



DESIGN ENGINEER SUSTAIN

[WWW.FUTURESERV.CO.UK](http://WWW.FUTURESERV.CO.UK)

# **T2 @ St.Johns**

## Manchester

## Energy Statement

## QA

Document ref: P6816-17.0-FS-MEP-001

### Document History

| Issue      | P1 - Draft  |  |  |  |
|------------|-------------|--|--|--|
| Date       | March 2020  |  |  |  |
| Purpose    | For Comment |  |  |  |
| Created by | Gareth Webb |  |  |  |
| Signature  |             |  |  |  |

### Approvals

|               |              |  |  |  |
|---------------|--------------|--|--|--|
| Name          | Craig Cleary |  |  |  |
| Title         | Director     |  |  |  |
| Signature     |              |  |  |  |
| Date of Issue | March 2020   |  |  |  |
| Version       | First Draft  |  |  |  |

### Distribution

| Document Issue    | Name | Organisation | Role |
|-------------------|------|--------------|------|
| Preliminary Issue |      |              |      |
|                   |      |              |      |
|                   |      |              |      |
|                   |      |              |      |
|                   |      |              |      |

### **FUTURESERV LTD**

10 Oxford Court  
Bishopsgate  
Manchester  
M2 3WQ

[enquiries@futureserv.co.uk](mailto:enquiries@futureserv.co.uk)

# Contents

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>Section 1 – Executive Summary .....</b>                    | <b>4</b>  |
| <b>Section 2 – Introduction .....</b>                         | <b>5</b>  |
| <b>Section 4 – Policy and Legislation .....</b>               | <b>6</b>  |
| <b>Section 5 – Energy Strategy .....</b>                      | <b>11</b> |
| <b>5.1 - Baseline Energy Assessment.....</b>                  | <b>11</b> |
| <b>5.2 - Passive Design Improvements .....</b>                | <b>12</b> |
| <b>5.3 - Energy Efficiency Improvements .....</b>             | <b>13</b> |
| <b>5.4 - Renewable Energy Improvements .....</b>              | <b>14</b> |
| <b>5.5 - Energy Generation and Distribution Systems .....</b> | <b>20</b> |
| <b>5.6 - Energy Performance Calculations.....</b>             | <b>21</b> |
| <b>Section 6 - Conclusions.....</b>                           | <b>23</b> |

## Section 1 – Executive Summary

This Energy Statement addresses the planning requirements of Manchester City Council as set out in Manchester's Local Plan and City Centre Area Action Plan, in which the new development falls, both adopted 6<sup>th</sup> December 2017.

This Energy Statement has been prepared to illustrate the environmental aspects of the proposed development highlighting the Energy/Carbon emission profile and, assess the options available for reducing energy consumption and associated CO<sub>2</sub> emissions in accordance with Manchester City Council's policies and guidelines.

A number of planning policies, both national and local that apply to the proposed development, have been reviewed together with the Building Regulations Approved document part L1A & L2A. The policies advise that a carbon emissions reduction of 15% greater than Part L of the Building Regulations (2010) shall be achieved.

The baseline energy emissions have been developed, producing a preliminary SBEM calculation for the building. Passive fabric measures across the building including improvements to the thermal performance and air tightness above Part L requirements of the Building Regulations have been incorporated.

| Construction Element | Building Regulation Specification   | Development Specification          |
|----------------------|-------------------------------------|------------------------------------|
| Floor                | 0.25 W/m <sup>2</sup> K             | 0.15 W/m <sup>2</sup> K            |
| Wall                 | 0.30 W/m <sup>2</sup> K             | 0.20 W/m <sup>2</sup> K            |
| Roof                 | 0.20 W/m <sup>2</sup> K             | 0.15 W/m <sup>2</sup> K            |
| Window               | 2.0 W/m <sup>2</sup> K              | 1.4 W/m <sup>2</sup> K             |
| Air Permeability     | 10 m <sup>3</sup> /h/m <sup>2</sup> | 3 m <sup>3</sup> /h/m <sup>2</sup> |

In addition to the Passive design measures, Active Building Services are to be designed to minimise direct energy consumption and CO<sub>2</sub> emissions, with particular emphasis on the following;

- Improved Boiler Efficiencies;
- Reduced Standing Losses from Pipes and Cylinders;
- Increased Hot Water Generating Efficiencies;
- Energy Efficient LED Lighting;
- Improved Lighting Controls;
- Low Energy Motors in Pumps and Fans;
- Efficient Heat Recovery in relevant systems and,
- Enhanced heating controls

Renewable and Low Carbon technologies have been considered and of the available solutions, it is recommended that the proposed scheme implements a combined heat and power system.

The inclusion of Combined Heat and Power technology (CHP) is considered to be the most appropriate for this proposed development and has been incorporated into the primary heat generation for the hot water systems. This will reduce the primary energy use requirement within the proposed development, i.e. the Domestic Hot Water generation.

The Energy Model has been calculated to take account the selected renewable energy technologies proposed for this proposed development.

The carbon emissions on this proposed development has been calculated to be between a 19-26% reduction below Part L 2010 which exceeds the required 15% and is therefore in line with the local Manchester energy policy (Supplementary Planning Document 2009).

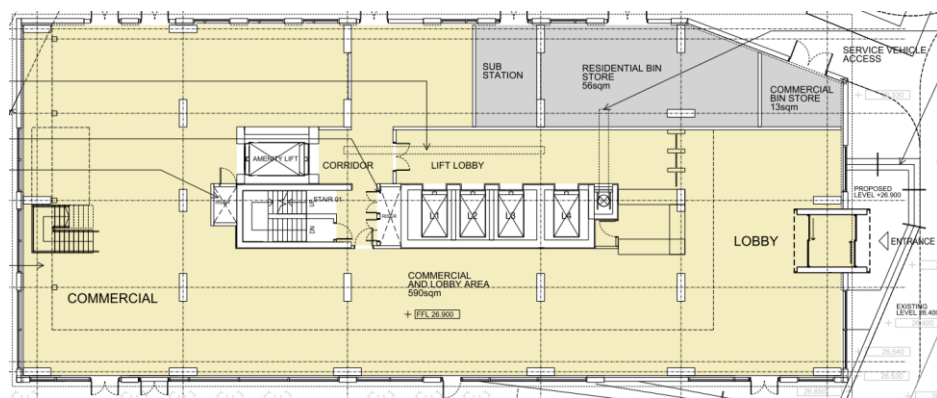
## Section 2 – Introduction

Futureserv Ltd have been appointed to produce an Energy Statement to support the planning application for a proposed development at St. Johns, Manchester. The proposed development shall consist of approximately 372 co-living apartment units with a mixture of slight variations in sizes, but all containing ensuite facilities and fitted kitchens.

This Energy Statement addresses the planning requirements of Manchester City Council as set out in Manchester's Core Strategy Development Plan, adopted 12<sup>th</sup> July 2012.

The strategy proposed for this development is the use of a Central Energy System incorporating renewable and Low Carbon techniques to meet Manchester City Council's desire for carbon reduction using Low or Zero Carbon Technology.

The strategy is essentially based on the reduction of energy consumption by use of passive construction measures, active energy efficient equipment and Low Carbon technology.



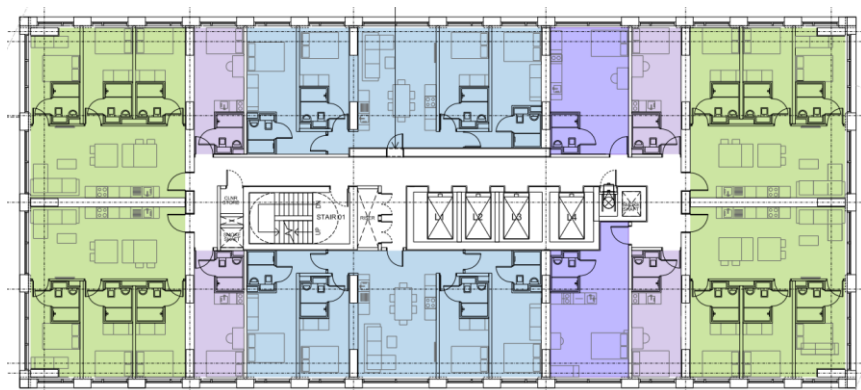
Ground floor level



## Section 3 – Development Proposals

Futureserv Ltd have been appointed by Vita Group Ltd to produce an Energy Statement in support of a planning application for the construction of a high-quality new multi-use development at St. John's, Manchester.

The development shall consist of approximately 372 co-living studio units. The building will also incorporate co-working floors, amenity space, communal spaces and commercial areas.



Typical upper level accommodation floor

This Energy Statement has been prepared to illustrate the environmental aspects of the proposed development highlighting the Energy/Carbon emission profile and assess the options available for reducing energy consumption and associated CO<sub>2</sub> emissions, in accordance with Manchester City Council's policies and guidelines.

Futureserv Consulting Engineers have collaborated with the design team in order to provide a holistic solution for the building that will provide an efficient envelope and contain intelligent building services reducing the environmental impact of the development whilst providing comfortable living accommodation.

## Section 4 – Policy and Legislation

There are a number of planning policies both national and local that apply to the proposed development.

The UK government has signed up to a legally binding agreement to reduce Carbon emissions by 34% based on 1990 levels before 2020 and by 80% before 2050, this responsibility is being discharged using the Climate Change Act 2008.

The National Planning Policy Framework (NPPF), offers specific guidance which highlights the UK's aspiration to support a transition to a Low Carbon future in a changing climate and in particular, to encourage the use of renewable resources such as Renewable Energy and states;

*Planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and effects of climate change through policies which reduce energy use and emissions, promote development of renewable energy resources, and take climate change impacts into account in the location and design of development.*

### Local Policies

The proposed development is located at St. Johns, within Manchester City Centre. This means that both the Manchester Local Development Framework/Core Strategy Development Plan apply to this development.

In addition to Building Regulations compliance the performance of the buildings will be such as to provide additional carbon savings in line with Policy EN 4 & EN 6 of the Core Strategy.

Within these documents, specific policies highlight carbon emissions reductions and the impacts of climate change. These are as follows;



## Manchester's Local Development Framework

### Core Strategy Development Plan Document

Adopted 11<sup>th</sup> July 2012

Published by Manchester City Council  
[planningstrategy@manchester.gov.uk](mailto:planningstrategy@manchester.gov.uk)



## Manchester Local Framework

### Policy EN 4: Reducing CO<sub>2</sub> Emissions

#### Policy EN 4

##### Reducing CO<sub>2</sub> Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO<sub>2</sub> emissions, and rising fossil fuel prices, through the following actions:

- All development must 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
  - to meet residual energy requirements through the use of low or zero carbon energy generating technologies
- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings.
- Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.
- The use of building materials with low embodied carbon in new development and refurbishment schemes.

## Policy EN 6: Target Framework for CO2 reductions

### Policy EN 6

#### Target Framework for CO<sub>2</sub> reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO<sub>2</sub> emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows

As the application for residential development is of 10 or more units and generally, over 1,000 sqm will, as a minimum, the development will meet the Core Strategy targets shown in Tables 12.1 regarding domestic CO<sub>2</sub> emissions, and 12.2 regarding non-domestic CO<sub>2</sub> emissions.

Development must follow the principles of the Energy Hierarchy, being designed:

- to reduce the need for energy through design features;
- to reduce the need for energy through energy efficient features; and
- to meet residual energy requirements through the use of low or zero carbon energy generating technologies.

New residential development of 10 units or more, to achieve **carbon emissions reduction standards 15% greater than Part L of the Building Regulations (2010)** depending on the type and location of the scheme, unless this can be shown not to be viable.

Non-domestic development over 1,000m<sup>2</sup> will be expected as a minimum to achieve **carbon emissions reduction standards 15% greater than Part L of the Building Regulations (2010)** depending on the type and location of the scheme, unless this can be shown not to be viable.

- Commercial buildings with a high proportion of emissions from electricity use (>45 kg CO<sub>2</sub> /m<sup>2</sup>) to achieve +10% increase on Part L 2010.
- Other buildings to achieve +15% increase on Part L 2010

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 Electricity intense areas: Locations where the predominant building type has an all electric fit-out such as retail units and leisure complexes.
- Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

#### Domestic CO<sub>2</sub> emissions reduction targets

Table 12.1

| Target                                  | % Minimum requirement                                                                         |
|-----------------------------------------|-----------------------------------------------------------------------------------------------|
| Target 1: Network development area      | CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010 |
| Target 2: Electricity intense buildings | +15% increase on Part L 2010                                                                  |
| Target 3: Micro generation area         | +15% increase on Part L 2010                                                                  |

#### Non-domestic CO<sub>2</sub> emissions reduction targets

Table 12.2

| Target                                                                                                                                                                    | % Minimum requirement                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Target 1: Network development area                                                                                                                                        | CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010 |
| Target 2: Electricity intense buildings<br>(Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO <sub>2</sub> /m <sup>2</sup> ) | +10% increase on Part L 2010                                                                   |
| Target 3: Micro generation area                                                                                                                                           | +15% increase on Part L 2010                                                                   |

## Building Standards

1. New development should be designed and constructed to meet the relevant Building Regulations, as a minimum, with a view to:
  - a) Maximising energy efficiency and the use of low carbon energy
2. In meeting the carbon reduction targets set out in Building Regulations, the Council will expect development to be designed in accordance with the following energy hierarchy:
  - a) Reduce energy demand through energy efficiency measures
  - b) Supply energy through efficient means (i.e. low carbon technologies)
  - c) Utilise renewable energy generation

To reduce a **building's carbon footprint**, it is important that a **simple energy hierarchy** is used.



## Renewable Energy Generation

1. Proposals for the installation of renewable and low carbon energy technologies, including both building-integrated and standalone schemes will be promoted and encouraged, provided that:
  - a) any significant adverse impacts can be mitigated;
  - b) where biofuels are to be utilised, they should be obtained from sustainable sources and transportation distances are minimised;
  - c) any energy centre is suitably located and designed to a high quality such that it is sympathetically integrated with its surroundings; and
  - d) all proposals are consistent with any relevant Policies in this Plan.

Renewable energy can be supplied at a national level from sources such as large offshore wind farms, solar farms or hydroelectric schemes. Although not a source of renewable energy, nuclear power is a major low carbon source. Locally, smaller and on-site renewable energy schemes include solar photovoltaic, solar thermal, ground source and air source heat pumps and, where fuelled by biomass or biogas, district energy schemes and combined heat and power plants (CHP). Due to the lack of large areas of open space within the city, on-site and neighbourhood-scale renewable energy schemes are the most effective way for Manchester to contribute to renewable energy targets set out by the Government.

Although wind turbines are a good example of a renewable energy source, around 90% of Manchester is unsuitable for wind turbines due to the density of development.

The indications from the evidence base identify there will be a greater need to encourage and support a wider spectrum of renewable energy technologies to help deliver the energy supply that would be placed on the grid as a result of the levels of growth planned for the city. Therefore, as part of the strategic sites detailed in this Plan, any proposed development schemes will be expected to

consider and incorporate, where viable, renewable energy generation technologies as part of the overall suite of energy supply.

### **Building Regulations Part L (2013) Compliance**

The proposed development is being designed to comply with the Building regulations approved document Part L1A & L2A, 2013 edition. These approved documents took effect from 6<sup>th</sup> April 2014.

The scheme will comply with the criteria of Building Regulations (2013) Part L1A for residential and Part L2A (2013) for the non - residential units.

The main changes in these approved documents from the previous revisions are that;

- The notional building used to determine carbon dioxide targets is the same size and shape as the actual building, constructed to a concurrent specification. The Part L2a 2013 specifications have been strengthened to deliver 9 per cent carbon dioxide savings across the new non-domestic building mix relative to part L 2010. The Part L1a 2013 specifications have been strengthened to deliver 6 per cent carbon dioxide savings across the new domestic building mix relative to part L 2010.
- A wider set of notional buildings has now been defined for top-lit, side-lit (heated only) and side-lit (heated and cooled) buildings. The notional building air permeability has been further subdivided by size.
- The document consolidates the amendments made in December 2012 requiring the feasibility of high-efficiency alternative systems to be taken into account before construction commences.

### **Summary of Requirements.**

- 1. Commercial areas = Reduce carbon emissions by 6% over Part L2a 2013**
- 2. Residential areas = Reduce carbon emissions by 9% over Part L1a 2013**



## Section 5 – Energy Strategy

### 5.1 - Baseline Energy Assessment

Futureserv Ltd have conducted analysis for this stage of the development on the current design of the building, to show compliance with the Building Regulations Part L1A & L2A:2013, therefore setting a reference baseline. This was carried out in order to understand the development's Carbon emissions without any Carbon Emission mitigation measures.

This baseline energy assessment has been developed, producing a preliminary Simplified Building Energy Model (SBEM) calculation & SAP calculations (Standard Assessment Procedure) for the building. The baseline models have been created to provide Target Emission rates (TER). The calculations then in turn produce Building Emission rates (BER) & Dwelling Emission rates (DER) which are equal to or lower than that of the TER.

SBEM & SAP are the standard assessment methods for the carbon emission levels of a building. This considers the fabric properties of the building, the method of heating/cooling/ventilating/hot water etc and produces an estimate of carbon emissions.

If the building does not pass the Part L criteria, then it is an iterative process to add renewable/low carbon technologies, to lower the overall carbon emissions.

For this development, the sample residential carbon emissions for the TER are **15.79 kgCO<sub>2</sub>/m<sup>2</sup>/annum**, and the actual DER are **14.10 kgCO<sub>2</sub>/m<sup>2</sup>/annum**.

For this development, the commercial/office carbon emissions for the TER are **18.80 kgCO<sub>2</sub>/m<sup>2</sup>/annum**, and the actual BER are **14.90 kgCO<sub>2</sub>/m<sup>2</sup>/annum**.

| Block Compliance Report - DER                         |            |                                |                                          |                                          |
|-------------------------------------------------------|------------|--------------------------------|------------------------------------------|------------------------------------------|
| Block Reference: 000734                               |            | Block Name: Vita T2 [INTENT 1] |                                          |                                          |
| Property-Assessment Reference                         | Multiplier | Floor Area (m <sup>2</sup> )   | DER (kgCO <sub>2</sub> /m <sup>2</sup> ) | TER (kgCO <sub>2</sub> /m <sup>2</sup> ) |
| 107123-001                                            | 1          | 103.7                          | 10.16                                    | 11.27                                    |
| 107124-001                                            | 1          | 17.35                          | 22.50                                    | 29.47                                    |
| 107125-001                                            | 1          | 77                             | 13.35                                    | 13.83                                    |
| 107126-001                                            | 1          | 77                             | 14.24                                    | 14.41                                    |
| 107127-001                                            | 1          | 17.35                          | 22.50                                    | 29.88                                    |
| 107128-001                                            | 1          | 103.7                          | 12.25                                    | 12.90                                    |
| 107129-001                                            | 1          | 17.35                          | 22.50                                    | 29.88                                    |
| 107130-001                                            | 1          | 27                             | 16.23                                    | 22.14                                    |
| 107131-001                                            | 1          | 77                             | 14.24                                    | 14.41                                    |
| 107132-001                                            | 1          | 77                             | 13.35                                    | 13.83                                    |
| 107133-001                                            | 1          | 27                             | 16.05                                    | 21.28                                    |
| 107134-001                                            | 1          | 17.35                          | 22.50                                    | 29.47                                    |
| Totals:                                               | 12         | 638.8                          | 199.87                                   | 242.79                                   |
| Average DER = 14.10 kgCO <sub>2</sub> /m <sup>2</sup> |            |                                | PASS                                     |                                          |
| Average TER = 15.79 kgCO <sub>2</sub> /m <sup>2</sup> |            |                                |                                          |                                          |

## BRUKL Output Document



Compliance with England Building Regulations Part L 2013

### Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

|                                                                                                    |                     |
|----------------------------------------------------------------------------------------------------|---------------------|
| CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum | 18.8                |
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum               | 18.8                |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum             | 14.9                |
| Are emissions from the building less than or equal to the target?                                  | BER <= TER          |
| Are as built details the same as used in the BER calculations?                                     | Separate submission |

## 5.2 - Passive Design Improvements

On the completion of the model and establishment of the Target Emission Rates (TER), the building emissions have been reduced through judicious passive design. This has involved an assessment of non-energy consuming design decisions to create a fabric first approach to energy efficiency. This is through.

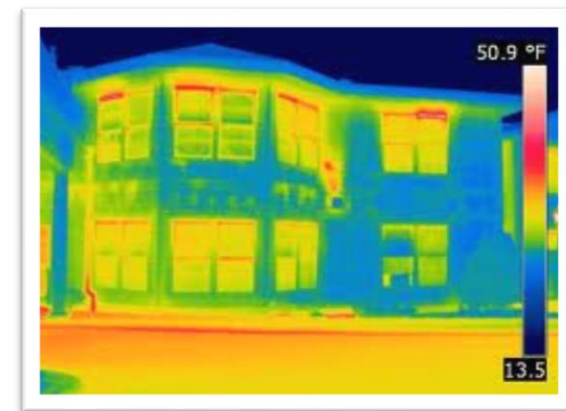
- Improved air permeability performance
- Better thermal insulation

Passive fabric measures across all the building include improvements to the thermal performance and air tightness above Part L requirements of the Building Regulations and this effectively allows the building envelope to attenuate external conditions without recourse to active Building Services.

The table to the right shows the proposed material specification that will be incorporated within the building design to limit heat losses and ensure efficient operation of the proposed development.

An airtightness of 3-4 m<sup>3</sup>/hr/m<sup>2</sup> @50Pa is targeted for this development in order to minimise uncontrolled ventilation. An improved air tightness reduces heat losses and energy demand of the development.

| Construction Element | Building Regulation Specification   | Development Specification            |
|----------------------|-------------------------------------|--------------------------------------|
| Floor                | 0.25 W/m <sup>2</sup> K             | 0.15 W/m <sup>2</sup> K              |
| Wall                 | 0.30 W/m <sup>2</sup> K             | 0.20 W/m <sup>2</sup> K              |
| Roof                 | 0.20 W/m <sup>2</sup> K             | 0.15 W/m <sup>2</sup> K              |
| Window               | 2.0 W/m <sup>2</sup> K              | 1.3-1.4 W/m <sup>2</sup> K           |
| Air Permeability     | 10 m <sup>3</sup> /h/m <sup>2</sup> | 3-4 m <sup>3</sup> /h/m <sup>2</sup> |



## 5.3 - Energy Efficiency Improvements

In addition to the Passive design measures described in the preceding Section to improve the building envelope performance, the Active Building Services are to be designed to minimise direct energy consumption and CO<sub>2</sub> emissions, with particular emphasis on the following;

- Improved Boiler Efficiencies;
- Reduced Standing Losses from Pipes and Cylinders;
- Increased Hot Water Generating Efficiencies;
- Energy Efficient LED Lighting;
- Improved Lighting Controls;
- Low Energy Motors in Pumps and Fans;
- Efficient Heat Recovery in relevant systems and,
- Enhanced heating controls

It is currently proposed that the heat energy for the domestic hot water will be generated using gas fired centralised plant and a combined heat and power (CHP) plant installation which will be distributed to each individual studio accommodation unit.

The space heating will be via electric panel heaters or similar in all residential areas of the building. These will be complete with thermostatic and time controllers.

The ventilation to each studio unit will be natural ventilation via openable windows, for which further analysis will be required. The kitchen and ensuite facilities will have high efficiency Mechanical Ventilation with Heat Recovery (MVHR), as required by Building Regulations.

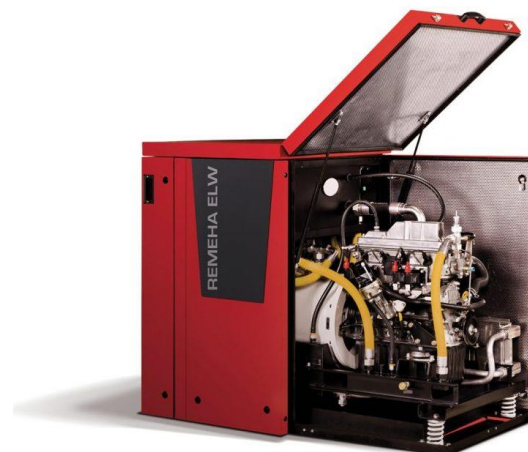
Communal and general areas of the building will be ventilated and potentially cooled as required by detailed calculations, with dedicated mechanical ventilation heat recovery units or air handling units.

All internal lighting installations will make use of low energy technologies combined with presence and absence detection in conjunction with timed

setbacks. 100% low energy lighting provision will be included within the development. Photo switching and automatic dimming will be specified to the communal areas of the building in order to improve the efficiency of the lighting system.

All fans, motors and pumps shall be specified to incorporate ECA accredited technology and appropriate controls.

| Construction Element | Specification                                                                                |
|----------------------|----------------------------------------------------------------------------------------------|
| Ventilation          | Natural Ventilation supplemented with MVHR                                                   |
| Lighting             | 100% low energy fittings                                                                     |
| Space Heating        | Electric Panel Heaters                                                                       |
| Heating Control      | Thermostatic and time controlled                                                             |
| Water Heating        | Plate heat exchangers with buffer vessels fed from CHP and high efficiency gas fired boilers |

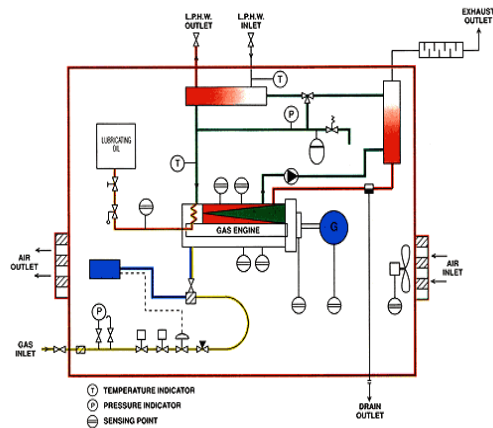


## 5.4 - Renewable Energy Improvements

In order to comply with Manchester's Local Plan, which aims to utilise renewable or low carbon technologies, there are a number of options to consider. All currently acknowledged and commercially available technologies have been considered and assessed with the conclusions summarised below;

### Combined Heat and Power (CHP)

On-site generation of electricity and the utilisation of waste heat from this process within a building can create a beneficial arrangement whereby the transmission losses of grid supplied electricity can be omitted. The use of CHP tends to require a steady and continuous heat demand therefore the large quantities of domestic hot water associated with residential studio accommodation would satisfy this requirement.



Diagrammatic layout of small-scale CHP unit

Since it has been established that the dominant energy requirement within the studio accommodation results from domestic hot water generation, the use of an accurately sized CHP solution can dramatically reduce the energy and Carbon intensity of this type of development.



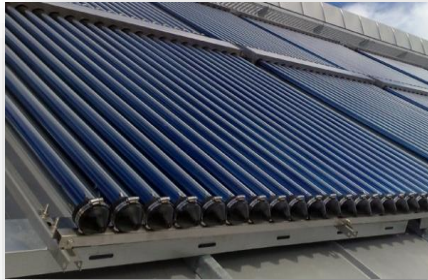
Typical CHP Unit

Taking into account the proposed building size, usage and occupancy level, it has been determined that a suitably sized CHP engine operating for a minimum of 5000hrs/annum would contribute to a reduction in Carbon emissions.

### Solar Thermal Collectors

The use of flat plate & evacuated tube thermal panels has been identified as a potential method of harnessing renewable solar energy by pre-heating domestic hot water provision.

The recent introduction of the renewable Heat Incentive may further improve the financial viability for the technology.



Example of Solar Thermal unit

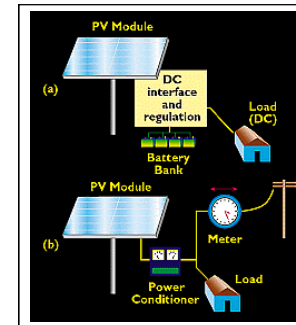
However, there is a fundamental conflict between Solar Thermal Collectors and the proposed Combined Heat and Power technology as both systems would be attempting to deliver to the same hot water heating systems and thus would effectively de-rate each other.

For this reason, we have not considered the use of solar thermal collectors on this development.

## Solar Photovoltaic Panels

The option to utilise roof mounted or Building Integrated Photovoltaic panels to generate electrical energy is a renewable energy method of generating Carbon free electrical power.

Due to the density in occupancy within the development, there is likely to be a fairly constant base electrical load prevalent on the building which may be mitigated in part by the use of Solar PV.



PV System components

The flat roof areas of the building are relatively limited therefore the contribution from PV would not provide a significant impact for the development.

## Wind Turbines

Wind energy can be a cost-effective method of renewable power generation and turbines can produce Carbon neutral electricity with outputs ranging from watts to megawatts.

The most common design is for three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower. The blades drive a generator either directly or via a gearbox (generally for larger machines) to produce electricity.

The electricity can either link to the grid or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC) for feeding into the grid.

There are a variety of wind turbines on the market ranging from smaller turbines that can be attached directly to a buildings structure to larger stand-alone turbines.

City centre and sub-urban locations generally experience poorer yields for electricity output from small and medium scale wind turbines, due to obstructions and variations in local topography.



Wind Turbine Installation

Also taking into account the visual impact and unwanted noise in an environment with sleeping accommodation the use of wind turbines is discounted from inclusion at this development.

## **Ground Source Heat Pumps**

The ground below buildings remains at a constant temperature of around 10°C to 12°C offering the ability to extract energy in the winter and discharge energy in the summer from cooling with the energy exchange being achieved via open or closed loop systems linked to heat pumps.



Ground Source Heat Pump Installation

The footprint of the development and the surrounding site conditions do not have the potential to deliver an element of space available for closed loop heat exchange, due to this and the conflict with the CHP heat sink, the likely yield, peak load demand and cost feasibility, we have discounted Ground Source Heat Pumps at this development in favour of better performing technologies.

## **Air Source Heat Pumps**

Air source heat pumps provide an accepted solution for using renewable energy taken from ambient air to heat a building in the winter and discharge heat from cooling in the summer.



Typical External Condenser Unit

The use of air source heat pumps in order to provide heating to the development would conflict with the electric heating system that makes use of the energy generated from the CHP.

However, for the main ground floor communal area of the development, refrigerant based air source heat pumps will be utilised in the form of a VRF system to heat and cool the areas, due to the higher concentration of occupancy.

For this reason, we have not considered the use of air source heat pumps throughout this development.

## **Biomass**

Some success on other projects has been made with the implementation of wood fuelled energy equipment forming a Carbon Neutral heat source however these projects have tended to be light density Sub-Urban or even rural in their location. The relatively constrained nature of this site, together with limited storage space and potential delivery issues, due to the city centre location, reduces the opportunity to take advantage of a Biomass solution for this development.



Plantroom Biomass Installation

In addition, flue emissions and the requirements the Clean Air Act has led to a dismissal of this technology for this particular scheme.

## **Total Assessments**

Following the optimisation of the respective energy efficiencies of the buildings the development will aspire to obtain a proportion of its predicted usage through decentralised low and zero carbon technologies where feasible and viable.

The central Building Services Systems will be supplemented by Renewable and Low Carbon technologies to further reduce the associated Carbon emissions.

Of the available solutions considered, it is therefore recommended that the proposed scheme implements the following renewable energy technologies:

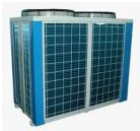
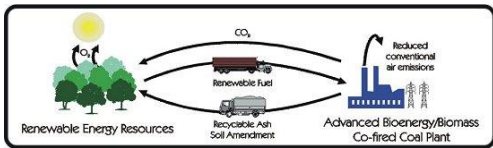
- Combined Heat and Power System
- Air Source Heat Pumps (co-work areas & ground floor communal areas only)



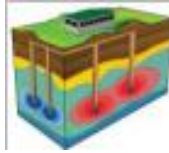
The inclusion of Combined Heat and Power technology (CHP) is the most appropriate for this development and has been incorporated into the primary heat generation for the hot water systems. This will reduce the primary energy use requirement within the development, i.e. the Domestic Hot Water generation.

The air source heat pumps will only be used within the commercial and office areas of the building, but nonetheless present a high efficiency method of heating and cooling for this area.

The Energy Models have been calculated to take account of the selected renewable energy technologies proposed for this development.

| Renewable Technology                       | Image                                                                                | Comments                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Combined Heat and Power<br><b>SELECTED</b> |     | The integration of Combined Heat and Power technology is proposed for the new development, to provide base load domestic hot water generation. Can be easily linked to the grid supplied electricity.                                                                                                                                                                         |
| Solar Photovoltaic<br><b>POSSIBLE</b>      |     | The flat roof areas of the building are fairly exposed to the sunlight, but the relatively small footprint could not provide a significant contribution in energy reduction. It is preferred to maximize the low carbon heating and power supplies provided by the district heating and provide an appropriate base load for this.                                            |
| Air Source Heat Pumps<br><b>SELECTED</b>   |     | Refrigerant Air Source Heat Pumps will be utilised for the main ground floor commercial areas and the co-work levels of the development, where cooling as well as heating will be required due to the higher occupancy concentration.                                                                                                                                         |
| Solar Thermal<br><b>POSSIBLE</b>           |     | There is potential to include flat panel solar thermal collector located at roof level serving the domestic hot water systems. However, this solution would conflict with the selected LZC for heat discharge capacity. It is preferred to maximize the low carbon heating and power supplies provided by the district heating and provide an appropriate base load for this. |
| Biomass Boilers<br><b>DISCOUNTED</b>       |  | Biomass boiler solutions have been discounted at this location due to potential clean air issues, deliverability logistics and the lack of available storage space for the required quantity of fuel.                                                                                                                                                                         |
| Wind Turbines<br><b>DISCOUNTED</b>         |   | Wind turbines have been discounted due to the resulting visual/noise impact from the equipment, and relatively poor performance of the solution when used within Urban and Sub-Urban locations.                                                                                                                                                                               |

Ground Source Heat Pump  
**DISCOUNTED**



The inclusion of Ground Source Heat Pumps has been discounted within this development due to the conflict with the selected CHP technology, system cost viability and also the site constraints.

The technologies that are likely to be feasible will be considered and assessed further against viability criteria through the design development.

## 5.5 - Energy Generation and Distribution Systems

The case for renewable energy systems is clear and Manchester City Council's current energy policy requires developments to make the fullest contribution to the mitigation of climate change, and to minimise Carbon Dioxide emissions.

As a consultant, Futureserv has an over-arching philosophy delivering design of truly sustainable energy systems, employing the widely recognised hierarchy;

- Be Lean - Reduce demand wherever possible utilising passive measures.
- Be Clean - Where energy is used, then it should be optimised to operate at the highest efficiencies practical.
- Be Green - Take advantage of renewable options to reduce fossil fuel energy sources.

The proposed development will be designed to be served by electric panel heaters throughout, utilising the ever-increasing clean electricity provided from the grid. This will be supplemented by the electricity generated from the onsite CHP unit.

The heating plant will be designed around a high efficiency heat generator, providing Domestic Water Heating. Pre-heat to the systems will utilise Low Carbon energy taken from a Combined Heat & Power system acting as lead heat source in conjunction with thermal storage.

The main Mechanical and Electrical plant systems would be located within a purpose designed plant space at the basement level, incorporating adequate access for future maintenance and plant replacement.

All plant and equipment would be equipped with energy control measures incorporating variable speed drives, with low energy motors provided on ventilation fans and hydraulic pumps.

The development would be provided with a boosted cold-water supply system located within the main plant rooms and all sanitary appliances are to be equipped with low water flow devices.

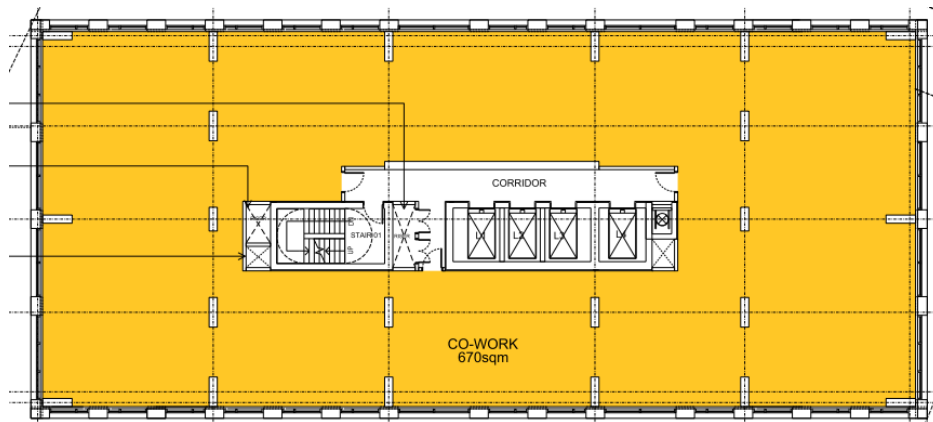
The proposed Combined Heat and Power system will provide a source of Low Carbon electricity to the development and where possible, redundant generation will be exported back to grid. However, it is anticipated in this type of building that there will be sufficient electrical demand all year round to utilise all the generated electricity.

## 5.6 – Carbon & Energy Performance Calculations

To enable demonstration that the environmental benefits associated with our energy hierarchy approach to energy demand and emission reductions for St. John's T2, approved SBEM & sap software has been used to generate energy demand calculations for the building.

At this stage of the development, typical values and efficiencies have been selected for the assessment. These will be updated to more precise figures when equipment selections are made during the detailed design stage.

The below tables present baseline energy demand and emissions and actual energy demand and emissions for the development in the form of Target Emission Rates and Building Emission Rates (Kg CO<sub>2</sub>/m<sup>2</sup>/annum) and Target Fabric Energy Efficiency and Building Fabric Energy Efficiency (kWh/m<sup>2</sup>/annum).



Typical Co-Work Office Floor Layouts

|                                         |                                   |
|-----------------------------------------|-----------------------------------|
| <b>Commercial Target Emissions Rate</b> | <b>18.80 kg/CO2/m<sup>2</sup></b> |
|-----------------------------------------|-----------------------------------|

|                               |                                   |
|-------------------------------|-----------------------------------|
| <b>Building Emission Rate</b> | <b>14.90 kg/CO2/m<sup>2</sup></b> |
|-------------------------------|-----------------------------------|

|                                                                |                                                                 |
|----------------------------------------------------------------|-----------------------------------------------------------------|
| <b>Carbon Reduction from Target Emission Rates Part L 2013</b> | <b>20% reduction = 26% reduction over Part L 2010 emissions</b> |
|----------------------------------------------------------------|-----------------------------------------------------------------|

Therefore, the CO<sub>2</sub> reduction due to utilising the energy hierarchy on this development has been calculated to be **20%** and also in line with Manchester City Council Local Plan Document.

The Part L 2013 specifications have been strengthened to deliver 6 per cent carbon dioxide savings relative to part L 2010 therefore the emissions rate is a **26% improvement** on the Part L 2010.

|                                          |                                   |
|------------------------------------------|-----------------------------------|
| <b>Residential Target Emissions Rate</b> | <b>15.79 kg/CO2/m<sup>2</sup></b> |
|------------------------------------------|-----------------------------------|

|                               |                                   |
|-------------------------------|-----------------------------------|
| <b>Dwelling Emission Rate</b> | <b>14.10 kg/CO2/m<sup>2</sup></b> |
|-------------------------------|-----------------------------------|

|                                                                |                                                                     |
|----------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Carbon Reduction from Target Emission Rates Part L 2013</b> | <b>10.7% reduction = 19.7% reduction over Part L 2010 emissions</b> |
|----------------------------------------------------------------|---------------------------------------------------------------------|

Therefore, the CO<sub>2</sub> reduction due to utilising the energy hierarchy on this development has been calculated to be **10%** and also in line with Manchester City Council Local Plan Document.

The Part L 2013 specifications have been strengthened to deliver 9 per cent carbon dioxide savings relative to part L 2010 therefore the emissions rate is a **19% improvement** on the Part L 2010.

## Section 6 - Conclusions

This energy statement has summarised the energy hierarchy requirements for St. John's T2 to respond to emission reduction aspirations set out within the Manchester Core Strategy Plan, in particular policies EN4 and EN6, to implement the use of low carbon and/or renewable technologies.

The proposed development will incorporate passive energy techniques available in the construction industry to reduce its ongoing requirement to consume energy to heat, ventilate and light the building, this is achieved by improved efficient fabric design in excess of the thermal properties set out within the Building Regulations.

The proposed development will incorporate energy efficiency measures in its Building Services to reduce the carbon footprint of the site below the passive improvement stage, using highly efficient heat generation plant, heat recovery systems and energy efficient and highly controllable lighting.

The proposed development will make use of renewable and Low Carbon energy techniques comprising a Combined Heat and Power system and associated thermal storage to generate hot water (hot water demand being identified as the dominant energy requirement within the proposed development).

Achieving a net-zero carbon building within a city centre location with the available/suitable technologies and occupant expectations is limited. A low-rise remote building on a low-density site will have a better chance of being net-zero carbon emissions via using onsite renewables. However, a high-rise city centre development faces many restrictions when looking to implement those purely renewable technologies, such as wind turbines and biomass boilers.

The feasibility of getting to net-zero carbon is unrealistic for this development. The approach adopted is to implement energy saving options which reduce the requirement for regulated energy, such as a more efficient building envelope, and utilising those high efficiency low carbon and suitable renewable technologies which are feasible and appropriate for this type of building.

Net-zero energy is an ambitious goal for any building, however like the related goal of creating a carbon-neutral building, any net-zero carbon building has to first achieve significant load reductions and system efficiencies, and then try to meet the remaining loads with onsite energy generation. This is the "lean", "clean", "green" approach as mentioned earlier in the document. The measures adopted by this development do follow this principle. The regulated energy sources are targeted for reduction by means of both passive and active measures in terms of improved u-values, reduced air tightness, and energy efficiency MEP systems. CHP is then proposed for on site electrical and hot water generation, together with air source heat pumps (utilising energy absorbed from the outside ambient air) for the commercial co-workspaces.

Overall, the Carbon emissions from the proposed St. John's T2 development show potential for a total reduction in emissions from baseline set by current Building Regulations Part L 2013, by 10% on the residential and 20% on the commercial areas. This equates to a 19% and 26% increase over Part L1/L2 2010 and is well in excess of the required 15% improvement as required by the planning policy documents.

The strategy improves on the fundamental principles of the Building Regulations and will make a significant contribution to reducing the annual CO<sub>2</sub> emissions of the proposed development.