

1 SNELL STREET MANCHESTER

Energy & Environmental Standards
Statement

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NOVO

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AMENDMENT HISTORY



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Appendix A – SAP Reports

1 EXECUTIVE SUMMARY

The proposed development of 9nr Houses known as 1 Snell Street Manchester, is located in an urban area of Manchester City Centre and has incorporated building fabric enhancement (above current Building Regulation requirements) and renewable technology to increase the energy efficiency of the building.

This concludes that the development uses less energy, by adopting sustainable design and construction measures and by supplying energy efficiently.

Given the complexity of calculating and assessing CO₂ emissions, the Manchester City Council requires all proposed developments to be designed and built to minimise greenhouse gas emissions across their lifetime and incorporate sustainable design and construction measures to comply with the current criteria set out within their adopted Core Strategy.

The methodology for this report is to take a 'fabric first' approach as set out in Manchester City Councils Core Strategy, making improvements to the envelope first, reviewing the results due to these fabric improvements and then reviewing suitable technologies to enhance this design philosophy where feasible. The calculations have been carried out using current Building Regulations Part L1A 2013.

The proposed fabric specification is described in Table 1 below, the floors, roof u-values and air permeability target are improved over the notional u-values of Part L1A 2013. Accredited construction details have also been used throughout to improve the Y-value. This is key to the fabric first approach which aims to reduce the buildings energy demand and ultimately achieve a reduction in annual CO₂ production prior to the installation of low carbon/renewable technologies.

Table 1 Building Fabric Specification

Building Fabric			
Element	L1A: 2013 Limiting U-values (W/m ² .k)	L1A: 2013 Notional U-values (W/m ² .k)	Proposed U-values (W/m ² .k)
Floors	0.25	0.13	0.125
External Walls	0.30	0.18	0.18
Party walls between dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.12
Windows	2.00	1.40	1.40
Doors	2.00	1.0	1.8
Y – value (W/m ² .k)	0.15	~0.05	~0.03 – 0.08
Air permeability (m ² /h.m ² @ 50 pa)			
All dwellings	10.0	5.0	4.0

Regarding the systems used, the development will utilise an all-electric approach, heating and hot water energy demand will be provided by Low Carbon Electric Air Source Heat Pumps. For the ventilation needs, highly efficient Mechanical Ventilation Heat Recovery (MVHR) units will be implemented, these units will have a heat recovery efficiency of 88%. Finally, all units will utilise 100% low energy lighting throughout.

In addition to efficient systems, consideration has been given to the reduction of mains potable water usage through efficient water fixtures. This is further detailed in section 4.5 however potable water demand is to be reduced to <16 litres/person/day as per the requirement within Building Regulations.

The location itself is sustainable in respect to flooding as it is situated in flood zone 1 and constitutes minimal risk of flooding. The available roof space also allows for opportunities for planting.

There is an emphasis on fully utilising electric systems in this recommendation owing to the imminent implementation of a new update to Part L1A building regs known as SAP 10. This update has a major change to the Fuel Carbon Factors for each fuel type and effectively brings grid electricity in line with gas. This is further discussed in Section 2.5.1 of this report, the primary benefit of the decarbonising of grid electricity is that it makes all-electric schemes far more efficient in terms of CO₂ reduction and opens up the possibility of achieving zero carbon in the future as the portion of renewable energy being added to the grid increases. An all-electric strategy has therefore been pursued to take advantage of this benefit.

An all-electric system has been pursued over a wet system as the use of a wet heating system, connected to the district heating source, would require additional plant space at ground floor level to incorporate plate heat exchangers, large buffer vessels, pumps, pressurisation units. This would lose key space at ground floor level as well as expand the amount of plant for the development to maintain.

Utilising an all-electric strategy combined with the application of PV will allow the development to achieve the required CO₂ reduction dictated by the Manchester Core Strategy and also open up the opportunity to achieve zero carbon in the future. Currently the portion of renewable energy supplying the national grid is circa 48% therefore as the grid becomes greener so will developments that primarily use grid electricity.

For each of the 9nr units within the development, the following results have been obtained, based on an area weighted average block compliance calculation method to adhere to the site wide requirements set out within the Local Authority Policies:

Current 2013 Building Regulations Results

- | | |
|--|--|
| • Combined Target Carbon Dioxide Emission Rate (TER) | 21.94 kgCO₂/m².yr |
| • Combined Building Carbon Dioxide Emission Rate (BER) | 14.66 kgCO₂/m².yr |

Total % improvement over Part L1A 2013 = 33.18%

Total % improvement over Part L1A 2010 = 40.01%

Estimated SAP 10 Building Regulations Results

- | | |
|--|--|
| • Combined Target Carbon Dioxide Emission Rate (TER) | 10.24 kgCO₂/m².yr |
| • Combined Building Carbon Dioxide Emission Rate (BER) | 3.6 kgCO₂/m².yr |

Total % improvement SAP 10 Estimate = 64.85%

The Manchester Core Strategy states that a 15% reduction over 2010 Building regulations is required, the difference between 2010 and current 2013 regulations is a 6% improvement. Therefore, to meet the requirements of Policy EN6 of the Manchester Core Strategy a 9% improvement under today's 2013 regulations is appropriate as this would translate to a 15% improvement over 2010 Building regulations.

The summary CO₂ reduction results above state, a 33.18% reduction over Part L 2013 has been achieved. This results in a 40.01% reduction by Part L 2010 standards therefore exceeding the requirements of the Manchester Core Strategy.

Results have also been provided for SAP 10; as the software is still in BETA and the regulations have not yet been finalised, the results are an estimation only and may change as the software develops. They have been included in this instance however to demonstrate the potential of the chosen strategy which takes advantage of the vastly improved fuel factor for grid electricity.

Figure 1: Overall Carbon Emissions per Energy Hierarchy Stage Current 2013 Building Regulations

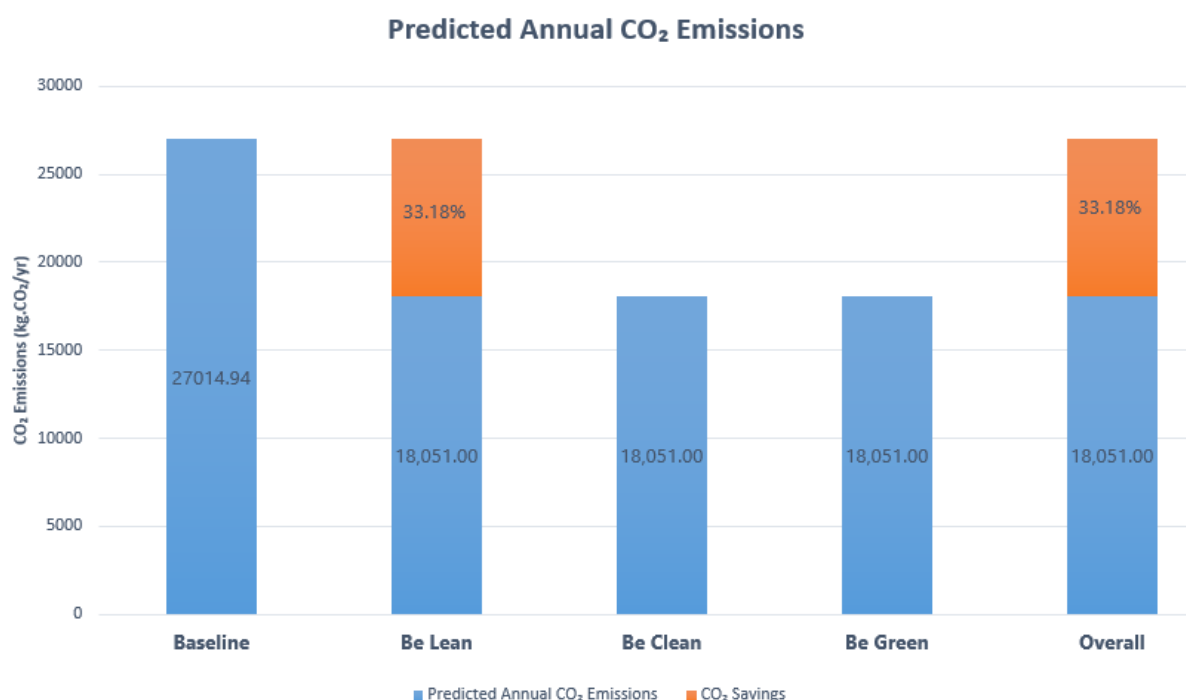
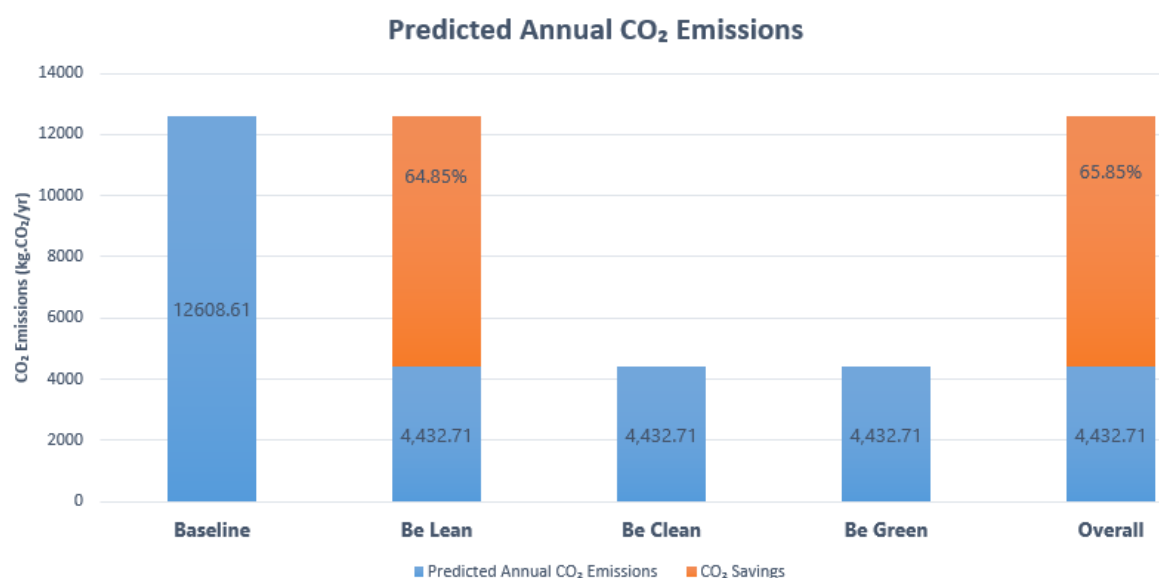


Figure 2: Overall Carbon Emissions per Energy Hierarchy Stage SAP 10 Building Regulations



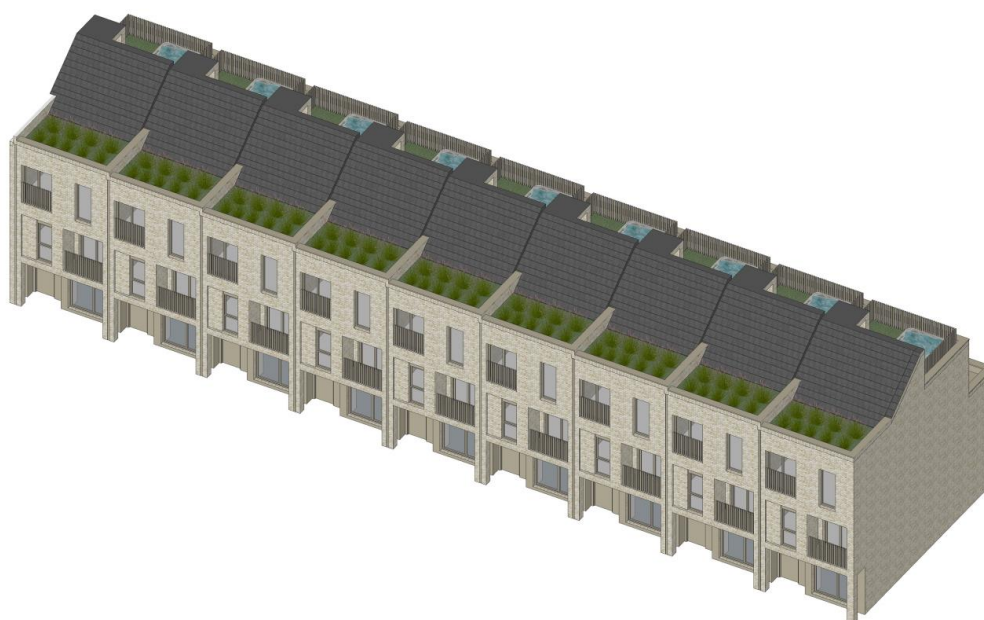
2 INTRODUCTION

2.1 PURPOSE

NOVO Integration Ltd has been appointed as Energy Consultants to produce an Energy and Environmental Standards Statement for the 1 Snell Street Manchester development.

This is to support the scheme design process, demonstrate Building Regulations Part L compliance and to achieve the applicable planning policies set out in the Manchester Core Strategy.

Figure 3: 1 Snell Street, Manchester



This report will outline the following:

1. Assess the proposed development site's estimated CO₂ emissions, it will look into the feasibility of Low Zero Carbon technologies, examining the following aspects relative to LZC/renewable technologies:
 - Energy generated by Renewable/Low Zero Carbon Technologies (LZC)
 - Feasibility assessment for each Renewable/Low Zero Carbon Technologies (LZC)
 - Local Planning Requirements
2. The proposed building fabric and Low Zero Carbon (LZC) design strategy and analysis calculations, with respect to the Standard Assessment Procedure (SAP). Demonstration of how the design is compliant against the current 2013 Part L1A buildings regulations.

2.2 BACKGROUND POLICY DOCUMENTS

The following statements and regulatory guidelines form the policy background to this energy strategy:

- The Kyoto Protocol at the United Nations.

- Framework Convention on Climate Change as negotiated in December 1997 has come into effect on 16 February 2005 following the ratification of the agreement by Russia on 18 November 2004. The Burden Sharing Agreement of the EU mandates a 12.5% reduction in greenhouse gas emissions for the UK by 2008 - 12.
- The Department of Transport and Industry White Paper, titled "Our Energy Future - Creating a Low Carbon Economy", spells out a target for 10% of electricity to be from renewable sources nationally by 2010 and twice this by 2020.
- National Policy Objectives in regard to renewable energy Planning Policy Statement 22: Renewable energy guidance for local governing bodies concerning implementation of renewable energy technologies through appropriate planning.
- The United Kingdom has made commitments that extend beyond this requirement. National Targets are for a reduction to 20% below 1990 CO₂ levels by 2010 and a 60% reduction by 2050.
- Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, September 2004.
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new buildings other than dwellings.
- National Planning Policy Framework (February 2019)
The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. In particular point A of paragraph 16 which states the following:

Plans should:

- a) be prepared with the objective of contributing to the achievement of sustainable development.*
- b) be prepared positively, in a way that is aspirational but deliverable*
- c) be shaped by early, proportionate, and effective engagement between plan makers and communities, local organisations, businesses, infrastructure providers and operators and statutory consultees*
- d) contain policies that are clearly written and unambiguous, so it is evident how a decision maker should react to development proposals*
- e) be accessible through the use of digital tools to assist public involvement and policy presentation; and*
- f) serve a clear purpose, avoiding unnecessary duplication of policies that apply to a particular area (including policies in this Framework, where relevant).*

Another key point of the NPPF is paragraph 8, point C which states the following:

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

- a) an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;*

- b) *a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities’ health, social and cultural well-being; and*
- c) *an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*
- Manchester Core Strategy 2012
 - Guide to Development in Manchester SPD (2007)
 - Manchester City Council Climate Change Framework (2020-2025)
 - RIBA 2030 Climate Challenge

2.3 SITE DESCRIPTION

The Site is located on Snell Street East of the city centre, the surrounding area is predominantly domestic in nature with scattered local amenity nearby including hotels, a supermarket, church and a primary school.

Figure 4: Ariel View



2.4 PLANNING POLICY

2.4.1 Local Policy

The locality of the development site means it falls under the jurisdiction of Manchester City Council. As such the policies adopted by Manchester City Council must be adhered to.

The document that details Manchester's strategy for development is 'Manchester's Local Development Framework – Core Strategy Development Plan Document', throughout the remainder of this report it shall be referred to as Manchester Core Strategy. The Core Strategy was adopted 11th July 2012.

Policy EN 4:

Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO₂ emissions, and rising fossil fuel prices, through the following actions:

- *All developments 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*

Policy EN6

Target Framework for CO₂ 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 CO₂ 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:

- *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*

Policy EN 8:

Adaptation to Climate Change

The council outlines an indicative list of remedial actions for new developments in order to be adaptable to climate change in terms of design, layout, siting and function:

- *Minimisation of flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability*
- *Reduction in urban heat island effect through the use of Green Infrastructure such as green roofs, green walls, increased tree cover and waterways*
- *The need to control overheating of buildings through passive design*
- *The opportunity to provide linked and diverse green space to enhance natural habitats which will assist species adaptation*

Domestic CO₂ emission targets

Table 12.1

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

Non-domestic CO₂ emissions reduction targets

Table 12.2

Target	% Minimum requirement
Target 1: Network development area	<i>CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010</i>
Target 2: Electricity intense buildings <i>(applies to commercial uses with a high proportion of emissions from electricity use (>45kgCO₂/m²))</i>	<i>+ 15% increase on Part L 2010</i>
Target 3: Micro generation area	<i>+ 15% increase on Part L 2010</i>

Where the CO₂ emissions reduction required under any future revision to Part L of the building regulations become greater than the ' % minimum requirement', the reduction required under building regulations would apply.

Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the ' % Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO₂ mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

Guidance on what the energy statement should contain and how to decide which target applies to a development proposal is given in appendix A.

The above policy states that this specific development requires a 15% betterment with CO₂ emission reduction over 2010 Building Regulations. However, the development will be constructed to adhere to 2013 Building Regulations.

2013 Part L1A Building Regulations is widely recognised within the industry as being 6% better than 2010. Meaning that it is already more onerous to achieve just a Building Regulations pass.

As such, the logic should apply to the Manchester Core Strategy policy. As 2013 Building Regulations has a 6% betterment, then the target should be 9% over 2013 Building Regulations for CO₂ emissions.

This is the target that shall be utilised throughout the remainder of this report.

Furthermore Section 4 Environmental Standards of the Manchester Supplementary Planning Document details the requirement for an Environmental Standards Statement highlighting a number of Environmental issues to be addressed. These issues are addressed in Section 5 of this report.

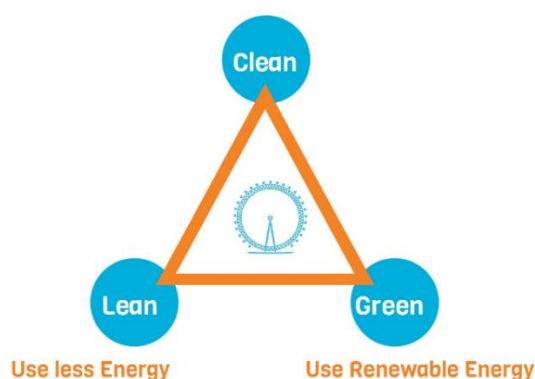
2.4.2 Energy Hierarchy

As part of the Sustainability and Energy analysis of the development Energy Hierarchy has been used as a means of structuring the sustainable design process.

We have taken this approach in order to properly address the Manchester Core Strategy Policies which promote low carbon design, assessment of connection to CHP and consideration of other low – zero carbon technologies.

An overview of the Energy Hierarchy is provided below:

Figure 5: Energy Hierarchy Diagram

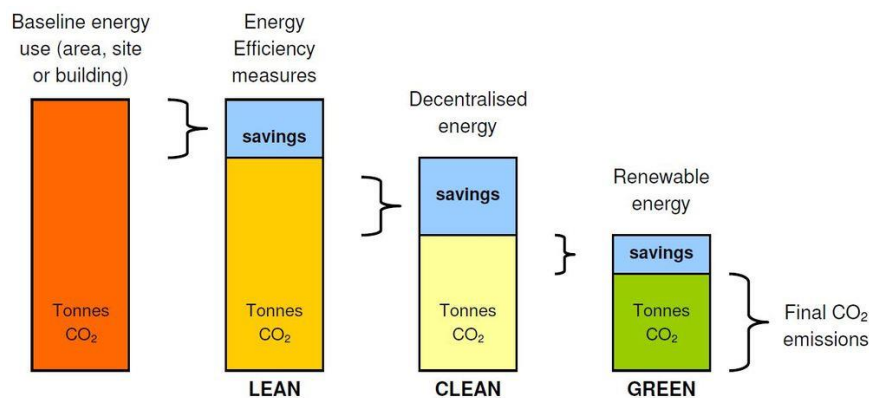


- Using less energy, in particular by adopting sustainable design and construction measures.
- Supplying energy efficiently, in particular by prioritising decentralised energy generation; and
- Using renewable energy.

The development Energy strategy has adopted the following design ethos:

- **BE LEAN** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

Figure 6: Energy Hierarchy Example Graph



2.5 BUILDING REGULATIONS

Approved document L1A (2013)– Conservation of fuel and Power sets the standard for carbon emissions for new dwellings. Buildings will need to comply with the criteria set out in the document, as follows:

Approved document L1A – Conservation of fuel and Power sets the standard for carbon emissions for new dwellings and was revised last April 2014 (Part L: 2013). Dwellings will need to comply with the criteria set out in the document, as follows:

- 1) The predicted Dwelling CO₂ Emission Rate (DER) should not be greater than the Target CO₂ Emission Rate (TER).
- 2) The performance of the building fabric and fixed building services should be no more than the design limits set out in Table 2 of the approved Document.
- 3) The dwelling will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer.
- 4) That the performance of dwellings as built comply with DER values achieved, including site testing or a representative sample of dwellings, demonstrating that the 'air permeability' rate achieved is as per that specified, or better.
- 5) The necessary provisions for energy efficient operation of dwellings are put in place, including operation and maintenance instructions

Compliance with the Approved Document Part L1A should be demonstrated at detailed design stage, prior to construction in the detail design phase of the project.

2.5.1 The Introduction of SAP 10

As mentioned earlier within this report a new update to Part L1A is expected to come into force for Residential developments in 2021. Please note that approved software's for residential projects (L1A) including FSAP used for this energy model, have not yet been updated to allow Consultants to produce reports under the new regulations which are targeted to come out on 15th June 2022.

The new methodology has several aspects that make Part L more stringent to achieve in general, however one major change is the Fuel Carbon Factors for each of the fuel applied within the calculation for energy generation. The change is specific to the grid electricity, this fuel factor is to be lowered to fall in line with gas.

This change makes an all-electric heating and hot water system in line with a gas system in terms of efficiency, therefore gas and CHP systems will have less of a benefit within the new calculations. This coupled with the benefits of removing gas from certain sites has huge advantages for developments such as this.

This change in the fuel factor is a direct result of the "greening of the grid" which has occurred due to the current proportion (circa 48%) of grid energy now coming from renewable sources, primarily offshore wind, solar PV and Biomass generators. There is a focus on the use of all electric heating and hot water systems within our recommendation to take advantage of the new fuel factors coming out in SAP 10 and support the policies of the Manchester Core Strategy by using an all-electric system supplied by grid electricity which will eventually become a zero-carbon energy source.

2.5.2 RIBA 2030 Climate Challenge

In addition to the upcoming fuel carbon factors this Energy Strategy has also given consideration to the RIBA 2030 Climate Challenge.

The RIBA 2030 Climate Challenge sets out a number of Sustainable Outcome targets including:

- Operational Energy
- Embodied Carbon
- Potable Water Use

It also sets out a number of best practice Health Targets including:

- Overheating
- Daylighting
- CO₂ Levels
- Total VOC's (Volatile Organic Compounds)
- Formaldehyde

The RIBA 2030 Climate Challenge was created following the RIBA Council vote on 29th June 2019 to join the global declaration of an environmental and climate emergency. These targets are none binding and still under development as RIBA discusses these metrics further with industry bodies before the targets are finalised. They do however make a useful resource for best practice given that these targets were developed to address the current climate emergency, therefore, although the targets are non-binding they have been considered where appropriate.

Figure 7: RIBA 2030 Climate Challenge Target Metrics

RIBA 2030 Climate Challenge target metrics for domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y 	146 kWh/m ² /y (Ofgem benchmark)	< 105 kWh/m ² /y	< 70 kWh/m ² /y	< 0 to 35 kWh/m ² /y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ² 	1000 kgCO ₂ e/m ² (M4i benchmark)	< 600 kgCO ₂ e/m ²	< 450 kgCO ₂ e/m ²	< 300 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day 	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

RIBA 2030 Climate Challenge target metrics for non-domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y 	225 kWh/m ² /y DEC D rated (CIBSE TM46 benchmark)	< 170 kWh/m ² /y DEC C rating	< 110 kWh/m ² /y DEC B rating	< 0 to 55 kWh/m ² /y DEC A rating	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ² 	1100 kgCO ₂ e/m ² (M4i benchmark)	< 800 kgCO ₂ e/m ²	< 650 kgCO ₂ e/m ²	< 500 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day 	>16 l/p/day (CIRA W11 benchmark)	< 16 l/p/day	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G

RIBA 2030 Climate Challenge target metrics for all buildings

Best Practice Health Metrics 		References
Overheating	25-28 °C maximum for 1% of occupied hours	CIBSE TM52, CIBSE TM59
Daylighting	> 2% av. daylight factor, 0.4 uniformity	CIBSE LG10
CO ₂ levels	< 900 ppm	CIBSE TM40
Total VOCs	< 0.3 mg/m ³	Approved Document F
Formaldehyde	< 0.1 mg/m ³	BREEAM

Above is an extract showing the target metrics for domestic and non-domestic buildings. Particularly relevant to this report are the "Operational Energy" and "Potable Water Use" targets as through a fabric first approach, low/zero carbon technology and use of renewables these issues have been considered.

The Embodied Carbon target is addressed as far as our capacity as the Sustainability Consultant is concerned however in order to fully tackle the Whole Life Carbon of the building using Circular Economy Strategies; consideration of Embodied Carbon will be required by all parties involved with the design, construction and operation of each block, particularly parties with ISO14001 accreditation.

We have endeavoured to achieve the targets outlined through the fabric first approach combined with Low Carbon technology and efficient fittings all of which are detailed further in this report.

3 DESIGN PARAMETERS

3.1 METHODOLOGY

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions for new domestic developments.

Results are derived in respect of floor area and consider energy use (kWh/m²/yr) and associated CO₂ emissions (kg.CO₂/m²/yr) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generation technology

SAP is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purpose of this report, data has been produced by a Accredited Energy Assessor using FSAP 2012 software to produce the data for this report.

To enable a review of each level of the Energy Hierarchy, firstly the Baseline CO₂ emission figures must be established. These figures are based on Part L1A 2013's 'Notional Building', a specific set of specification criteria referenced in section 3.4 of this report.

All additional measures included to reduce the overall CO₂ emissions such as improved building fabric and low carbon technology will be compared against the Baseline figures. These figures are the Target Emission Rate derived from the SAP assessment and resulting Design Stage SAPs issued separately to this report.

A 'fabric first' approach will be undertaken throughout this report, looking at improvements to the thermal envelope initially to understand the improvements that can be gained prior to the feasibility of any renewable / low carbon technologies.

Renewable / low carbon technologies will then be considered with regards to special constraints, feasibility, and appropriateness in relation to the site.

NOVO Integration Ltd have used the following information to formulate the Energy Strategy.

3.2 ARCHITECTURAL DRAWINGS BY CALDERPEEL ARCHITECTS

Table 2 Architects Drawing Schedule

Drawing Number	Drawing Contents
20096 (FE) 300	Proposed indicative site section
20096 (PL) 010	Proposed site plan
20096 (PL) 100	Proposed house
20096 (PL) 400	Proposed 3D view

3.3 FUEL

The assessment has assumed the following fuel carbon emissions factors - The fuel carbon emissions factors used are in accordance with SAP 2012 (for Building Regs Part L1A).

Table 3 Fuel Factors

Carbon Emissions Factor	SAP 2012 kgCO ₂ /kW
Grid Electricity	0.519
Grid displaced Electricity	0.529
Manufactured smokeless fuel	0.402
Coal (traditional British Coal)	0.301
Heating Oil	0.28
LPG	0.25
Natural Gas	0.215
Wood Pellets	0.028
Bio Diesel	0.098
Bio Gas	0.019

3.4 BASELINE CO₂ EMISSIONS

The baseline energy use and resulting CO₂ emissions rates of the development have been assessed using the SAP 2012 Government approved software. The SAP 2012 calculations have been produced according to the L1A 2013 building regulation requirements.

For the purpose of this report the baseline energy use and CO₂ emissions are calculated based on the 'Notional Dwelling' requirements specified in the Building Regulations L1A 2013 (Table 5).

Table 4 Residential Baseline Building Fabric

Element	Part L1A: 2013 Limiting u values (W/m ² .k)	Part L1A: 2013 Notional u-values (W/m ² .k)
Floors	0.25	0.13
External Walls	0.30	0.18
Party Wall between dwelling	0.20	0.00
Roof	0.20	0.13
Windows	2.0	1.40
Doors	2.0	1.00
Y-value (W/m ² .k)	0.15	~0.05
Air permeability (m ³ /h.m ² @ 50 pa)		
All dwellings	10.0	5.0

An area weighted block compliance baseline carbon emission result is presented below. In order to satisfy the Manchester Core Strategy, this development must achieve a 9% (translating to 15% over 2010 building regulations) reduction over the base line figure presented. A full copy of the SAP calculations has also been included within the appendix of this report.

Figure 8: SAP 2012 Block Compliance Report

Calculation Summary	
Total Floor Area	1231.31
Average TER	21.94
Average DER	14.66
Average DFEE	44.09
Average TFEE	49.58
Compliance	Pass
% Improvement DER TER	33.18
% Improvement DFEE TFEE	11.07

Please note that all units (9 No) have been modelled using the SAP 2012 software.

By using low u-values and high-performance materials to reduce greenhouse emissions and improve energy efficiency; the Be Lean stage of this report addresses policies EN4 and EN6 of the Manchester Core Strategy and is in accordance with Paragraph 8 of the National Planning Policy Framework (NPPF) by reducing CO₂ emissions and supporting a low carbon economy.

The following table details the notional baseline area weighted CO₂ regulated emissions for the development. The target emission rates (TER's) in the above figures combined with the total floor area was used to produce the baseline CO₂ emissions below.

Table 4 Baseline Carbon Emissions Current 2013 Building Regulations

Building Services	Baseline CO ₂ Emissions (kg CO ₂ /m ² /yr)	Baseline CO ₂ Emissions for overall development (kg CO ₂ / yr)
Total regulated emissions (heating, hot water, lighting, fans & pumps)	21.94	27,014.94

To cover all aspects a second baseline emission target has been produced in the below table. This provides an estimated baseline under the upcoming SAP 10 Building Regulations discussed earlier in Section 2.5.1 of this report.

Table 6 Baseline Carbon Emissions SAP 10 Building Regulations

Building Services	Baseline CO ₂ Emissions (kg CO ₂ /m ² /yr)	Baseline CO ₂ Emissions for overall development (kg CO ₂ / yr)
Total regulated emissions (heating, hot water, lighting, fans & pumps)	10.24	12,608.61

4 ENERGY STRATEGY

4.1 ENERGY EFFICIENT DESIGN

This section outlines the design energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline (Building Regulations 2013 Part L1A compliance), often referred to as the 'Fabric First' approach.

The energy efficient measures include:

- Inclusion of better U-values than the minimum U-values set in the ADL1A
- Designing for a buildings air permeability exceeding ADL1A target values
- Utilising the highly efficient heating and hot water systems
- Utilising low energy efficient lighting such as LED lighting

The table below outlines the improvements made to the building fabric elements compared against both the Building Regulations limiting U-values and the 'Notional Dwelling' U-values which the baseline is derived from.

Table 5 Proposed Building Fabric Specification

Building Fabric			
Element	L1A: 2013 Limiting U-values (W/m ² .k)	L1A: 2013 Notional U-values (W/m ² .k)	Proposed U-values (W/m ² .k)
Floors	0.25	0.13	0.125
External Walls	0.30	0.18	0.18
Party walls between dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.12
Windows	2.00	1.40	1.40
Doors	2.00	1.0	1.8
Y – value (W/m ² .k)	0.15	~0.05	~0.03 – 0.08
Air permeability (m ² /h.m ² @ 50 pa)			
All dwellings	10.0	5.0	4.0

The above table 6 shows that the floors, roof and air permeability target are improved over the Part L1A 2013 Notional building; accredited construction details will also be used throughout, and all fabric u-values are better than the limiting values.

4.1.1 Heating Demand

The heating energy demand will be reduced by providing high performance insulation of the building envelope as well as a low Air Permeability Target in order to minimise heat losses.

At the Be Lean stage, low carbon Air Source Heat Pumps have also been observed for heating and hot water demand. As this strategy effectively reduces the reliance on fossil fuels and contributes to the overall CO₂ reduction of the development, it therefore addresses Policy EN6 of the Manchester Core Strategy whilst also adhering to paragraph 150 of the National Planning Policy Framework (NPPF).

4.1.2 Ventilation

The development will take advantage of a Mechanical Ventilation Heat Recovery (MVHR) system.

Occupants will also have a natural ventilation option via the openable balcony doors. Extract fans will be included to all wet areas and in the kitchens.

MVHR is, in its simplest form is a heat exchanger. The system extracts warm stale air from within the Building, at the same time drawing in cooler fresh air from outside. These are then ducted into the actual MVHR unit itself, at which point the heat is exchanged without mixing the air, therefore fresh, warm air is vented into the building.

This system recovers heat from within the units which otherwise would be lost, therefore reducing the amount of energy required to maintain temperature within the units.

4.1.3 Lighting

The proposed light fittings will be low energy efficient fittings, in this instance LED fittings only throughout.

4.1.4 Embodied Carbon

All materials used within the construction of the development will have embodied carbon within them, taking into consideration manufacturing processes and supply chains. It is assumed that the developer will seek to procure materials and construction elements with appropriate sustainable accreditations, for example FSC for timber, ISO:140001 accreditations where applicable etc, to minimise the use of high embodied carbon within the building.

4.2 CO₂ REDUCTIONS AFTER FABRIC FIRST APPROACH

The following table demonstrates the reduction in CO₂ emissions based on an area weighted average calculation utilising a fabric first approach with no reduction incorporated from the inclusion of any renewable / low carbon technology:

Figure 9: Fabric First Results Current 2013 Building Regulations

Regulated Emissions	Baseline CO ₂ Emissions	Fabric First Building CO ₂ Emissions	CO ₂ Emission Savings	% reduction in CO ₂ Emissions
kg of CO ₂ /m ² /yr	21.94	14.48	7.46	33.18%
kg of CO ₂ /yr	27,014.94	17,829.36	9,185.58	

The Dwelling Fabric Energy Efficiency (DFEE) results also shows a 11.07% improvement over the Target Fabric Energy Efficiency at the Be Lean stage.

- Target Fabric Energy Efficiency 49.58 kWh/m²/yr.
- Dwelling Fabric Energy Efficiency 44.09 kWh/m²/yr.

This proves that the fabric efficiency measures included in the design have improved the Be Lean stage results.

SAP calculation software for the upcoming SAP 10 Building Regulations is still in BETA and can only be used to provide estimated results using the improved fuel carbon factors for grid electricity. The below figure shows the estimated CO₂ reduction this development would achieve at the BE LEAN stage under SAP 10 Building Regulations.

Figure 10: Fabric First Estimated SAP 10 Results

Regulated Emissions	Baseline CO ₂ Emissions	Fabric First Building CO ₂ Emissions	CO ₂ Emission Savings	% reduction in CO ₂ Emissions
kg of CO ₂ /m ² /yr	10.24	3.6	6.64	64.85%
kg of CO ₂ /yr	12,608.61	4,432.71	8,176.61	

As can be seen in the above figure, the estimated SAP10 results show a 64.85% reduction in CO₂ at the Be Lean stage, this vastly exceeds the requirements of Manchester Core Strategy and provides a certain level of future proofing. This demonstrates the potential of the current strategy and although the software is still in BETA, it more realistically displays the benefits of grid electricity as it uses more up to date fuel carbon factors for this fuel source.

Figure 11: Fabric First Carbon Emissions Current 2013 Building Regulations

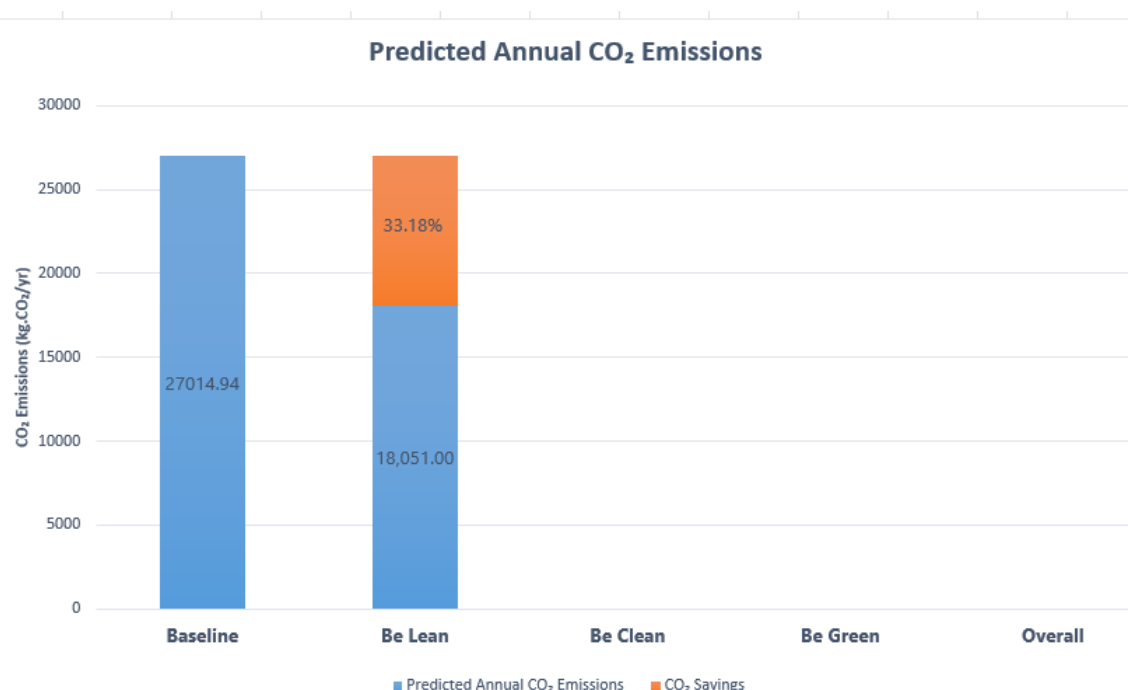
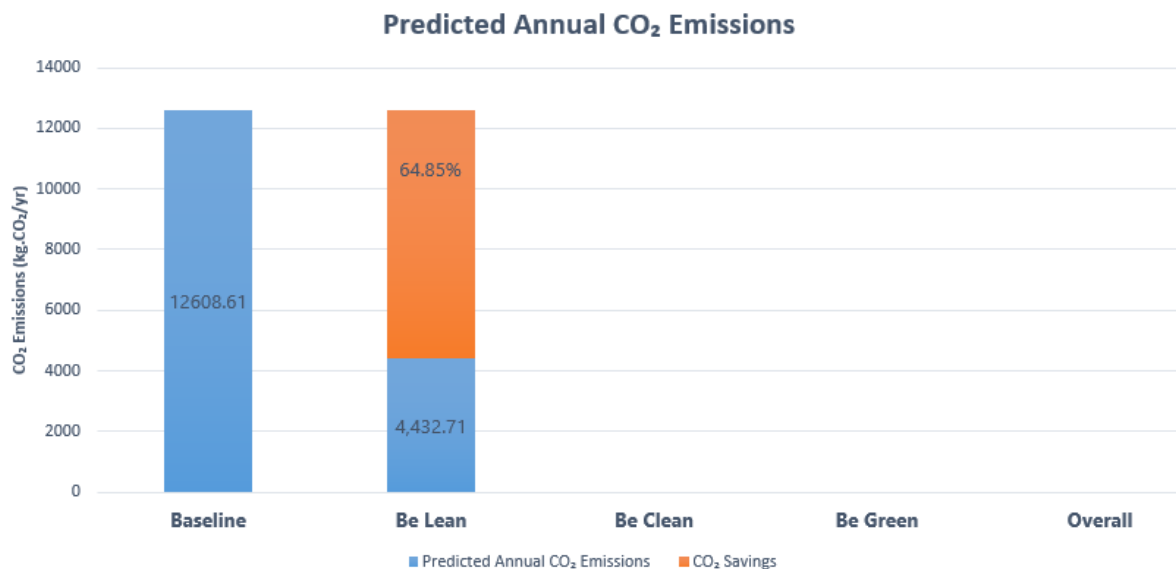


Figure 12: Fabric First Carbon Emissions SAP 10 Building Regulations



4.3 CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS

The Energy Hierarchy encourages the use of a CHP system and/or the connection to District Heating system to reduce CO₂ emissions further.

4.3.1 CHP

The Energy Hierarchy identifies combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP.

The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for the majority of the year
- CHP operation based on maximum heat load for minimum 10 hours per day
- CHP operation at maximum capacity of 90% of its operating period

A CHP system will not be considered for this development due to the following reasons:

- Due to restrictions on site space would be limited for the level of plant required for a CHP system, which would require accumulators, additional boiler power, pumps, pressurisation units etc.
- Pollution discharged from the CHP unit may not be appropriate given the site locality and the number of people passing the site given its location within a residential area.
- Noise pollution is a consideration given the function of the development and its proximity to other surrounding buildings.
- Economic viability is heavily dependent on the constant demand for heat and power, as well as the price of electricity and gas.
- An all-electric system has been used in this strategy to take advantage of upcoming fuel factors for grid electricity and provide some level of future proofing as grid electricity closes in on carbon neutrality over time.

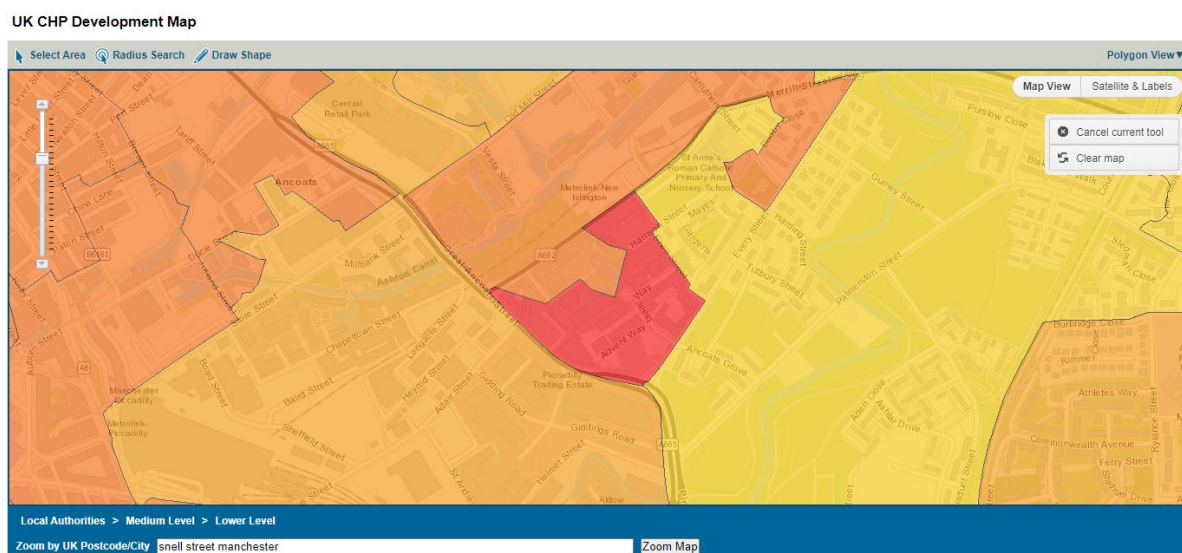
Hence, the implementation of a CHP strategy is not recommended for this development.

As a result, no CO₂ reduction can be achieved as part of the Be Clean section of the Energy Hierarchy.

4.3.2 Decentralised Energy Network

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed through the use of UK CHP Development Map, for Manchester as for a District Heating network. The development is located within the Civic Quarter District Heating Network.

Figure 13: CHP Development Map – Local Heat Loads



Presently there is the potential to connect to a heat network and should the District Heating Network evolve into an all-electric system and the infrastructure for such be provided then connection could be considered in the future.

Heat networks are best suited to large developments with appropriate plant space for buffer vessel, plate heat exchangers and manifold positions, meters. As this project incorporates 9nr terrace houses only, space is extremely limited to accommodate such a system, furthermore the pipework required for connection to each unit makes this option financially unviable.

An all-electric strategy is the preferred option as the fuel carbon factor for grid electricity is to be brought in line with natural gas and will eventually become zero carbon as the portion of renewable energy supplied to the grid increases. This therefore provides the development with some future proofing, better addresses the current climate emergency by removing another potential source of emissions and supports the RIBA 2030 Climate Challenge through a low carbon heating and hot water solution.

As such no additional CO₂ reduction can be observed at the Be Clean stage, this is described in the graph below:

Figure 14: Be Clean Carbon Emissions Current 2013 Building Regulations

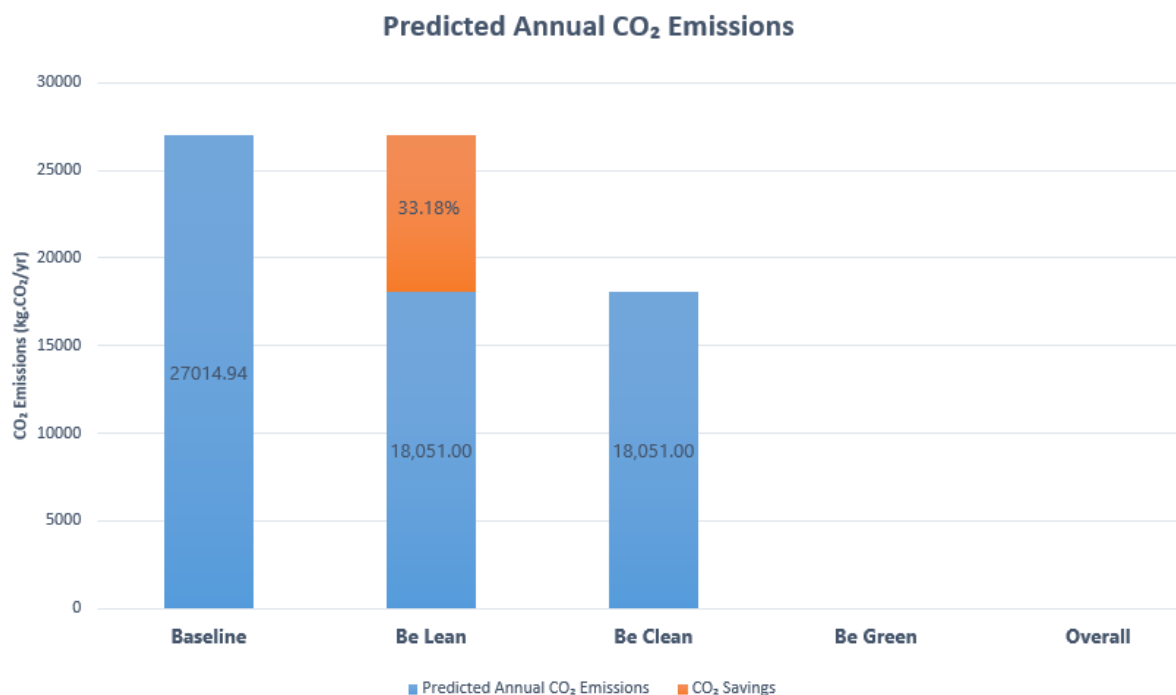
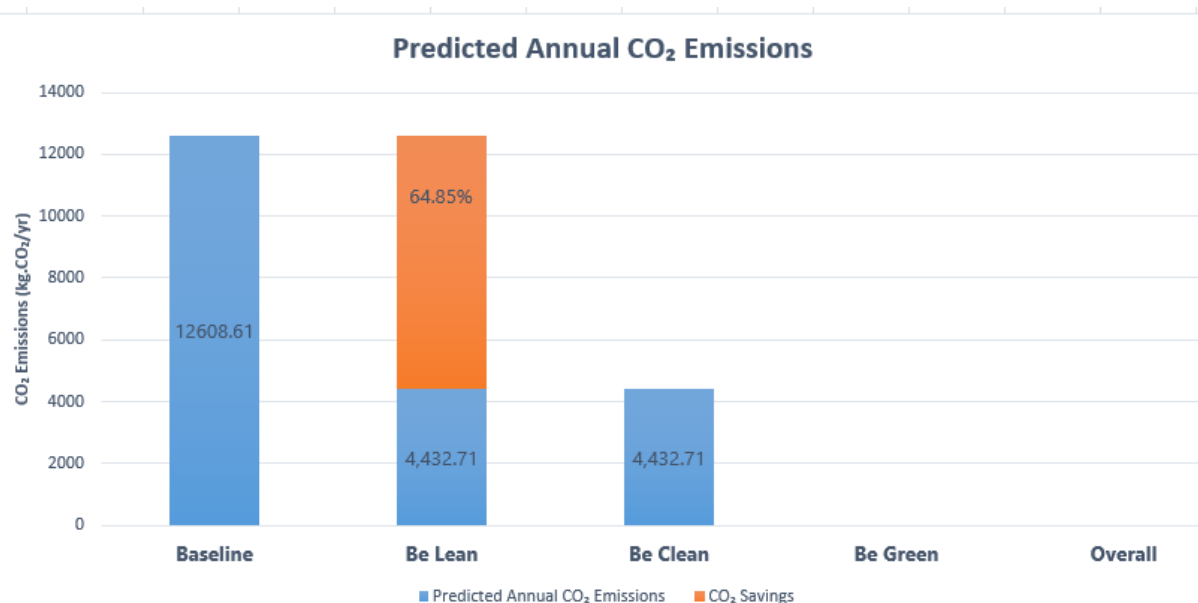


Figure 15: Be Clean Carbon Emissions SAP 10 Building Regulations



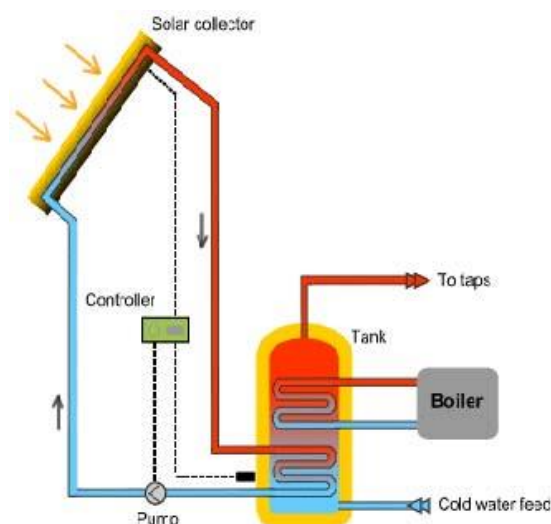
4.4 LOW & ZERO CARBON TECHNOLOGIES

4.4.1 General

Low and zero carbon (LZC) technologies are systems that generate energy with either zero or reduced CO₂ emissions when compared against traditional energy generation methods.

The alternative LZC technologies have been assessed in relation to the development and their viability assessed. Some of the LZCs are intrinsically unsuitable due to the development type and location whereas others are potentially viable.

Figure 16: Solar Thermal Diagram



4.4.2 Solar Water Heating

Solar thermal panels utilise the sun energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected to shade.

This system alone would not generate a large enough CO₂ reduction in proportion to other comparable technologies. This technology has also been discounted due to the inflated cost of installation with regards additional pipe runs, maintenance requirements and the significant roof area that would be required.

4.4.3 Wind Turbines

Wind turbines generate electrical energy derived from kinetic energy provided by the local wind resource. The performance of wind turbines depends greatly on the wind speed and turbulence that in turn is influenced by the terrain and installation height.

Figure 17: Wind Turbine



The use of wind turbines on the development will also have a significant visual impact on the city centre location and neighbouring buildings, as well as low frequency noise source and hence it is likely to meet opposition within the local area.

In very simplistic terms, space for such a large technology on this development site cannot be considered.

For the reasons detailed above wind turbines are not considered viable for the development.

4.4.4 Photovoltaic Cells (PV)

Photovoltaic (PV) panels utilise the sun's energy to generate electricity. The optimum location for PV panels is south facing at an approximate 30° inclination angle in areas where they are not subjected to shade.

Figure 18: PV Examples



In terms of CO₂ reduction and energy demand within the SAP calculations, it is determined that PV would be an appropriate renewable technology which could provide electricity to the buildings and contribute to the overall CO₂ reduction of the development.

PV has not been included at this stage however as the Manchester Core Strategy CO₂ requirements and Part L Compliance can be met through low carbon ASHP's and efficient fabric alone. The technology remains a viable option should the strategy evolve to include it.

4.4.5 Source Heating and Cooling

The Air Source Heat Pumps can be linked with indoor units to heat and cool the space. These could be either ceiling mounted cassette units, wall mounted units or floor mounted units. This option therefore has good flexibility in terms of installation.

The outdoor units can be located anywhere and are not dependant on orientation. They need to be externally mounted and in a local compound to be safe. Compared to a wet system this technology is more simplified in terms of installation and maintenance.

This technology has been included in the strategy and provides a low carbon solution to the heating and hot water energy demand.

4.4.6 Biomass Boiler

Biomass is considered to be a renewable fuel source as the CO₂ absorbed during the growth period is assessed as being approximately equal to the CO₂ emitted during combustion and hence deemed "carbon neutral". Biomass for boilers is typically wood either in chip or pellet form.

Biomass boilers require fuel storage together with associated transportation and delivery to the store location.

Figure 19: Biomass Example



With the minimal plant areas available for a biomass generator combined with the logistics and increase in pollution from wood pellet deliveries/transportation, biomass generators have not been included in this Energy Strategy.

For the above reasons, the use of a biomass boiler plant is not considered viable for the development.

4.4.7 Fuel Cell

The fuel cell technology essentially converts chemical energy into both electrical and heat energy. The cell needs to be continually supplied with hydrogen (derived from either a piped or storage source) and oxygen (derived from air) that are combined and the chemical reaction produce electrical energy, heat energy and water vapour.

The fuel cell requires a hydrogen fuel source that can either be from a piped source (not currently available) or from stored gas. However, the more usual approach currently in the UK is to use natural gas in order to generate the hydrogen required to operate the fuel cell.

Fuel cells have various commercial and technical limitations. There is a high initial capital cost together with there being few established suppliers and a very limited specialist design, installation, and maintenance capabilities.

Certain fuel cell elements require regular replacement imposing a significant on-going cost implication. The fuel cells themselves are generally large, heavy and require fresh air ventilation.

Due to the initial capital cost, space requirements and on-going maintenance costs fuel cells are not considered viable for this development.

4.5 WATER

The development will be designed to reduce mains/potable water and include water efficient devices and equipment. This will comprise of efficient water fixtures (low flow taps and showers, dual flush WCs and low volume baths) to reduce potable water demand to <16 litres/person/day as per the requirement within Building Regulations.

As stated previously <16 litres/person/day is the 2020 target in the RIBA 2030 Climate Challenge and the next target 2025 is <13 litres/person/day, this surpasses the requirement of Part G and we will use our best endeavour to reach this target.

This will be done using low flow rate sanitaryware and the use of flow restrictors throughout the development.

An example of the flow rates and capacities that could potentially be used are as follows. Please note these are a guide at this stage and actual figures may differ at the time of construction. However, they will fall within the required level:

- WC – Dual Flush – 6/3 Litre Flush capacity
- Wash hand basin taps – 5 L/min
- Kitchen sink taps – 7L/min
- Shower – 7L/min

4.6 CHOSEN RENEWABLE SOLUTION

Following the above review of various LZC technology the chosen solution for this strategy is to utilise low carbon Air Source Heat Pumps in conjunction with the fabric efficiency improvements as described at the Be Lean stage.

As discussed earlier the SAP10 estimate will not require this technology to meet the required CO₂ reduction levels.

Figure 20: Be Green Carbon Emissions Current 2013 Building Regulations

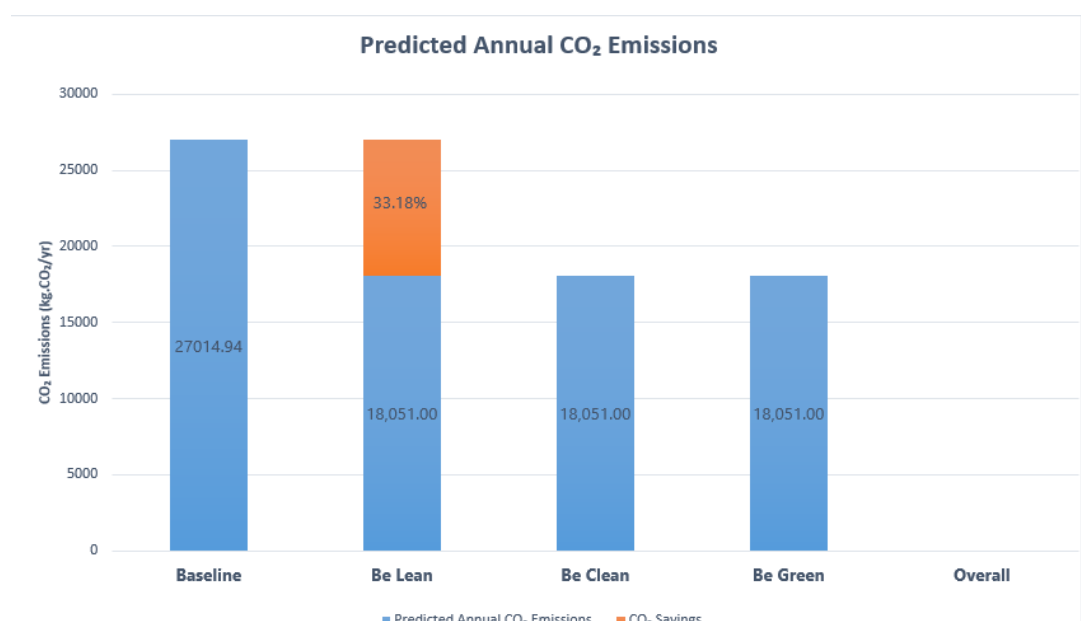
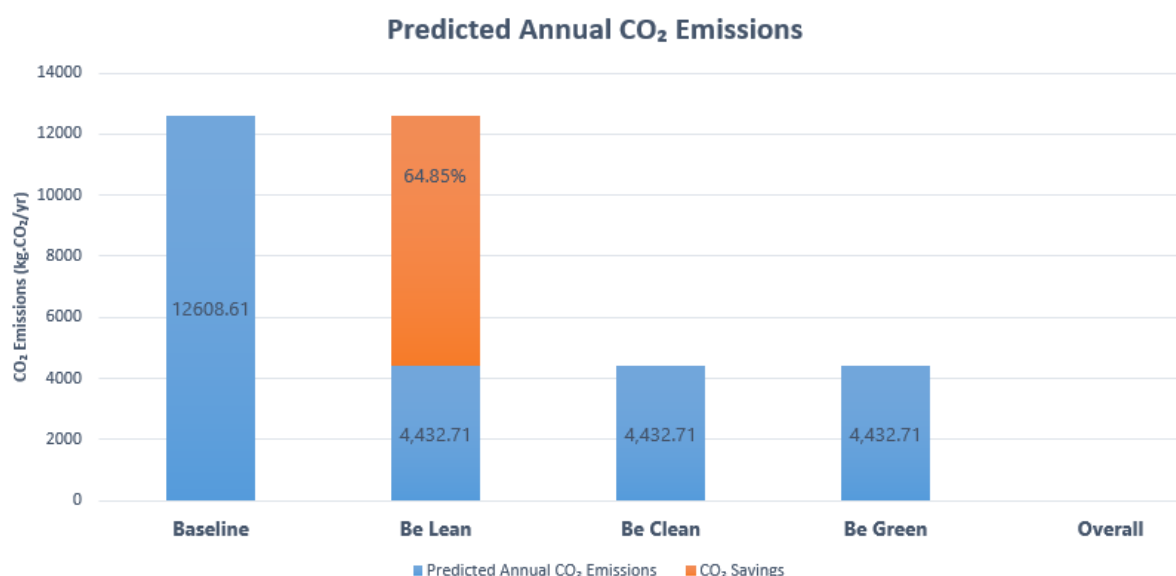


Figure 21: Be Green Carbon Emissions SAP 10 Estimate



4.7 ENERGY DEMAND & LOW CARBON/RENEWABLE SOLUTIONS

In order to calculate the energy demand for the entire development in kWh/yr the follow is required.

The energy demand is made up of the following factors:

- Energy for space heating
- Energy for space cooling
- Energy for water heating
- Energy for ventilation
- Energy for lighting
- Energy generated by renewables

This is more specifically the Primary, Regulated Energy Demand given the fabric, considering the above factors.

The primary energy demand results for current 2013 building regulations is displayed in the below table. Results under SAP 10 cannot yet be provided as the notional values for comparison are not yet fully developed.

Table 7 Primary Energy Demand Current 2013 Building Regulations

	Notional	Actual	% Improvement
Single End Terrace Unit	17.71 kWh/m ² /yr	13.51 kWh/m ² /yr	23.72
Single Mid Terrace Unit	15.25 kWh/m ² /yr	11.05 kWh/m ² /yr	27.54

The result is a 23.72% reduction in primary energy for end terraces and 27.54% reduction for mid terraces between the baseline notional building and the actual building incorporating sustainable design measures, improved fabric efficiency and use of low carbon technology.

This is an excellent improvement on the current benchmark target of 105 kWh/m²/yr and achieves the current RIBA 2030 Climate Challenge 2025 Target of < 0 to 35 kWh/m²/yr. It is worthy of note however that RIBA intend to work with professional bodies to finalise their target metrics which may change as those discussions progress.

Figure 22: RIBA 2030 Climate Challenge Domestic Target Metrics

RIBA 2030 Climate Challenge target metrics for domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y 	146 kWh/m ² /y (Ofgem benchmark)	< 105 kWh/m ² /y	< 70 kWh/m ² /y	< 0 to 35 kWh/m ² /y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ² 	1000 kgCO ₂ e/m ² (M4i benchmark)	< 600 kgCO ₂ e/m ²	< 450 kgCO ₂ e/m ²	< 300 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day 	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

The Part L1A CO₂ reduction results also contribute to the embodied carbon targets with a 33.18% reduction in kg CO₂/m² being achieved through the use of fabric improvements and renewable technology as per the Be Lean and Be Green stages of this report.

As per the summary results in Section 1 Executive Summary of this report, the development achieves and estimated CO₂ reduction of 64.85% under the upcoming SAP 10 Building Regulations therefore further increasing the contribution made towards the embodied carbon target.

As stated in section 2.5.2 The Embodied Carbon target is addressed only as far as our capacity as the Sustainability Consultant is concerned. In order to fully tackle the Whole Life Carbon of the building using Circular Economy Strategies; consideration of Embodied Carbon will be required by all parties involved with the design, construction and operation of each block, particularly parties with ISO14001 accreditation.

The RIBA 2030 Climate Challenge targets are ultimately non-binding however indicate good practice; we have therefore endeavoured to achieve the targets outlined.

5 ENVIRONMENTAL STANDARDS STATEMENT

It is best practice to incorporate Environmental Standards within the design of such a development. Being mindful of the design standard issues often compliment the Energy Strategy and the Sustainability aspects of the design and this planning report.

Some elements described within the environmental standards section fall outside the remit of NOVO Integration Ltd and as such will be incorporated within other parties' appointments. This report will however summarise and reference other third-party reports where applicable to aid with addressing all applicable elements of the Environmental Standards.

The various topics covered within the environmental standards sections are as follows:

- Energy Efficiency
- Renewable Energy
- Environmental Design
- Water Management and Weather Resilience
- Waste Management
- Construction Management
- Waterways

Each element will be summarised how the development will achieve this, and any relevant third-party reports referenced accordingly.

Please note that where assumptions have been made of specific reports being carried out, confirmation of these reports from the developer will be required. Reference only is made within this report.

Any reports referenced within this section does not confirm that these reports are either required or have been or will be carried out and are assumptions of such only.

5.1 ENERGY EFFICIENCY

The Manchester Core Strategy states that in summary, all new developments should endeavour to reduce their CO₂ emission by particular targets as discussed previously in this report.

However, the principals highlighted within the section are carried through into the design.

Section 4 Energy Strategy of this report details specifically how the proposed design of the development including the fabric, mechanical and electrical services will use passive, energy efficient and low carbon technologies throughout with emphasis on a fabric first approach to minimise the CO₂ emissions and meet the targets set in the Manchester Core Strategy.

The Energy Strategy describes how the development follows the Energy Hierarchy approach which many local authorities advocate the use of.

5.2 RENEWABLE ENERGY

The Manchester Core Strategy encourages the use of Low Zero Carbon technologies, this again follows the Hierarchical approach.

This is to encourage opportunities to reduce the energy demand via the use of onsite renewable technologies to improve energy security for occupants of the site and export of surplus energy back to the grid.

Various opportunities and different technologies should be investigated to determine the most viable and appropriate technology for the site in question.

Again section 4 of this report deals with the Energy Hierarchical approach to Energy and the use of renewable technology. Many different technology opportunities have been investigated and discounted where applicable and included where appropriate.

Following these in-depth reviews of varying renewable technologies, Air Source Heat Pumps have been deemed viable and appropriate for the development and have been included within the design.

5.3 ENVIRONMENTAL DESIGN

This element encourages developers to use the Building Research Establishment Assessment Method (BREEAM) to assess environmental performance or Code for Sustainable homes depending on whether the development is residential or non-residential in nature. Code for Sustainable Homes is no longer applicable following the Housing Standards Review. Were this standard still in operation however, the CO₂ reduction results identified in this report would equate to Code Level 4.

5.4 WATER MANAGEMENT AND WEATHER RESILIENCE

Thoughtful design to reduce the levels of pollution within the city's watercourses, as well as mitigating the effects of flooding should significant storms present themselves in the future should be considered.

As such a Flood Risk Assessment and Drainage Strategy Report will be produced to demonstrate the methodology as to how the development will manage excessive water in times of storms etc to minimise the risk of flooding to the development and surrounding areas.

As the development is within Flood Risk Zone 1 there is a low risk of flooding. Is it anticipated that any excessive rainwater will be dealt with through the use of attenuation other methodologies falling line with SUDs techniques to improve flows and quality of the surface water run-off.

Water Usage has been covered earlier within this report under section 4.6 and describes how the development will utilise low flow / volume sanitaryware to reduce the amount of water consumed and comply with the Building Regulations Part G but also aspires to achieve the target metrics described in the RIBA 2030 Climate Challenge.

5.5 WASTE MANAGEMENT

The proposed development will include the re-use of the existing built land and associated elements and the construction of 9nr houses.

It is understood that the Construction Waste Management Plan will be prepared to ensure that all aspects of waste production, deliveries, noise, dust pollution etc are all accounted for and reasonably mitigated.

There is potential for the Waste Management Strategy to be reviewed by Building Management during the lifetime of the building for opportunities to improve the procedures and will also review areas where reductions in waste, or an increase in recycling waste can be made. This will form part of a Construction Management Plan which will likely be required by a condition attached to any planning permission.

The design of designated areas for waste and recyclable waste once construction has been completed for the use of the occupants has and will be carefully considered, not only in terms of capacity but allowances made for access for collections.

These areas will have designated areas for recyclable waste which will encourage further responsibility to be taken by the occupiers to separate their own waste accordingly.

5.6 CONSTRUCTION MANAGEMENT

Best practices encourage environmentally friendly construction methods and materials which in effect reduces energy consumption.

This standard also encourages best practices during construction to prevent or limit damage to the environment and to make sure these measures are not being abused during the full construction phase.

It is assumed that the contractor will be responsible for providing a comprehensive construction management plan containing all procedures on site and methodologies for a safe, environmentally conscious, and efficient construction period.

6 CONCLUSIONS

The Energy Strategy for the proposed development 1 Snell Street Manchester has adopted a hierarchical approach of using passive and low energy design technologies to reduce the baseline energy demand and hence CO₂ emissions followed by the feasibility of the application of low and zero carbon technologies as appropriate.

This is supported by the SAP Calculations to provide compliance in England with the Building Regulations Part L 2013, issued with this report. The analysis has shown that by incorporating passive and low energy design measures, there is a reduction of 33.18% over the developments annual CO₂ baseline emissions, equating to a 39.18% improvement over Part L1A 2010.

This is achieved by incorporation of the following elements:

- High performance glazing to reduce solar and transmission gains
- Improved thermal transmittance U-valued as depicted
- Mechanical Ventilation Heat Recovery systems with 88% heat recovery efficiency
- Low Carbon Air Source Heat Pumps for heating and hot water
- Low building air leakage rate (4.0 m³/h/m² at a pressure differential of 50 Pa)
- 100% Low energy lighting through the buildings
- Low flow aerated showerheads and basin tap inserts to reduce water consumption
- Reducing mains/potable water via water efficient devices and equipment

A 'Fabric First' approach has been used in this strategy then, following the stages of the Energy Hierarchy, CHP and district heating has been assessed followed by a study of various low and zero carbon technologies. The graph below demonstrates the results of the passive fabric improvements made along with the application of renewable technology.

Figure 23: Overall CO₂ Emissions Reduction Current 2013 Building Regulations

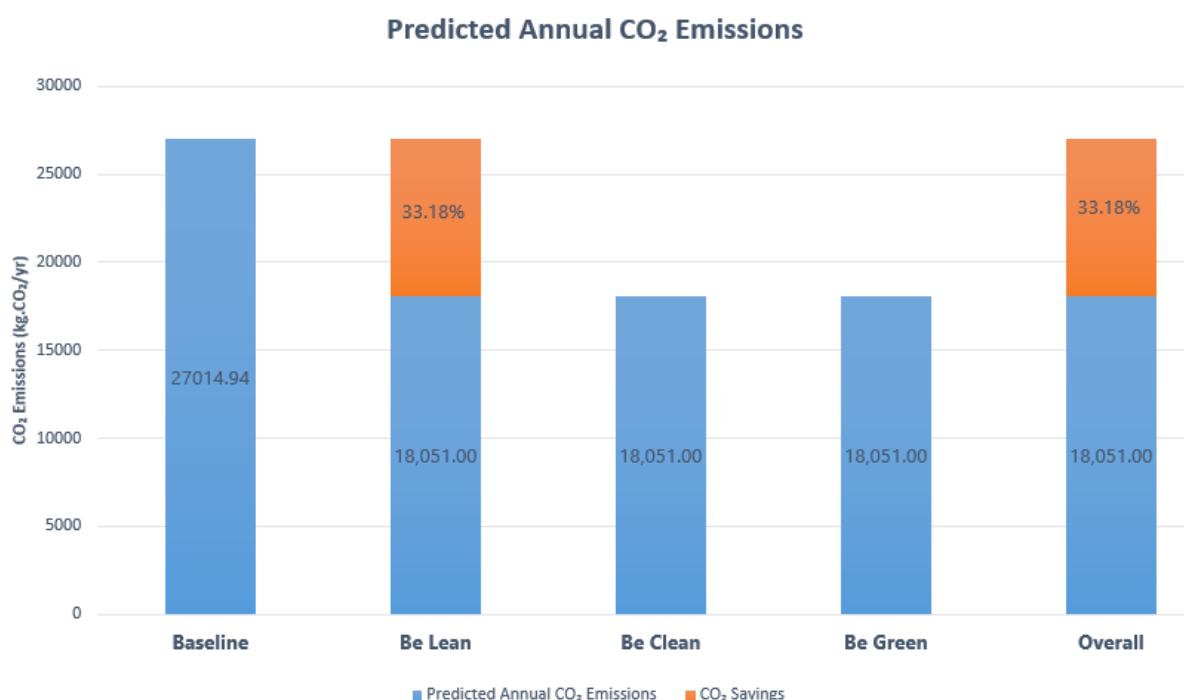
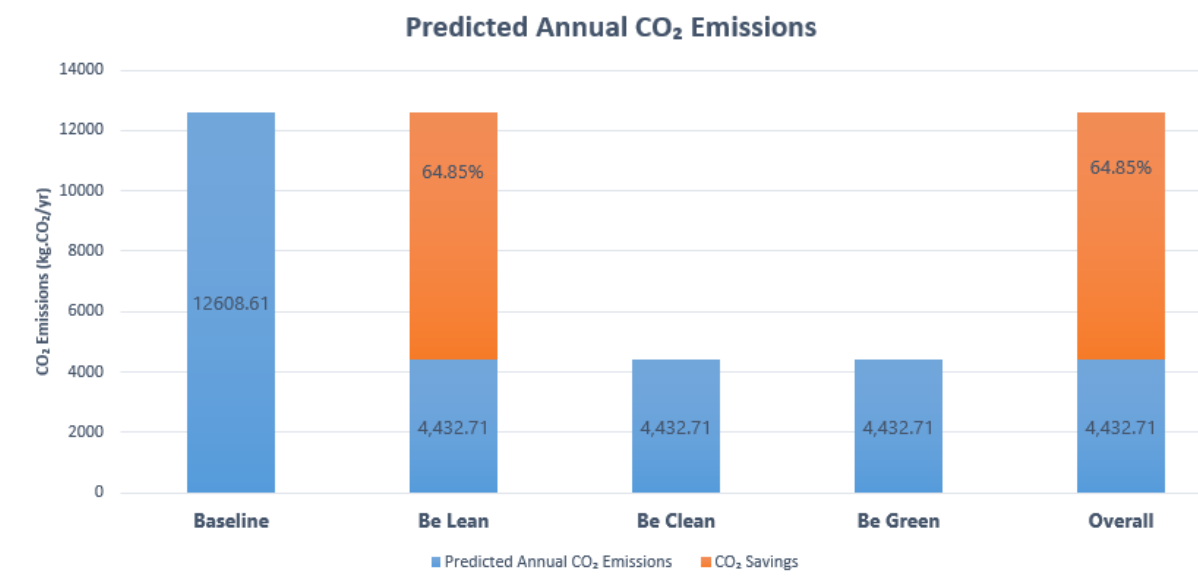


Figure 24: Overall CO₂ Emissions Reduction SAP 10 Building Regulations


A 33.18% overall reduction in CO₂ emissions over Part 13 Building Regulations can be observed. As stated previously, the Manchester Core Strategy requires a 15% improvement over Part L 2010 Building Regulations. These regulations have been superseded by 2013 Building Regulations which are a 6% betterment over 2010 Building Regulations. Therefore, by achieving a CO₂ reduction greater than 9% by 2013 Building Regulation standards the results achieve the required 15% improvement over 2010 building Regulations and meet the requirements of the Manchester Core Strategy.

Consideration has also been given to the RIBA 2030 Climate Challenge Targets with respect to non-domestic operational energy, embodied carbon and potable water use. Although RIBA plans on developing their targets further with UK professional bodies in order to obtain concrete benchmarks; we have made every effort to reach the current baselines prescribed as we share RIBA's urgency and enthusiasm in addressing the current Environment and Climate Emergency.

The overall CO₂ reduction of 33.18% equates to a 39.18% reduction over 2010 Building Regulations, this is an improvement over the requirements of Part L and the required 15% reduction dictated by the Manchester Core Strategy. Furthermore, it has been estimated that once SAP10 Building regulations come into force, the development will achieve an estimated CO₂ reduction of around 64.85% which goes even further beyond the requirements of the current Manchester Core Strategy. This estimate is a result of the all-electric strategy which takes advantage of the "greening of the grid" caused by the increased portion of renewable energy being supplied and does not require any PV to achieve a significant reduction in CO₂. Please note that as current 2012 software is not updated with the SAP10 fuel carbon factors, this reduction is an estimate only.

To summarise, the present 39.18% reduction in CO₂ over Part L2A 2010 Building Regulations has been achieved through the use of high-performance materials to improve the building fabric u-values, by incorporating low carbon air source heat pumps and heat recovery mechanical ventilation to efficiently provide the heating, hot water and ventilation needs. Efficient low energy lighting will be used throughout, and low flow rate fixtures and fittings will be used to reduce water consumption. It is therefore the conclusion of this report that the requirements of the Manchester Core Strategy have been met.

7 APPENDICES

Appendix A – SAP Reports

Appendix A

SAP Reports