emission building.

It is proposed to use ASHP for the generation of domestic hot water on this scheme, contributing to the proportion of energy generated from renewable technologies.

### 3.3.2 Solar Photovoltaic Array

Solar Photovoltaic (PV) uses energy from the sun to generate electricity by using cells to convert sunlight into electricity.

A solar PV array has been incorporated into the design to maximise onsite energy generation.

It has been estimated that c. 60kWp of Photovoltaic (PV) arrays could be distributed across the roof. It should be noted that this is the PV installation capacity considered feasible at this stage and should be developed as the design progresses.

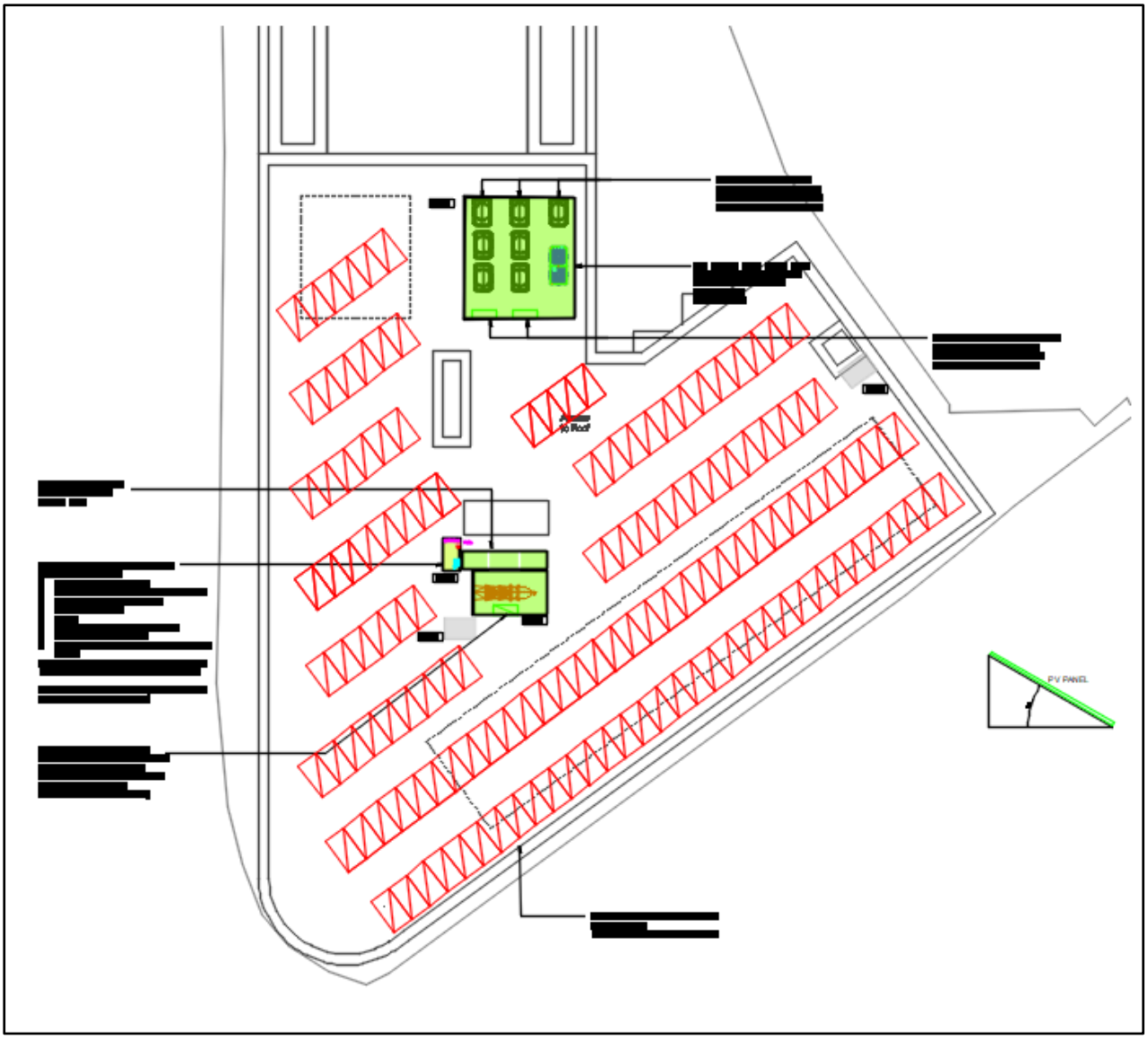



*Figure 2 – Proposed layout of Solar PV panels on roof.*

# 4.0 Energy and $CO_2$ Assessment

The energy demand and potential impact on $CO_2$ of the inclusion of renewable technologies has been considered for the development.

The requirement for this site is to achieve 6% improvement over Building Regulations Part L 2013 and to offset at least 20% of the site's energy consumption using renewable technologies.

At the time of writing this energy statement, the current Building Regulations is Part L 2021 which is a 31% improvement on Part L 2013. As a result, assessing for compliance with the current Building Regulations Part L 2021 would satisfy the 6% improvement that is required over Building Regulations Part L 2013.

The passive design measures identified in section 3 have been incorporated into energy calculations to reduce the site's energy consumption. The feasibility of renewable energy systems to further reduce consumption has been analysed above.

Based on the assessments, ASHP and Solar PV technologies have been selected as the most suitable options for the site.

The chart and table below present the results of the calculations.

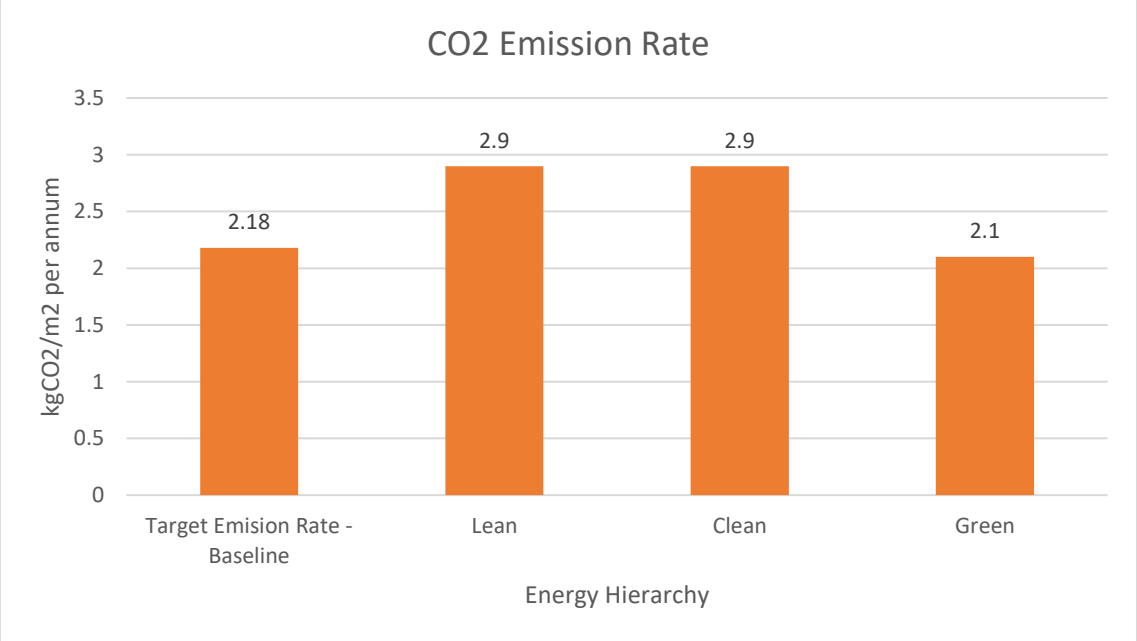



*Chart 1 – Annual $CO_2$ emissions rate*

**Target Emission Rate (TER) baseline** – This represents an equivalent building that is compliant with the Building Regulations Part L 2021.

**Lean** – the incorporation of passive design measures was not sufficient to reduce $CO_2$ emissions below the Part L target.

**Clean** – The assessment of district heating system and CHP has not been carried out as these technologies are not feasible.

**Green** – Through the incorporation of Solar PV panels, the building achieves approximately 3.7% reduction in $CO_2$ emissions compared to the Part L target.

The total regulated energy consumption for the building is 163,181.14 kWh per year.

It is estimated through the modelling software that the energy consumption from domestic hot water use is approximately 29,595.38 kWh / annum. This contributes to 18% of the total building's energy consumption.

It is estimated through the modelling software that the PV arrays in the image below will generate approximately 45,531.36 kWh / annum. This contributes to 28% of the total building's energy consumption.

As a result, the total energy contribution from the use of renewable energy technologies is 46%; thus, satisfying the requirement of Manchester's Guide to Development Supplementary Planning Document.

# 5.0 Conclusion

This energy statement has been created following the guidance from the relevant policy documents outlined in section 2.

The Energy Hierarchy, with focus on sustainable building design (reduction of energy consumption at source) and provision of energy efficiency measures; and to also assess the viability of including building integrated LZC technologies has been utilised.

SBEM calculations have been created for the proposed building, within relevant Part L compliance software to generate the various energy hierarchy carbon figures and improvements.

This energy statement demonstrates that an emphasis will be placed on energy efficient design, with a reduction in predicted carbon dioxide emissions through energy demand reduction.

Various renewable solutions have been considered for this scheme, all with abilities to greatly reduce the carbon footprint of the scheme. At this stage the provision of heat pump technology and Solar PV technology are regarded as the most viable solution in achieving greater improvements of efficiency and together with other efficiency measures.

The chart below present the results of the carbon emissions reduction beyond Building Regulations Part L 2021.

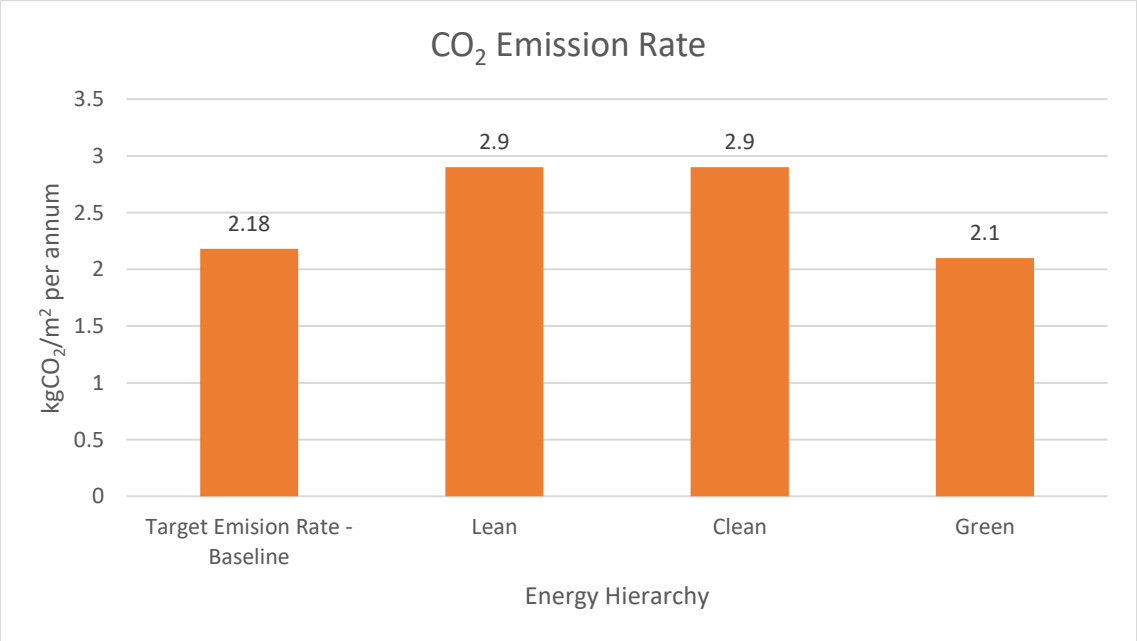



*Chart 2 – Annual $CO_2$ emissions rate*

The proposed development would achieve a 3.7% reduction in $CO_2$ emissions as a result of incorporating energy efficient building fabric and the application of LZC/ renewable energy technologies.

The energy generated from LZC/ renewable energy technologies would contribute to 46% of the total building's regulated energy demand; thus, complying with the Guide to Development in Manchester – Supplementary Planning Document.

# 6.0 Appendix 1 – BRUKL report

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

**Project name**

## The Residence at Plymouth Grove — As designed

**Date:** Tue Aug 08 10:37:47 2023

### Administrative information

**Building Details**

**Address:** TBC, TBC, Manchester, Postcode

**Certifier details**

**Name:** King Associates
**Telephone number:** 0161 211 7676
**Address:** 14 John Dalton St, Manchester, M2 6ET

**Certification tool**

**Calculation engine:** SBEM
**Calculation engine version:** v6.1.e.0
**Interface to calculation engine:** Virtual Environment
**Interface to calculation engine version:** v7.0.20
**BRUKL compliance module version:** v6.1.e.1

**Foundation area [m²]:** 965.99

### The $CO_2$ emission and primary energy rates of the building must not exceed the targets

| | | |
|---|---|---|
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2annum$ | 2.18 | |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2annum$ | 2.1 | |
| Target primary energy rate (TPER), $kWh_{PE}/m^2annum$ | 22.49 | |
| Building primary energy rate (BPER), $kWh_{PE}/m^2annum$ | 21.39 | |
| Do the building's emission and primary energy rates exceed the targets? | BER =< TER | BPER =< TPER |

### The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

| Fabric element | $U_{a\text{-Limit}}$ | $U_{a\text{-Calc}}$ | $U_{i\text{-Calc}}$ | First surface with maximum value |
|---|---|---|---|---|
| Walls* | 0.26 | 0.15 | 0.15 | ST000000_W1 |
| Floors | 0.18 | 0.1 | 0.1 | ST000000_F |
| Pitched roofs | 0.16 | - | - | No heat loss pitched roofs |
| Flat roofs | 0.18 | 0.12 | 0.12 | ST000002_C |
| Windows** and roof windows | 1.6 | 1.2 | 1.2 | ST000003_W2_O0 |
| Rooflights*** | 2.2 | - | - | No external rooflights |
| Personnel doors^ | 1.6 | 1 | 1 | ST000001_W1_O0 |
| Vehicle access & similar large doors | 1.3 | - | - | No external vehicle access doors |
| High usage entrance doors | 3 | - | - | No external high usage entrance doors |

$U_{a\text{-Limit}}$ = Limiting area-weighted average U-values [W/(m²K)] — $U_{i\text{-Calc}}$ = Calculated maximum individual element U-values [W/(m²K)]
$U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability | Limiting standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 8 | 3 |