

Albert Bridge House.
Manchester.
Oval Real Estate Ltd.

SUSTAINABILITY
STAGE 2 REPORT
ENERGY STRATEGY
REVISION 02 – 02 DECEMBER 2022



STAGE 2

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	04/10/2022	Draft issue to outline contents prior to completion of analysis	V. Wall	S. Stephenson	J. Ford
01	23/11/2022	Stage 2 issue	V. Wall J. Daoud	R. Palmer G. Papachristou	J. Ford
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Executive summary

1.1 Development description

This energy strategy has been prepared on behalf of Oval Real Estate Ltd in support of the proposed Albert Bridge House development in Manchester - hereafter referred to as the Proposed Development.

The project involves, “demolition of the existing building complex and the construction of a mixed use development comprising an office building of up to 19 storeys, (Class E(g(i))) with ground floor commercial, leisure, food and drink uses (Use Class E (a), (b), (c) and/ or drinking establishment Sui Generis) and, a residential building up to 45 storeys (Use Class C3) with roof top plant, basement car parking, cycle parking, landscaping and public realm, servicing and access arrangements, highway alterations and other associated works”.

The project is intended to deliver a “best in class” sustainable development in support of Greater Manchester’s target to be net zero by 2038 and Oval Real Estate’s own ESG objectives.

The mixed-use development is expected to contribute to sustainability in a broader sense through provision of:

- A high-density, well connected city-centre development
- Minimal on-site parking and high-quality cycle facilities
- High-quality accessible public realm and landscaping, re-activating the area and providing opportunity for improvements to local biodiversity through the retention of existing trees and planting of additional trees
- Integration of sustainable urban drainage (SuDS) to mitigate flood risk

Further, the commercial building is targeting a BREEAM rating of “Outstanding” under the BREEAM 2018 New Construction scheme (shell and core) and a minimum 5* rating under NABERS, with an aspiration to achieve 6*.

The residential building has been pre-assessed against the Home Quality Mark, indicating that a 4-star rating might be achievable.

This strategy summarises the relevant regulatory and planning policies and sets out how the development will address and achieve the relevant policy targets. The strategy responds to the UK planning and regulatory framework, and specifically to the Manchester Core Strategy policy documentation.

1.2 Energy strategy summary

Passive design and energy efficiency measures will provide the cornerstone to the energy demand and CO₂ emission reduction achieved for the Proposed Development.

The baseline scenario, which each step of the energy hierarchy will be compared against, is established by the Part L 2021 Target Emission Rate for a gas boiler baseline simulation.

1.3 National drivers - Approved Document Part L of the Building Regulations

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO₂ emissions from new buildings. The assessment of the Proposed Development against policy targets has been carried out using Building Regulations Part L 2021 methodology.

1.4 Planning Policy

The Manchester Core Strategy Policy EN6 states that residential development of 10 or more units and all other non-residential development over 1,000m² will be expected as a minimum to meet the following targets *(unless this can be shown not to be viable)*:

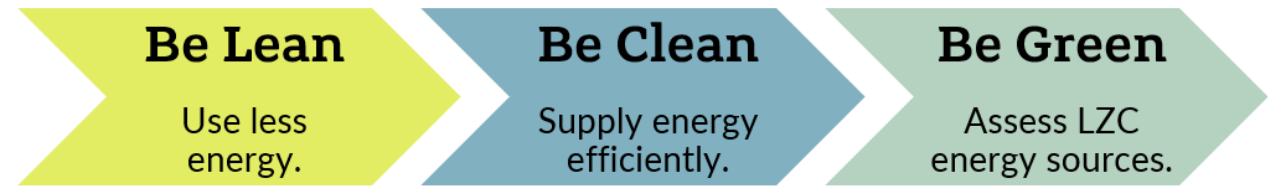
Target	% Minimum Requirement	
	Domestic	Non-domestic
Target 1: Network Development Area	CHP/ District heating anchor or connection or, where not feasible, a 15% increase on Part L 2010	CHP/ District heating anchor or connection or, where not feasible, a 15% increase on Part L 2010

Target	% Minimum Requirement	
Target 2: Electricity Intense Buildings	+ 10% increase on Part L 2010	+ 15% increase on Part L 2010
Target 3: Micro Generation Area	+ 15% increase on Part L 2010	+ 15% increase on Part L 2010

Table 1 CO₂ Emission Reduction Targets, Manchester Core Strategy

1.5 Approach

This report evaluates the Proposed Development against the energy hierarchy; be lean, be clean and be green.



Energy Hierarchy

	Albert Bridge House
Be Lean	A fabric first approach and energy efficiency building services will be utilised to reduce carbon emissions and energy demand through best practice passive design measures.
Be Clean	CHP would offer very little benefit in terms of carbon emission reduction and further loses any value as the grid decarbonises. Therefore, CHP has not been considered.
Be Green	Use of ASHP’s and incorporation of PVs for the development is anticipated to significantly reduce energy consumption and carbon emissions in operation by generation zero carbon electricity onsite.
Results	Overall reduction in regulated carbon emissions over current building regulations target for each building is shown as below: Commercial: 19.50% Residential: 70.00%

Energy Strategy Compliance Overview.

The energy strategy indicates that the Proposed Development achieves a reduction, over the Part L 2021 baseline, of 19.50% and 70% for the commercial and residential building, respectively. As such, meets Policy EN6 within the Manchester Core Strategy document.

The proposed energy strategy in this report reflects this philosophy and ties in closely with Manchester City Councils carbon zero 2028 / 2038 targets.

1. Introduction

This strategy has been prepared on behalf of Oval Real Estate Ltd in support of the proposed Albert Bridge House development in Manchester.

The project involves, “demolition of the existing building complex and the construction of a mixed use development comprising an office building of up to 19 storeys, (Class E(g(i)) with ground floor commercial, leisure, food and drink uses (Use Class E (a), (b), (c) and/ or drinking establishment Sui Generis) and, a residential building up to 45 storeys (Use Class C3) with roof top plant, basement car parking, cycle parking, landscaping and public realm, servicing and access arrangements, highway alterations and other associated works”.



Figure 1 Visualisation of the Proposed Development (SEW Architects)

This strategy summarises the relevant regulatory and planning policies applicable to the development and sets out how the development will address and achieve the relevant policy targets.

Manchester has recently set an ambitious target to be a ‘zero carbon city’ by 2038, with new development to be zero carbon by 2028. Whilst the shorter-term target is not included in current policy, the Proposed Development is expected to support these ambitions through incorporation of low carbon and renewable energy instead of fossil fuels.

Manchester Core Strategy (2012 – 2027) states within Policy EN6 that applications for commercial developments exceeding 1,000m² will be expected to achieve a minimum +10% increase on Part L 2010 and residential developments a minimum 15% increase on Part L 2010. Since the publication of the Core Strategy document, Approved Document Part L has since been updated in 2013, and again in 2021. Broadly speaking,

compliance with Part L 2013 required a 9% reduction in carbon emissions compared to Part L 2010. A new non-domestic building built to ADL 2021 standards will deliver a 27% reduction in CO₂ emissions on average across the new non-domestic building mix relative to ADL 2013, and a new domestic building will deliver a 31% reduction, therefore compliance with ADL 2021 will automatically achieve the required improvement over ADL 2010.

1.1 Proposed Development

The proposed site is currently occupied by Albert Bridge House; an 18-storey office block constructed in 1959 within the St Mary’s Parsonage strategic regeneration framework, near Spinningfields in central Manchester.

The new Albert Bridge House will provide 19 storeys of speculative office space with each floor plate stepping back to provide amenity terraces and greenery. A new residential tower is proposed alongside to provide a mix of 1, 2 and 3 bed apartments over 45 storeys. Both buildings will provide opportunities for ground floor retail, secure cycle storage and changing facilities. Building services will be located in the basement and on the roof-top as necessary.

This energy strategy considers the façade performance to find the balance between daylighting and useful solar gains. The table below details the indicative areas that have been subject to analysis.

Table 2 Indicative areas schedule

	Space use	GIA (m ²)*	Number of apartments**
Commercial	Office	32,403	
	Retail	1,431	
	Cycle Amenities	514	
	Ancillary	13,368	
Residential	1B2P		118
	2B3P		36
	2B4P		170
	3B4P		30
	3B6P		13

* Areas taken from the IES model, built according to National Calculation Methodology (NCM). These differ slightly to the stated office GIA (excluding basement) of 43,459m² – some of this additional area is included in the ancillary spaces of the IES model

** Numbers taken from SEW’s draft Design and Access Statement (DAS)

2. Policy and Key Drivers

The following section outlines the national and local policies and drivers.

2.1.1 Building Regulations Part L (2021)

Approved Document Part L (2021, England edition) is the Building Regulations relating to the conservation of fuel and power in buildings. The Approved Document is separated into two sections: Volume 1 and Volume 2:

- Part L Vol.1 relates to dwellings specifically, with an individual criterion for this building-use type
- Part L Vol.2 relates to buildings other than dwellings ‘Conservation of fuel and power in buildings other than dwellings’ and sets out specific criteria for this building use type.

Schedule 1: Conservation of Fuel and Power.

Schedule 1 of the Building Regulations Part L states that reasonable provisions shall be made for:

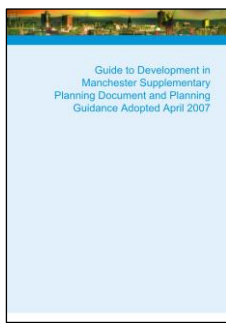
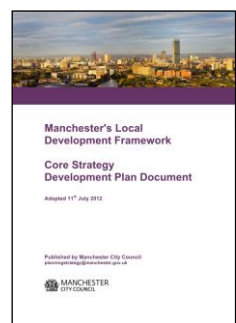
- 
- Limiting Heat Gains and Losses through;
 - Thermal elements and other parts of the building fabric; and;
 - From pipes, ducts and vessels used for space heating, space cooling and hot water services.
 - Providing fixed building services which are:
 - Energy Efficient;
 - Have effective controls; and;
 - Are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances

Developments should aim to at least meet the limiting values for system and fabric requirements in order to better the Building Emission Rate set by a notional building which uses standardised inputs based on the system and fabric design of each building.

Part L (2021) Conservation of Fuel and Power

With the release of the update to the Part L of Building Regulations in December 2021, the newest iteration is applicable to all developments commencing work after June 2022 which did not submit an initial notice.

2.1.2 Local Planning Policy



Manchester City Council (MCC) documentation:

- Core Strategy (CS) (July 2012)
- Supplementary Planning Documentation and Planning Guidance (SPDPG) (April 2007)

This strategy summarises the response of the Proposed Development's design to the policy framework of the MCC Adopted Core Strategy, and SPDPG documentation that together form the city's policy landscape. The CS documentation supersedes the SPDPG and therefore the CS documentation will take precedence.

2.1.3 Manchester Climate Change Framework (2020-2025)



The aim is that ““Manchester will play its full part in limiting the impacts of climate change and create a healthy, green, socially just city where everyone can thrive.””

It identifies four objectives we need to meet by 2025.

- Objective 1 – Staying within our carbon budgets
- Objective 2 – Climate adaptation and resilience
- Objective 3 – Health and wellbeing
- Objective 4 – Inclusive, zero carbon and climate resilient economy

Six priority areas for action have been identified as follows:

1. Buildings (existing and new)
2. Renewable energy
3. Transport and flying
4. Food
5. The things we buy and throw away
6. Green infrastructure and nature-based solutions

2.1.4 5-Year Environment Plan for Greater Manchester

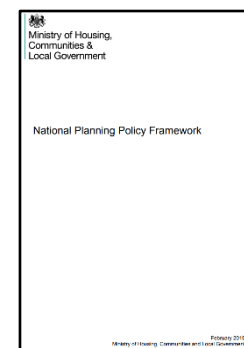


Greater Manchester Combined Authority (GMCA) sets an ambitious target to be a zero-carbon city by 2038. As part of this plan, the Greater Manchester Spatial Framework sets out plans for all new development to be zero carbon by 2028.

The five-year plan sets out a number of key items, including, but not limited to; increasing local renewable electricity generation, increasing the diversity and flexibility of energy supply and decarbonising how buildings are heated (served). These items encourage passive design and a shift away from fossil fuels to service buildings. The five-year plan also notes that new developments should seek to generate 20% onsite / renewable energy generation.

Additionally, the strategy includes a clean air plan to help tackle poor air quality – safeguarding Manchester residents from high levels of Nitrogen Dioxide (NO₂).

2.1.5 National Planning Policy Framework



The updated National Planning Policy Framework (NPPF) was published in July 2021 and has superseded all Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) documents, with the exception of PPS10 (Waste). The NPPF sets out the Government's strategy on the delivery of sustainable development.

The NPPF places responsibility for policy making with the Local Planning Authority, who shall communicate their policies through Local Plans and facilitate the creation of Neighbourhood Plans. The NPPF states that there is a presumption in favour of sustainable development.

The following is extracted from paragraph 11 of the NPPF:

“Plans and decisions should apply a presumption in favour of sustainable development. For plan-making this means that:

- a) *plans should positively seek opportunities to meet the development needs of their area, and be sufficiently flexible to adapt to rapid change;*

- b) *strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas, unless:*
 - i. *the application of policies in this Framework that protect areas or assets of particular importance provides a strong reason for restricting the overall scale, type or distribution of development in the plan area; or*
 - ii. *any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.*

For decision-taking this means:

- a) *approving development proposals that accord with an up-to-date development plan without delay; or*
- b) *where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date⁷, granting permission unless:*
 - i. *the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed⁶; or*
 - ii. *any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole."*

In respect of energy policy contained within the NPPF, paragraph 155 sets out that:

- "To help increase the use and supply of renewable and low carbon energy and heat, plans should:*
- a) *provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
 - b) *consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
 - c) *identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers."*

3. National Grid Decarbonisation

Future projections.

The Future Energy Scenarios (FES) document, produced by the National Grid, discusses how the UK's energy landscape is changing. The FES 2021 makes projections of how the mix of generation in the grid is likely to change between now and 2050 – the year by which the Climate Change Act 2008 set the target of reducing the UK's CO₂ emissions by 80% from 1990 levels. This target has now been revised to be Net Zero in light of the Committee on Climate Change's recent report and the declaration of a Climate Emergency.

The latest version, FES 2021, discusses these projections in four scenarios and Figure 2 combines these future trajectories with the actual carbon intensity of the National Grid over the past 13 years. The reported emissions associated with electricity generation have fallen steeply since 2012 and in three cases, the FES 2021 scenarios see carbon factors trending towards zero by the early 2030s. This is on the basis that FES 2021 have deemed it necessary to offset other industries such as freight, shipping and aviation, which will be unable to reduce their carbon emissions to zero. Offsetting the emissions of other industries will involve Carbon Capture and Storage (CCS) technologies on a significant scale in order for the UK as a nation to meet net zero carbon by 2050. It is important to note that CCS technology is not currently commercially demonstrated at a large scale, but the FES 2021 studies are useful as future forecasts.

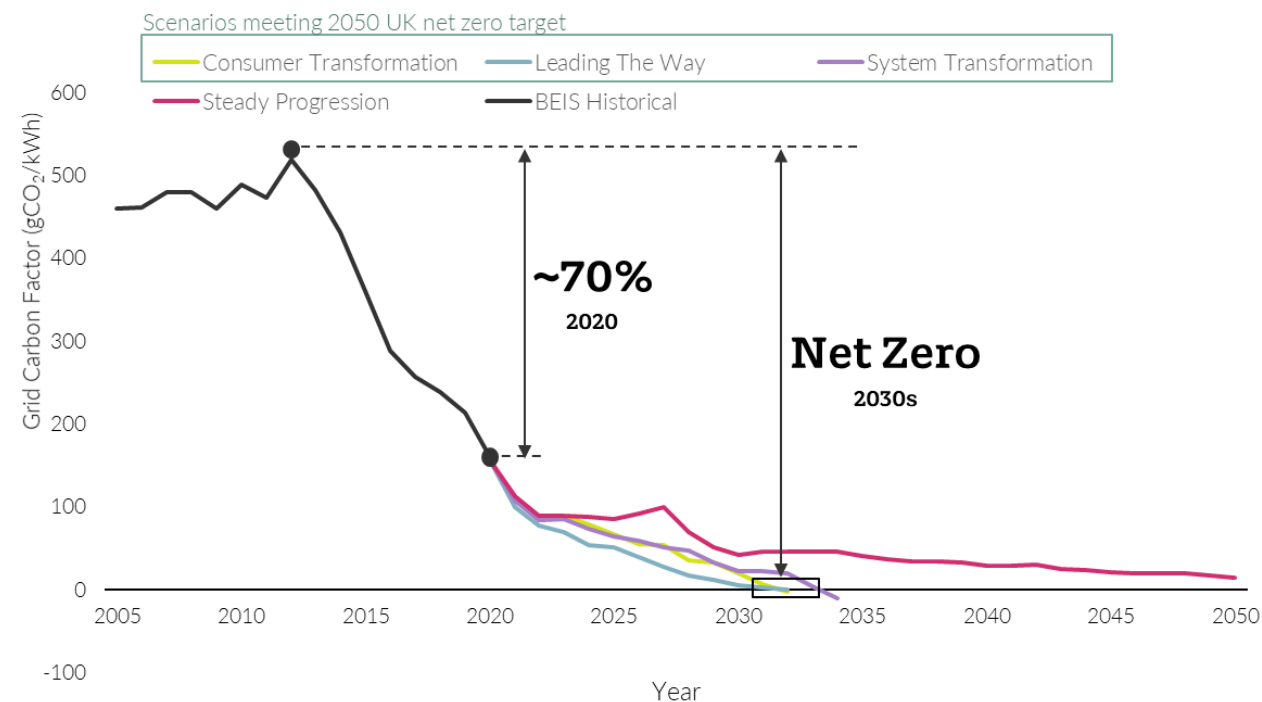


Figure 2: Historic and future projected carbon factor for the National Grid. 8% transmission and distribution losses are included. Sources: BEIS Green Book (historic carbon factors); National Grid Future Energy Scenarios (FES) 2021 (future projected carbon factors).

As a response to the decarbonisation trend, the latest Building Regulations (ADL 2021) include a significantly reduced carbon emission factor for grid electricity of 0.136 kgCO₂/kWh (SAP10.2) compared to 0.519 kgCO₂/kWh used in ADL 2013. This reduction reflects the increased contribution of renewable energy into the national mix of electricity generation. In 2020, renewable sources accounted for 43% of the electricity generated in the UK, up from 24.4% in 2016 (Ofgem).

Historic progress.

Figure 3 shows how the mix of generation technologies serving the National Grid, as well as the associated carbon factor, has varied between 2012 and 2018 based on the mix of generation techniques serving the National Grid over this six-year period.

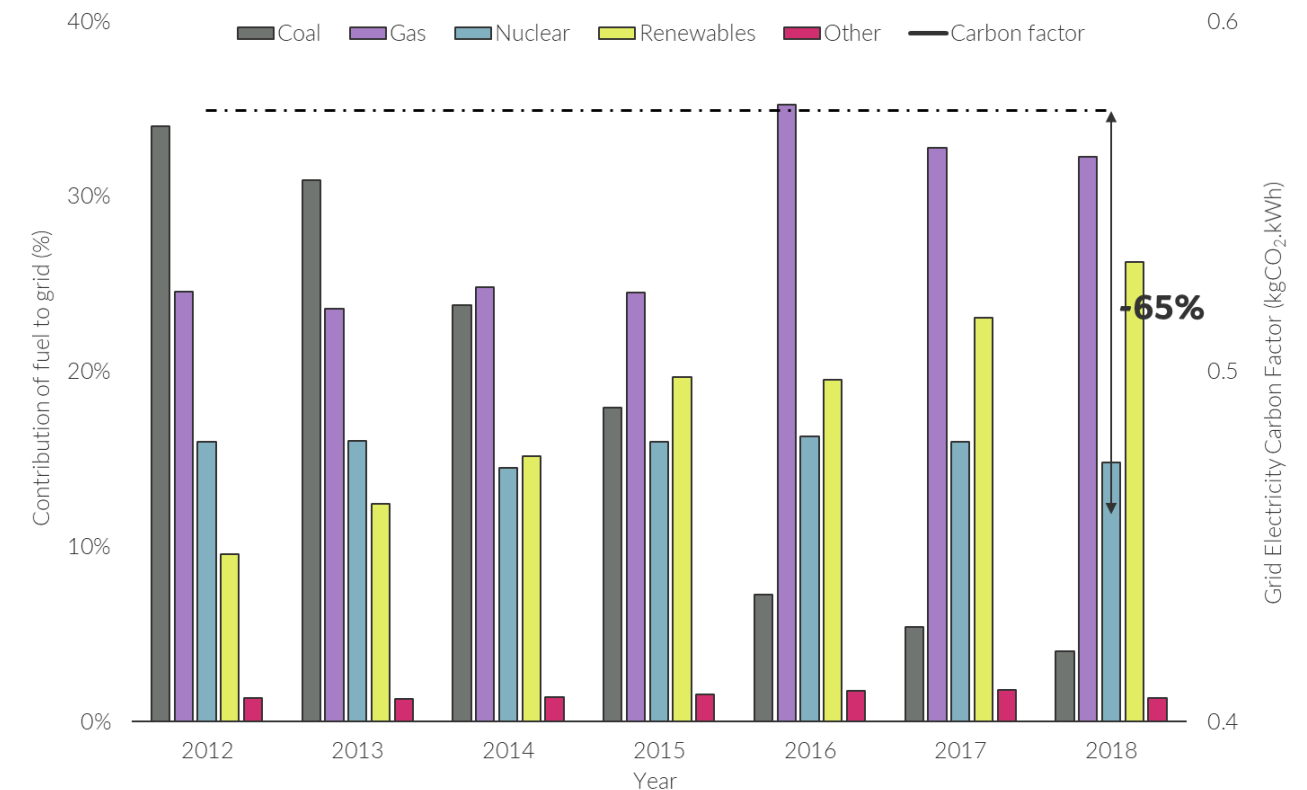


Figure 3: Historic mix of generation methods and associated carbon factor for the National Grid. 8% transmission and distribution losses are included. Sources: electricityinfo.org (generation mix); BEIS Green Book (historic carbon factors).

4. Assessment Methodology

The following is a summary of the data used and inputs / assumption made for simulation geometry modelling.

4.1 Site Context

The site is located within the St Mary's Parsonage strategic regeneration framework in central Manchester.



Figure 4: Location of the Albert Bridge House existing site and building with respect to the surrounding area.

4.2 Site location and weather data

A building's thermal performance is its response to external environmental conditions. The more dependant a building is on passive features to achieve acceptable internal comfort, the more important the use of external weather information becomes.

Climate data is assigned to the virtual environment of the dynamic model to simulate external weather conditions that are likely to occur. Thermal comfort calculations require the simulation to be tested against Chartered Institute of Building Services Engineers (CIBSE) Design Summer Year (DSY) climate data to best assess how spaces will perform during a year with hot summer conditions. The UK Meteorological Office (MO) collects weather data at stations across the UK. Climate variables measured at hourly intervals include air temperatures, wind speed and direction and air pressure amongst various other characteristics.

CIBSE licenses the historic weather data from the MO for 14 locations in the United Kingdom: Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, London (3 sites), Manchester, Newcastle, Norwich, Nottingham, Plymouth, Southampton and Swindon. The weather variables are synthesised into 2 types of CIBSE weather file:

- **Test Reference Year (TRY): 2006 and 2016**
The TRY is composed of 12 separate months of data each chosen to be the most average month from the collected data.
The TRY is used for operational energy analysis and for compliance with the UK Building Regulations (Part L).
- **Design Summer Year (DSY): 2006 and 2016**
The DSY is a single continuous year rather than a composite one made up from average months.
The DSY is used for overheating analysis.

As per the standardised methodology for Part L, the Manchester CIBSE TRY weather file was used.

4.3 Dynamic Simulation Model

Based on the information above a series of Dynamic Simulation Models were created to undertake appropriate assessments on the proposed design.

Integrated Environmental Solutions Virtual Environment (IESve) is an approved Dynamic Simulation Model (DSM) software package that has the capabilities of enabling the user to create a virtual representation of a building.

Models built in the IESve have been used to demonstrate compliance with Approved Document Part L2A 2021 using the National Calculation Methodology alongside the assessment of operational energy consumption.

One of the DSM models, with simplified versions of the surrounding buildings (as appropriate) is displayed below.

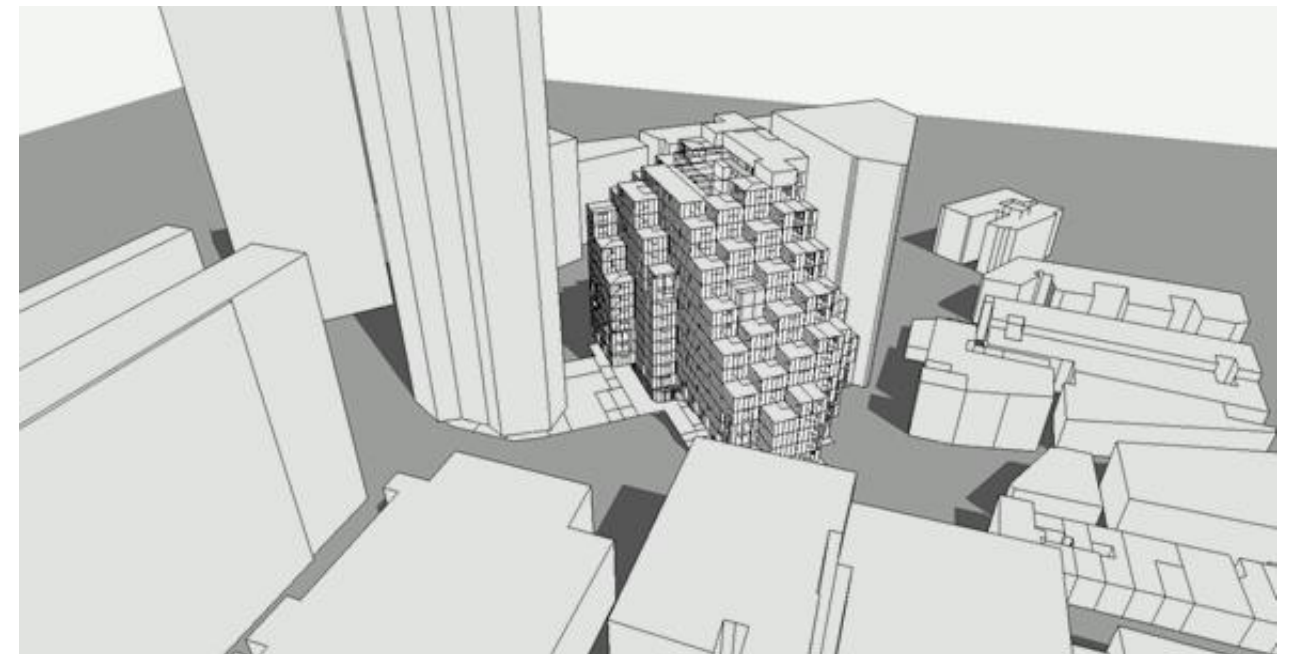


Figure 5: DSM Model Image

4.4 Standard Assessment Procedure (SAP)

SAP calculations were undertaken for a sample number of units using Elmhurst Design SAP 10. This is a software package that has the capabilities of enabling the user to assess performance against building regulations Part L 2021 and to, ultimately, create an Energy Performance Certificate (EPC) for a dwelling. The software calculates the annual operational regulated CO₂ emissions generated by the project.

The SAP geometry for the Proposed Development was modelled to geometry received from the Architect (Table 5).

The most efficient approach to demonstrating compliance during the early design stages is to model a sample set of SAPs and pro rata these results out across the building. In this case, each of the different apartment types has been modelled in SAP to test compliance for a representative mix of units across the building using block compliance. Table 3 records the apartments that have been modelled in SAP to represent different dwelling sizes (number of bedrooms and resulting floor area), account for different orientations and exposed heat loss elements i.e. external wall, floor and roof area. Further assessments will be undertaken during the next stage to account for any design changes and refined specification details.

Table 3 Apartment types that have been modelled in SAP

Reference	Typical level	Type	Floor area (m²)	Orientation	Multiplier	Actual #
1B2P Type 01	35	1B2P	55	South	40	118
1B2P Type 01 R	35	1B2P	55	South	78	
2B3P	5	2B3P	67	North	36	36
Duplex T.01	10/11	2B4P	50	East	4	198
Duplex T.03	22/23	2B4P	40	North	4	
Type 05 L	36-39	2B4P	76	South	95	
Type 05 R	36-39	2B4P	76	South	95	
Type 01 Low-mid	40	3B6P	110	South	4	15
Type 01 Upper	44				1	
Type 02 Low-mid	40		108	East	4	
Type 02 Upper	44				1	
Type 03 Low-mid	40		118	North	4	
Type 02 Upper	44				1	

4.5 Building Fabric Specification

Optimising the development's fabric is seen to be the most robust and effective way to improve energy efficiency and in turn reduce carbon emissions whilst also impacting thermal comfort.

The performance of the envelope is unlikely to deteriorate significantly with time and therefore the benefits of these measures will continue at a similar performance for the duration of their installation. The current values used are as indicated by the architects and the fabric performance parameters are detailed below.

Table 4 Fabric Performance.

Parameter	Non-Domestic	Domestic
Fabric air permeability (m³/m².h @ 50Pa)	3.00	3.00
Aggregated curtain wall U-value (W/m².K)	1.33 (base case)	1.00 (base case)
	1.11 (improved)	0.83 (improved)
Party Wall to heated corridor U-value (W/m².K)		0.00 ¹
Exposed floor U-value (W/m².K)	0.14	0.10
Exposed roof U-value (W/m².K)	0.15	0.12
Glazing g-value	0.40	0.40
Solid door U-value (W/m²K)	N/A	N/A
Thermal bridges	Heat loss through thermal bridges to be minimised as far as reasonably possible during construction.	

¹ Zero U-value is achieved with a solid/ fully filled cavity wall with effective edge sealing

4.6 Mechanical and Electrical Information

Mechanical engineers from Hoare Lea provided outline information on the systems modelled in the residential and commercial energy assessments.

4.7 Architectural drawings

The geometry used to assess the Proposed Development was determined by the following drawings received from SEW. While minor updates may have been made to these drawings since their issue, the majority of the modelling information was based on the below information.

Table 5: Architectural Information.

Demise	Document Package	Data Type	Date Received
Commercial	0412-SEW-ZZ-ZZ-M3-A-00000_01-08-22 0412-SEW-ZZ-ZZ-M3-A-00000_rev.04	Revit model	01/08/2022
	Building B - Level 00: 0412-SEW-BB-00-DR-A-051160 Building B - Level 01: 0412-SEW-BB-00-DR-A-051161 Building B - Level 02: 0412-SEW-BB-00-DR-A-051162 Building B - Level 03: 0412-SEW-BB-00-DR-A-051163 Building B - Level 04: 0412-SEW-BB-00-DR-A-051164 Building B - Level 05: 0412-SEW-BB-00-DR-A-051165 Building B - Level 06: 0412-SEW-BB-00-DR-A-051166 Building B - Level 07: 0412-SEW-BB-00-DR-A-051167 Building B - Level 08: 0412-SEW-BB-00-DR-A-051168 Building B - Level 09: 0412-SEW-BB-00-DR-A-051169 Building B - Level 10: 0412-SEW-BB-00-DR-A-051170 Building B - Level 11: 0412-SEW-BB-00-DR-A-051171 Building B - Level 12: 0412-SEW-BB-00-DR-A-051172 Building B - Level 13: 0412-SEW-BB-00-DR-A-051173 Building B - Level 14: 0412-SEW-BB-00-DR-A-051174 Building B - Level 15: 0412-SEW-BB-00-DR-A-051175 Building B - Level 16: 0412-SEW-BB-00-DR-A-051176 Building B - Level 17: 0412-SEW-BB-00-DR-A-051177 Building B - Level 18: 0412-SEW-BB-00-DR-A-051178 Building B - Level 19 Roof Plan: 0412-SEW-BB-00-DR-A-051179	PDF/ DWG	22/07/2022
Residential	Building A - Level 00: 0412-SEW-AA-00-DR-A-051100 Building A - Level 01: 0412-SEW-AA-01-DR-A-051101 Building A - Level 05: 0412-SEW-AA-05-DR-A-051105 Building A - Level 10: 0412-SEW-AA-10-DR-A-051110 Building A - Level 11: 0412-SEW-AA-11-DR-A-051111 Building A - Level 22: 0412-SEW-AA-22-DR-A-051122 Building A - Level 23: 0412-SEW-AA-23-DR-A-051123 Building A - Level 34: 0412-SEW-AA-34-DR-A-051134 Building A - Level 35: 0412-SEW-AA-35-DR-A-051135 Building A - Level 36: 0412-SEW-AA-36-DR-A-051136 Building A - Level 40: 0412-SEW-AA-36-DR-A-051140 Building A - Level 45 Roof Plan: 0412-SEW-AA-RF-DR-A-051145	PDF/ DWG	22/07/2022
	Building A - Level 10 Set Back A Lower 0412-SEW-AA-10-DR-A-051110 Building A - Level 11 Set Back A Upper 0412-SEW-AA-11-DR-A-051111 Building A - Level 22 Set Back B Lower 0412-SEW-AA-22-DR-A-051122 Building A - Level 23 Set Back 0412-SEW-AA-23-DR-A-051123	PDF	09/09/2022

5. Energy Strategy - Commercial

In order to develop the energy strategy, a 'baseline' case was created which:

- i) meets Part L 2021 of the Building Regulations;
- ii) utilises high efficiency gas fired boilers; providing space heating and domestic hot water; and
- iii) utilises high efficiency chillers to provide space cooling.

5.1 Baseline Case

The baseline case helps to inform the benefit of low and zero carbon technologies – which are implemented in the 'clean' and 'green' stages.

Table 6 Baseline Case Building Performance Parameters

	Fabric performance The baseline case utilises the same fabric performance as the Building Regulations Part L 2021 'notional' building; - External Walls; 0.18 W/m²K - Exposed Floors; 0.15 W/m²K - Roof; 0.15 W/m²K - External Glazing; 1.40 W/m²K - Air permeability; 3.00 m³/hr.m² @ 50Pa
 	Space cooling & heating Space cooling and heating is provided via Variable Air Volume (VAV) systems which are served by high efficiency boilers and chillers. The heating and chilled water circuits include efficient variable speed pumps to help minimise energy consumption. Comms areas are served by a DX system and shower/WC areas are heated via electric fan convectors, served by direct electric heat source.
	Mechanical ventilation The use of heat recovery is used throughout the office development. Recovering heat from the extract air can help reduce annual heating energy considerably with no impact on the air quality of the incoming fresh air. The air handling plant will have efficient fan motors and will be designed with low static fan pressures to help reduce the energy consumption associated with delivering fresh air into the building.
	Lighting The internal lighting design incorporates the use of high efficiency LED lighting combined with daylight linking (where applicable). The use of presence and absence detection prevents the internal lighting being 'on' when the occupied spaces are not occupied. The efficient lighting design also help to drive down the cooling energy consumption.
	Domestic hot water (DHW) system Domestic hot water is supplied via point-of-use (POU) electric domestic hot water (DHW) heaters. An allowance of 720 litres of storage has been made for the office areas.

5.1.1 Baseline Case Results

Figure 6 shows the energy demand for Proposed Development – using the baseline case.

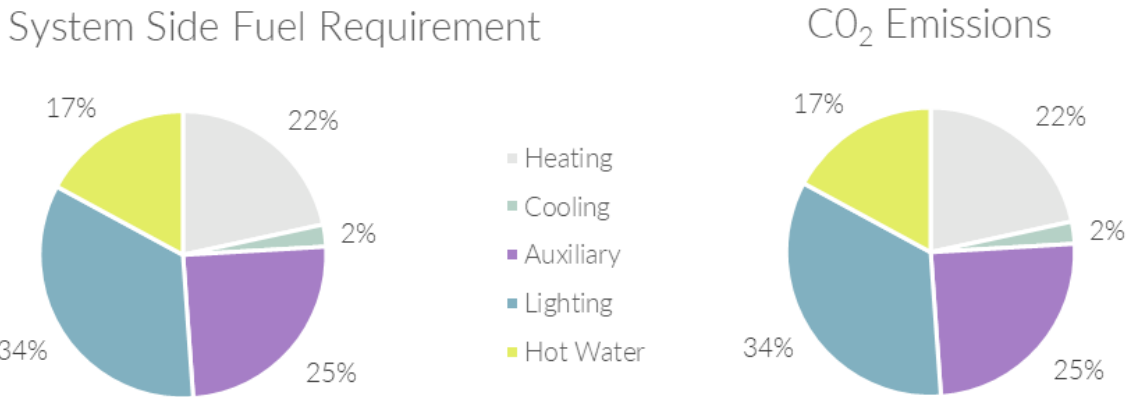


Figure 6 Baseline energy demand and emissions

Targeting the following elements will help drive down and improve the buildings carbon emissions.

- Improved thermal envelope; in particular, targeting external walls and air tightness
- Improved air handling plant; reducing specific fan powers and associated controls
- Improved lighting systems; higher efficiency light fittings and controls

It is important to consider the, sometimes unintended, consequences of implementing such improvements. For example, improving the lighting efficiency is likely to reduce internal gains and the associated cooling loads, reducing the overall energy demand of the building. Similarly, improving the thermal performance of the building envelope through enhanced insulation and air tightness will reduce heat loss and improve overall energy efficiency but may lead to overheating so it is important to consider thermal comfort alongside such measures.

5.2 Be Lean

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the Proposed Development. This energy strategy aims to reduce the energy demand initially by optimising the envelope. The fabric improvements are specified in Table 8.



Passive design and energy efficient features

Passive design measures are those which reduce the demand for energy within buildings, without actively consuming energy in the process. These are the most robust and effective measures for reducing CO₂ emissions as the performance of these solutions, such as façade insulation, is unlikely to deteriorate significantly over time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation.

Table 7 Passive Design Measures in addition to the baseline

	Fabric performance A ‘fabric first’ approach has been taken to reduce the energy demand and CO ₂ emissions from the Proposed Development. The overriding objective for the façade design will be to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter and limiting summertime solar gains to reduce space cooling demands.
	Space cooling & heating Space cooling and heating is provided via Variable Air Volume (VAV) systems which are served by high efficiency boilers and chillers. The heating and chilled water circuits include efficient variable speed pumps to help minimise energy consumption. Comms areas are served by a DX system and shower/WC areas are heated via electric fan convectors, served by direct electric heat source.
	Mechanical ventilation The use of heat recovery is used throughout the office development. Recovering heat from the extract air can help reduce annual heating energy considerably with no impact on the air quality of the incoming fresh air. The air handling plant will have efficient fan motors and will be designed with low static fan pressures to help reduce the energy consumption associated with delivering fresh air into the building.
	Lighting The internal lighting design incorporates the use of high efficiency LED lighting combined with daylight linking (where applicable). The use of presence and absence detection prevents the internal lighting being ‘on’ when the occupied spaces are not occupied. The efficient lighting design also help to drive down the cooling energy consumption.
	Domestic hot water (DHW) system Domestic hot water is supplied via point-of-use (POU) electric domestic hot water (DHW) heaters. An allowance of 720 litres of storage has been made for the office areas.

Table 8 Fabric Performance

Parameter	‘Standard Building’ Part L 2021 – Notional	‘Proposed Building’ Target Initial
Fabric Air Permeability (m ³ /m ² .h at 50Pa)	3.00	3.00
External Wall U-value (W/m ² .K)	0.18	0.25
Basement Wall U-value (W/m ² .K)	-	0.22
Aggregated Curtain Wall U-value (W/m ² .K)	-	1.33
Ground Floor U-value (W/m ² .K)	0.15	0.14
Roof U-value (W/m ² .K)	0.15	0.15
Door U-value (W/m ² .K)	2.20	N/A
Glazing (External Windows / Glazed doors) (g-value)	0.40	0.40
Glazing light transmittance (inclusive of External Windows / Glazed doors / External and Internal Atrium Glazing)	71%	71%

5.2.1 Be Lean Comparative Study

The façade is comprised of both solid and transparent elements that make up the curtain wall system. Therefore, it was decided that the entire system would be treated as one unified element with an area-weighted average U-value assigned to the whole component, referred to as a Unitised Façade System.

The Unitised Façade System’s average U-value includes a 20% contingency to account for thermal bridging as a worst-case scenario (1.33 W/m²K as used for Be Lean).

The calculated U-value without this margin is 1.11 W/m²K, however, similar commercial projects in Greater Manchester are achieving U-values better than 0.8W/m²K with the same type of façade system. Therefore these enhanced U-values have been tested to understand their impact.

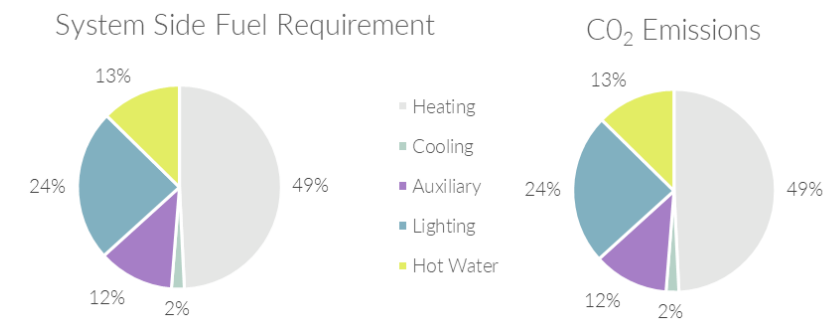
Table 9 summarises the performance options tested and the results are shown in section 5.2.2 below.

Table 9 - Fabric Performance per Scenario

Parameter	Option A	Option B	Option C
Aggregated Curtain Wall U-value (W/m ² .K) (Inclusive of glazing/spandrel/louver/solid elements)	1.33	1.11	0.80

5.2.2 Be Lean Results

5.2.2.1 Option A



Discussion

As shown in the pie charts, the space heating is the dominant end-use energy consumer at 49%. This is likely due to the worst-case U-value.

When compared to the Part L 2021 Target Primary Energy Rate (TPER) the building's Building Primary Energy Rate (BPER) exceeds the target by 15.3% (Figure 7).

The margin of failure against the target demonstrates the negative impact that the worst-case U-value is having on overall performance, and that consideration should be given to improvements.

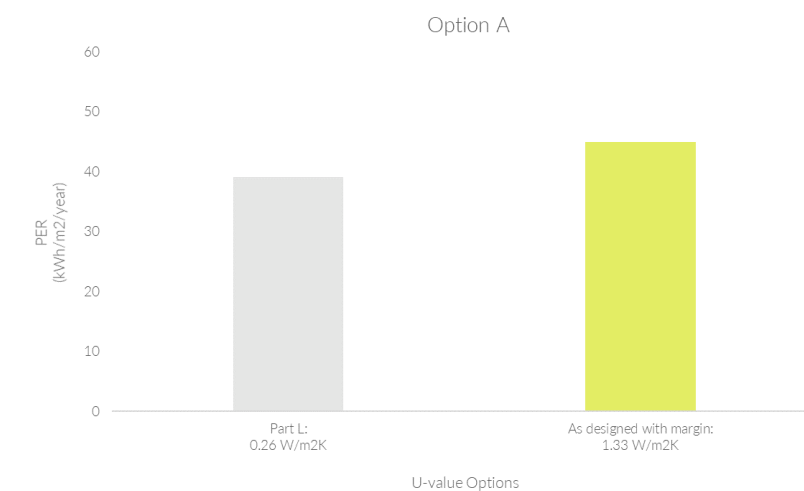
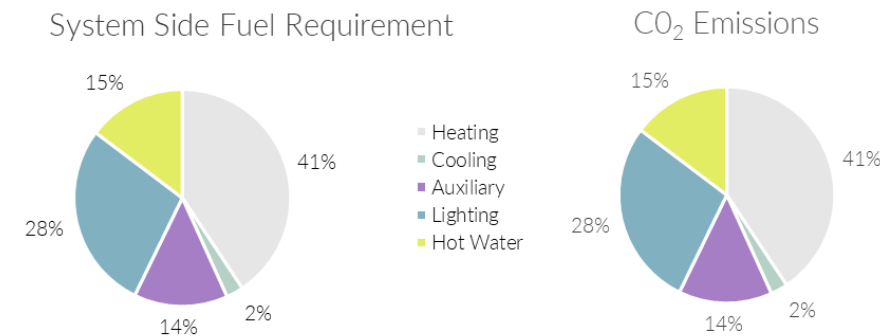


Figure 7 BPER and TPER for Option A

5.2.2.2 Option B



Discussion

As shown in the pie charts, the space heating remains the dominant end-use energy consumer followed by auxiliary.

However, removing the 20% contingency margin from the average U-value reduces the space heating demand by 8%. The BPER exceeds the TPER by 0.13%, demonstrating 15.43% improvement above Option A.

This indicates that improving the thermal performance of the unitised façade system will reduce the heating demand substantially and the resulting CO₂ emissions from the building.

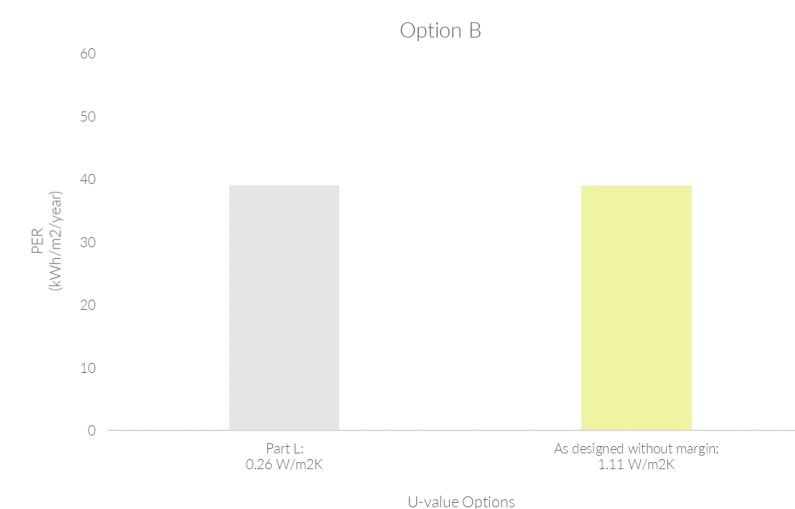
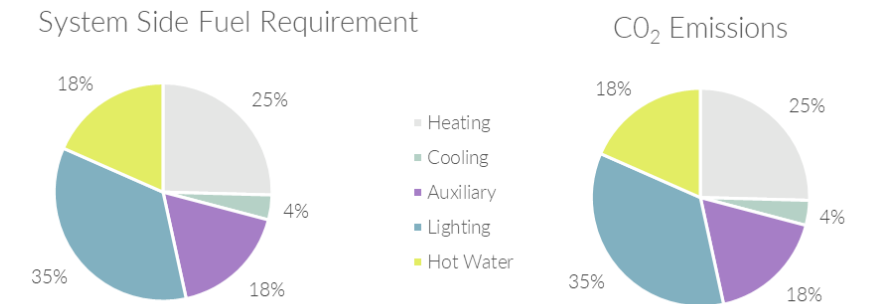


Figure 8 BPER and TPER for Option B

5.2.2.3 Option C



Discussion

Option C analyses the impact of an average U-value of 0.8 W/m²K, which has been taken from similar commercial projects.

The dominant end-use energy is no longer for space heating, but lighting, followed by auxiliary. Space heating demand has reduced by ~16% over Option A and 24% over Option B.

The BPER now passes the TPER by 18% demonstrating how passive design measures, such as improved fabric insulation, can improve performance.

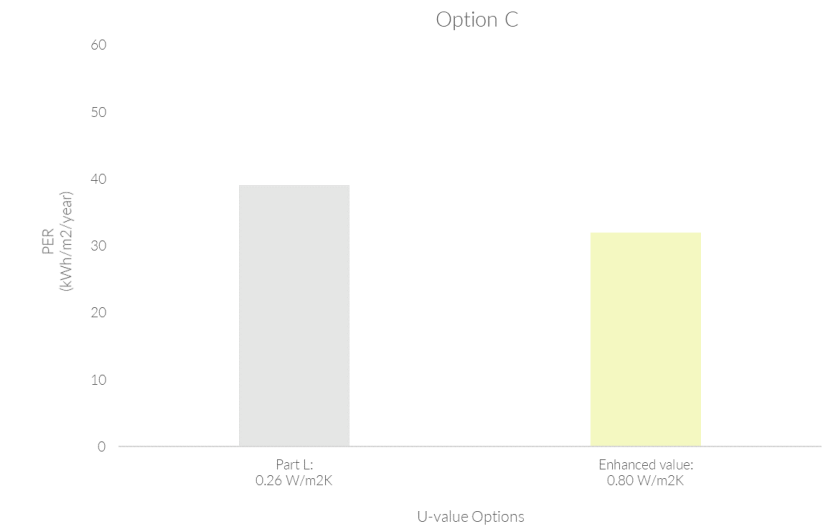


Figure 9 BPER and TPER for Option C

Conclusion

As demonstrated in the comparative study above, the calculated U-value of the unitised façade system with 20% contingency performs (option A) poorly in terms of both end-use energy consumption and primary energy rate. Removing this margin (option B) and then pushing on to enhanced performance (option C) results in a 18% improvement in the BPER when compared to the TPER.

Energy Consumption by End Use	Option A	Option B	Option C
	kWh/m²		
Heating	18.09	12.83	6.42
Cooling	0.75	0.81	0.93
Auxiliary	4.42	4.42	4.42
Lighting	8.84	8.84	8.84
Hot Water	4.65	4.65	4.65
TOTAL	36.76	31.55	25.27
Building Primary Energy Rate (BPER) per annum	44.94	39.04	31.92

Table 10 – Be Lean comparative study results

The results above indicate that improving the overall U-value of the façade will reduce the heating demand quite significantly. The improved fabric efficiency will result in less heat loss in winter and gains in summer.

This comparative study suggests that further thought should be given to the wall build-up because passive design measures are the first line of defence against high energy-expending buildings which will increase operational energy costs, place pressure on the electricity grid, but also incur maintenance costs due to increased loads on building services. The façade performance will be refined during the next stage to optimise energy efficiency.

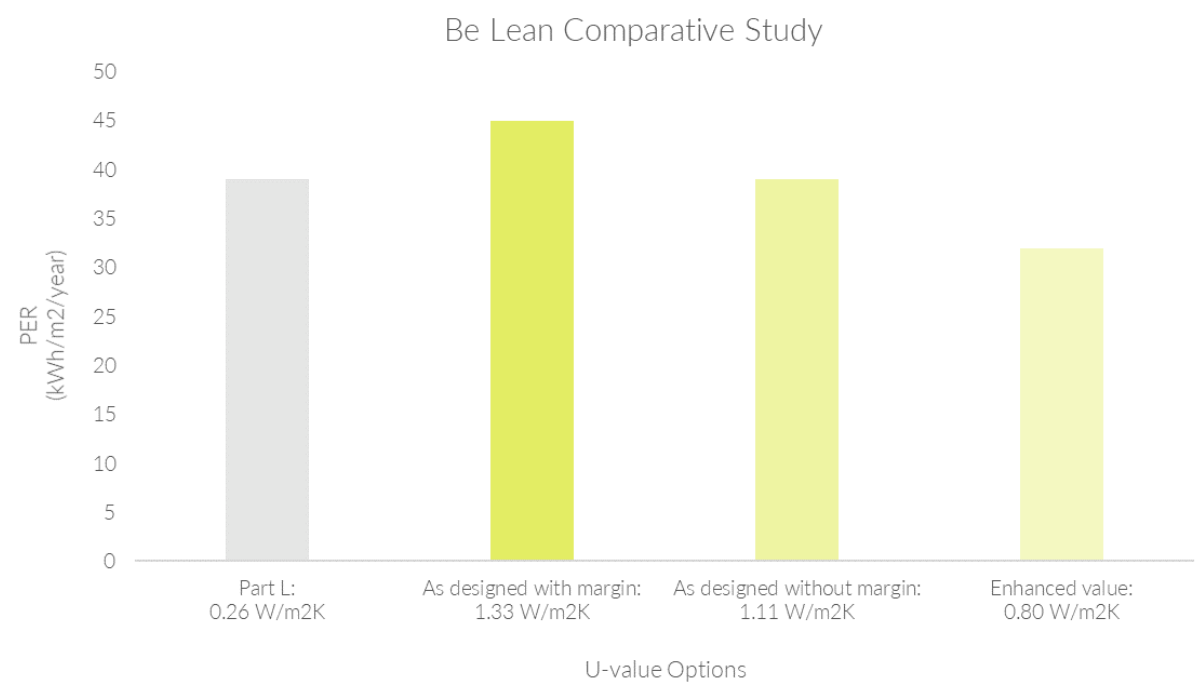
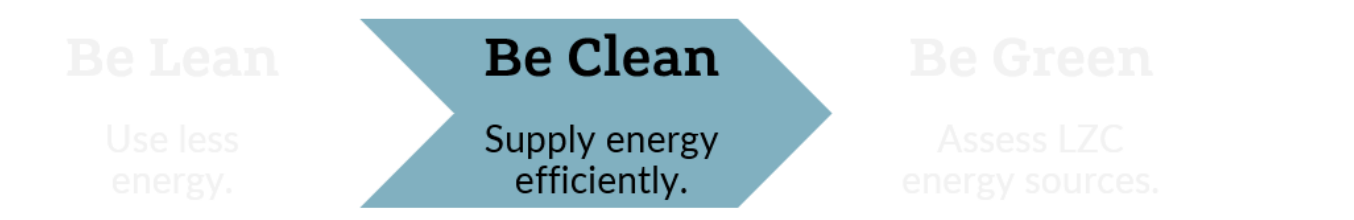


Figure 10 - Be Lean comparative study of BPER results for Options A, B and C

*Note: it is important to note that heating and domestic hot water end-uses are assigned a gas boiler energy source in the Be Lean cases; although the DX and electric convector system cannot be fed through a boiler source, it has been included in the overall space heating since its contribution is insignificant.

5.3 Be Clean

This stage of the energy hierarchy refers to the use of heat networks which typically consists of Combined Heat and Power (CHP) to provide carbon emission reductions. A CHP system consists of an engine, usually gas fired, which generates thermal energy and electrical energy – which is fed into the development.



The carbon emission benefit of gas fired CHP is diminishing as the national grid continues to decarbonise therefore there is no benefit to utilising this technology for a scheme that is already electrically led.

Table 11 Clean Energy Supply

	Combined heat and power (CHP) Due the recent change to the carbon emission factors in the latest revision of Part L, the use of Combined Heat and Power (CHP) is likely to offer a ‘negative benefit’ within the next five years and therefore has not been explored as part of the energy strategy.
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5.4 Be Green

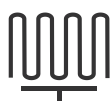
The final step of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the generation of renewable energy onsite in order to offer a further reduction in carbon emissions.



Table 12 Examples of Low and Zero Carbon Technology

	Energy from Waste Energy from waste (EfW) is the process of generating electricity and/or heat from the primary treatment and processing of waste usually by incineration. Where an EfW facility is in place to generate electricity, with heat generation essentially a by-product, it can be considered a low carbon heat source. Suitability to Proposed Development: Although a low carbon heat source, Energy from Waste systems usually operate on a large scale rather than on a single building basis. Connection to an EfW is not currently possible for this city centre location therefore is not a viable solution. Therefore, Energy from Waste is currently not proposed for the development.
	Air source heat pumps Air source heat pumps (ASHP) use thermodynamic principles to convert heat from the air into useable heat within the building. Unlike some other sources of renewable energy, heat pumps do require energy (typically electricity or gas) to pump and compress refrigerant through the system. However, under the Renewable Energy Directive 2009/28/EC heat pumps are classified as renewable technologies provided that the final energy output significantly exceeds the primary energy input required to drive the heat pump. They can typically operate at an efficiency of around 350% when delivering heating for space conditioning. ASHP need to be located externally with access to the ambient air, typically at roof level. Suitability to Proposed Development: Air source heat pumps use the delta air temperature to reject and extract heat to provide energy for the building. The ability of the heat pump to transfer heat from the outside air to the building depends on the outside temperature. As this temperature drops, the ability of the heat pump to absorb heat also drops. In the UK, external ambient temperatures are favourable for heat pump operation therefore this technology could be used to provide heating and/or hot water to the office development. Further, the use of this technology fits well with grid decarbonisation. Therefore, this technology is proposed for the development.

	Ground Source Heat Pumps (GSHPs) GSHPs work similarly to ASHP, except they extract heat from the ground. GSHPs are best suited to developments with a balanced heating and cooling load, to avoid long-term heating or cooling of the ground/ground water and associated decreased efficiency of the heat pump. Suitability to Proposed Development: The groundworks for a GSHP system are significant and would require higher costs and effort than an air source heat pump. Therefore, this option is considered to be less favourable. Therefore, this technology is not proposed for the development.
	Water source heat pumps (WSHPs) Water source heat pumps use bodies of water, such as rivers, lakes or oceans to provide heating or cooling energy to a building. Suitability to Proposed development: While the Proposed Development is located next to the River Irwell in Manchester, particular conditions need to be met to ensure technical and financial feasibility of a water-source heat pump scheme such as, but not limited to, proximity of the water body to the end use energy demand, depth of water, flow rates, distribution, regulatory approvals etc. Without this level of detailed information, it is not possible to model the potential benefits of such a system at this early stage for the high-level analysis provided within this Energy Strategy. Therefore, this technology has not been included for analysis within the strategy.
	Photovoltaics Photovoltaic (PV) panels harness energy from sunlight and convert this into useful energy in the form of electricity. A PV system requires sufficient roof space for the system array to be installed and function effectively. Suitability to Proposed Development: Photovoltaic panels are a convenient and affordable renewable energy source. Often, roof space can cause conflict of interest between the necessity to provide plant space, PV panels or social spaces, however in this case, there is a substantial amount of multi-levelled roof space which are alternate between terraces and PV-dedicated spaces. The upper most roof terrace contains plantrooms. Therefore, this technology is proposed for the development.

	Solar thermal Solar Thermal Panels are similar to PV Panels in that they harness energy from solar energy. This technology however converts solar energy into thermal energy that can offset the demand on hot water generation systems. Suitability to Proposed Development: Solar thermal technology and photovoltaic panels often compete for roof space, therefore a decision on the most valuable energy output needs to be made. Often, solar PVs would be prioritised over solar thermal panels since the electrical output from PV panels will be more suitable for implementation on a commercial building with a relatively small domestic hot water demand. Therefore, solar thermal is not proposed for the development.
	Wind turbine For efficient operation and to yield high energy output, wind turbines require a consistent flow of air to generate electricity using wind energy. Suitability to Proposed Development: The Proposed Development is located within a dense urban environment. Therefore, the wind flow profile is likely to be inconsistent and consequently not conducive to high annual yields from a turbine. Moreover, mounting wind turbines on the roof of the building could result in disturbance from vibration and resonance within occupied spaces. The turbines are likely to generate noise which may be a nuisance to neighbouring buildings. Therefore, given the complexities of installing this technology, the use of wind turbines is not proposed at the Proposed Development.
	Biomass Biomass boilers burn wood fuel or other bio-fuel sources to generate heat. These boilers can operate at high efficiencies, comparable to condensing gas boilers. However, they require a large fuel store to maintain continuous operation during the winter months. As such, area take for such plant is high. Furthermore, fuel deliveries in city-centre locations can prove difficult and security of fuel supply is an important consideration. Suitability to Proposed Development: The reasons listed above alongside high maintenance implications and air quality implications mean that biomass boilers are not considered a suitable technology for the scheme. Therefore, given the implications associated, the use of biomass boiler technology is not proposed at the Proposed Development.

Be Green Results

Utilising Air Source Heat Pumps (ASHP) and Photovoltaic (PV) panels to provide space heating and cooling as well as generate energy provides a significant reduction in regulated carbon emissions.

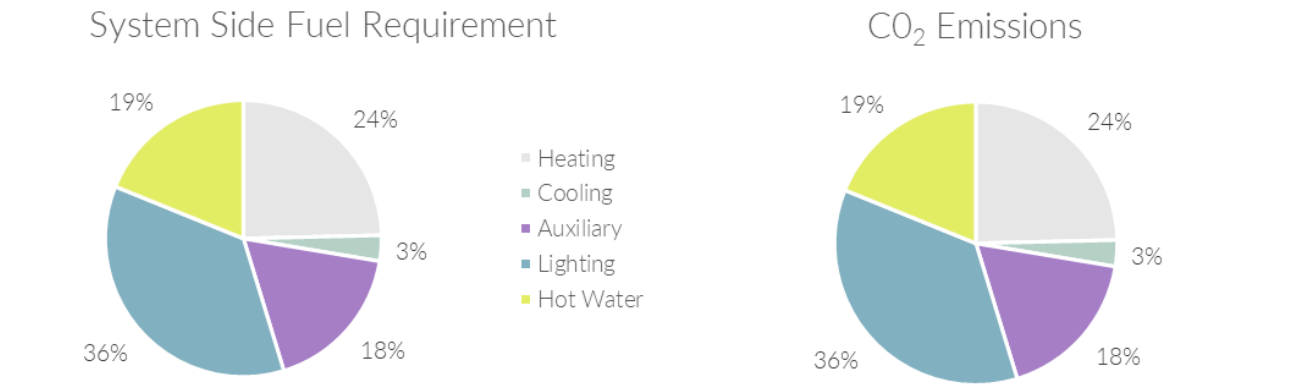


Figure 11 Be Green Energy demand and emissions

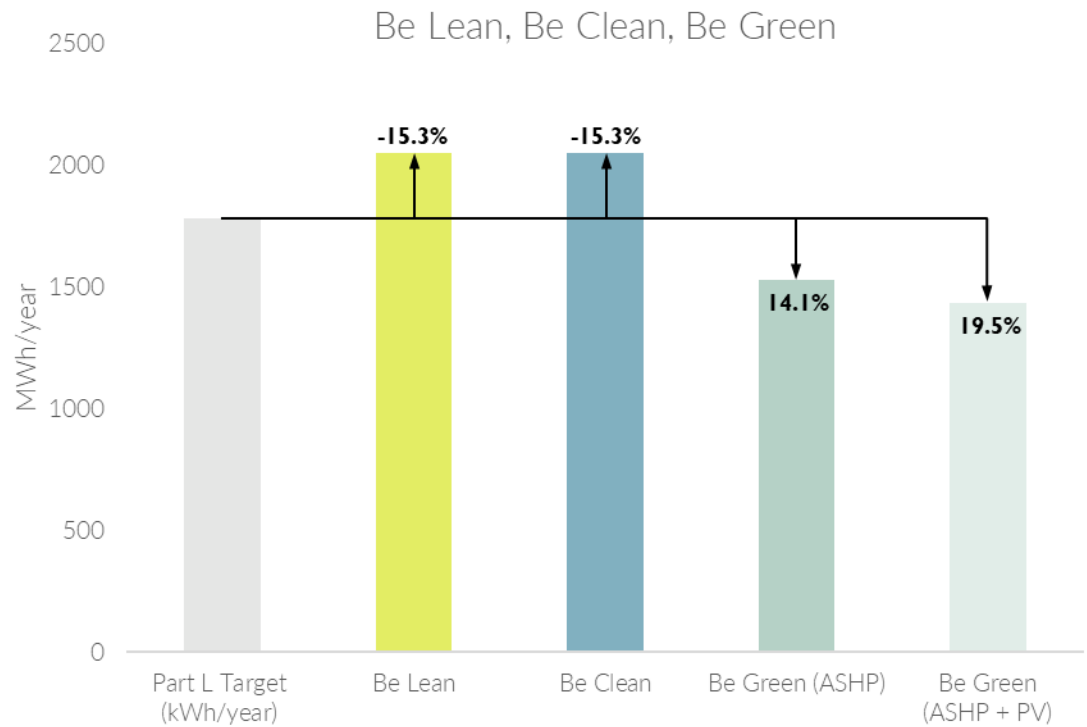


Figure 12 Be Lean and Green; regulated carbon emission reduction

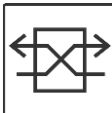
6. Energy Strategy – Residential

A sample set of residential units have been assessed against Part L 2021 and the preliminary results are set out below.

6.1 Baseline Case

The baseline case is informed by the notional building and default inputs from the SAP conventions where information is unknown.

Table 13 Specification details for the base case

	Fabric performance The baseline case utilises the same fabric performance as the Building Regulations Part L 2021 'notional' building; Curtain walls and windows: 1.00 W/m²K Exposed floors: 0.13 W/m²K Roof: 0.11 W/m²K Glazing g-value: 0.80 Air permeability: 5.00 m³/hr.m² @ 50Pa Thermal bridging = default 0.20W/m²K
	Space heating and domestic hot water Space heating is provided from a mains gas boiler 84% efficient in summer and 75% efficient in winter, radiators, 55°C flow temperature, central heating pump 2013 or later, in heated space. Domestic hot water is provided via the boiler.
	Mechanical ventilation The design air permeability rate for the apartments is 5 m³/h.m²@50Pa, supported by a mechanical ventilation unit with heat recovery. The mechanical ventilation units recover heat from the extract air to help reduce annual heating energy with no impact on the air quality of the incoming fresh air. The proposed unit is a Nuair MXRBOXAB-ECO5 with a specific fan power of 0.61W/l/s and heat recovery efficiency of 89%. "Level 2" insulated ducts have been selected for the base case. "Level 1" insulated ducts can be selected where supply or extract (whichever is longer) duct lengths are ≤2m and the duct system is continuously insulated throughout to a minimum depth of 25mm with an insulated thermal conductivity of 0.04W/m²K or less. If applicable, Level 1 insulated ducts can be introduced during the next stage.
	Lighting In line with the notional building, fixed lighting capacity (lm) = 185 x TFA, efficacy = 80lm/W.

6.1.1 Baseline Case Results

An area-weighted average is taken across the pro-rated apartments to provide a more accurate indication of overall performance for the whole building. This 'block-compliance' approach is often applied to apartment buildings where individual compliance can be harder to achieve given the small ratio of external wall to floor area per dwelling.

Preliminary results are provided for the three compliance metrics assessed under ADL 2021:

1. Target Emission Rate (TER) – the predicted regulated carbon emissions based on the fuels used to heat, light, cool and ventilate a dwelling, expressed in kWh/m²/yr
2. Target Fabric Energy Efficiency (TFEE) – the predicted energy used to heat and cool a dwelling expressed in kWh/m²/yr

3. Target Primary Energy Rate (TPER) - Primary energy is the energy from renewable and non-renewable sources which has not undergone any conversion of transformation process. SAP calculates how much primary energy has been used to heat, light, cool and ventilate a dwelling, expressed in kWh/m²/yr.

As shown in Table 14, the baseline case achieves marginal compliance against the first metric, with the Dwelling Emission Rate (DER) being 4.02% better than the TER. The baseline case fails the other two metrics.

Table 14 Area-weighted average results for the Base Case

DER	TER	% variance	DFEE	TFEE	% variance	DPER	TPER	% variance
kgCO ₂ /yr			kWh/m²/yr			kWh/m²/yr		
12.17	12.68	4.02%	29.52	23.95	-23.26%	76.11	70.09	-8.56%

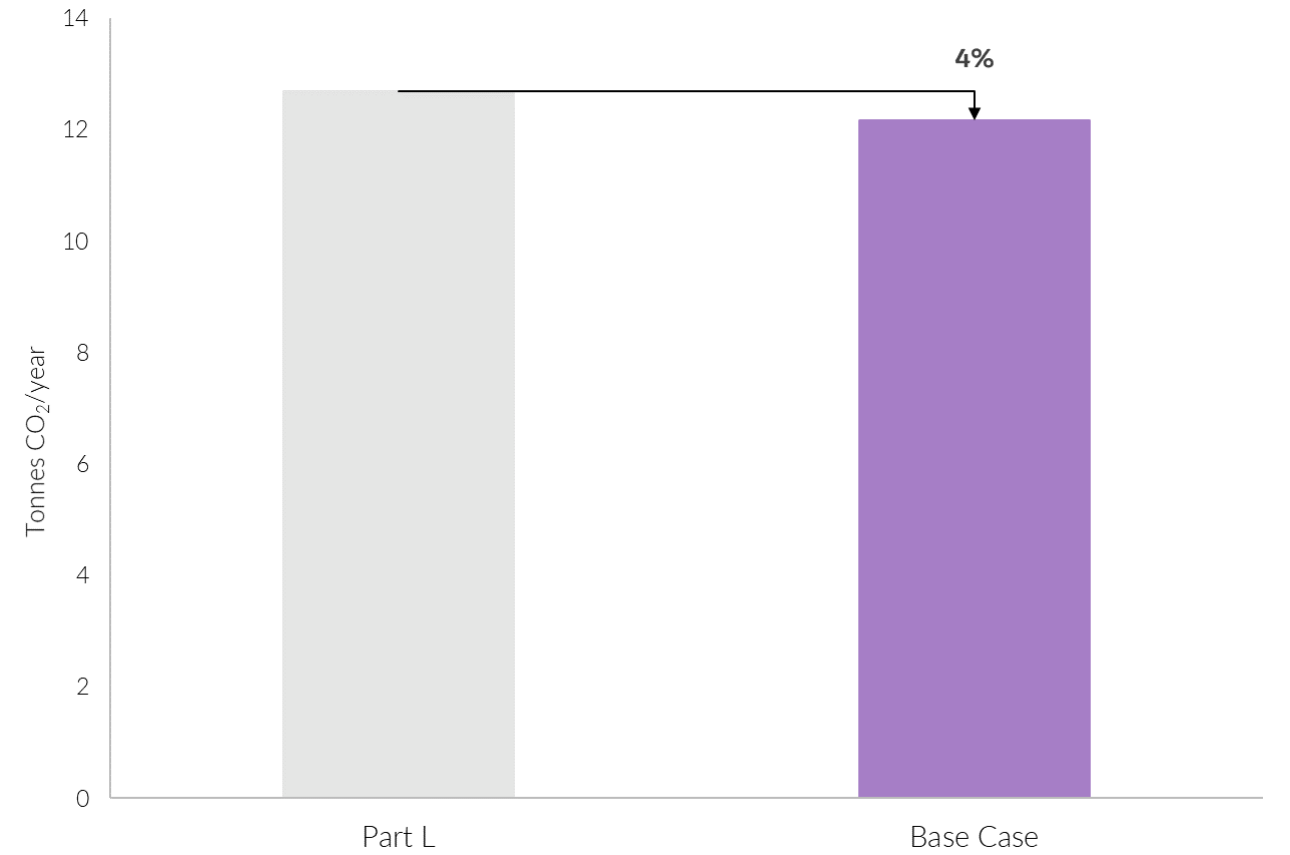


Figure 13 Improvement in average carbon emissions per dwelling for the Base Case over Part L 2021

6.2 Be Lean

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the Proposed Development. This energy strategy aims to reduce the energy demand initially by optimising the envelope and building services within the development.



6.2.1 Be Lean Summary - Passive design and energy efficiency

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

The overriding objective for the façade design will be to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter and limiting summertime solar gains to reduce space cooling demands.

These are the most robust and effective measures for reducing energy demand and associated CO₂ emissions as the performance of these passive solutions, such as wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is safe to assume that the benefits these measures have will continue at a similar level for the duration of their installation.

The parameters that have been amended from the base case for this be lean assessment are summarised below.

Table 15 Specification for Be Lean case

	Fabric performance The fabric performance parameters are as per the base case above, unless stipulated below. Curtain walls and windows: 0.83 W/m ² K Glazing g-value = 0.40 Air permeability; 3.00 m ³ /hr.m ² @ 50Pa Thermal bridging = assumed γ-value 0.08 W/m ² K
	Mechanical ventilation The design air permeability rate for the apartments is 3m ³ /h.m ² @50Pa, supported by the same MVHR unit used in the base case.

6.2.2 Be Lean results

The Be Lean case complies with all three metrics, demonstrating an improvement in DER/TER when compared to the base case and introducing a marginal pass on the other two metrics.

Table 16 Area-weighted average results for the Base Case

DER	TER	% variance	DFEE	TFEE	% variance	DPER	TPER	% variance
kgCO ₂ /yr			kWh/m ² /yr			kWh/m ² /yr		
10.51	12.68	17.14%	23.73	23.95	0.92%	67.17	70.09	4.18%

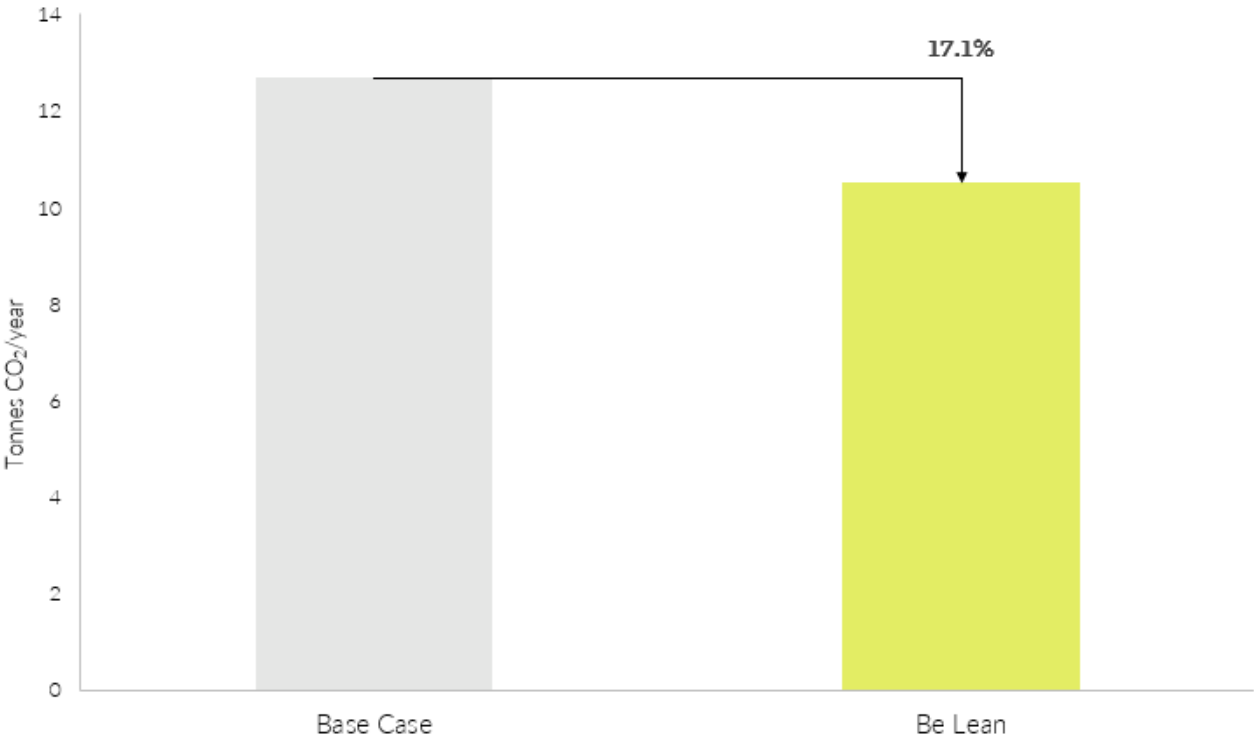
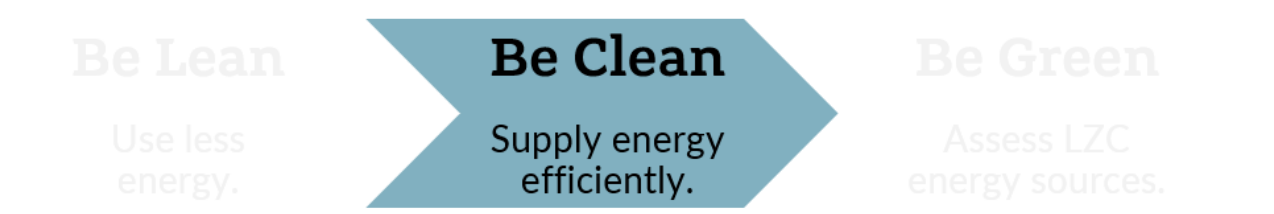


Figure 14 Improvement in average carbon emissions per dwelling for Be Lean over the base case

6.3 Be Clean

This stage of the energy hierarchy refers to the use of heat networks or on-site Combined Heat and Power (CHP) in order to provide energy and reducing consumption from the national grid and gas networks, through the generation of electricity, heating and cooling on-site.



Benefits of CHP have historically been based on the heat carbon factor which is derived from the CHP efficiency, the carbon factor of natural gas, and the carbon factor of the national electricity grid.

As the electricity grid is being progressively decarbonised, the benefit of CHP (which achieves carbon reduction chiefly from relying on the difference between carbon factors between natural gas and electricity), will diminish.

Based on the information set out above, a community network with CHP (gas-fired) is not proposed for the Proposed Development. As such the ‘Be Clean’ carbon emission reduction is the same as the ‘Be Lean’ stage.

6.4 Be Green

The final stage of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to offer a further reduction in carbon emissions.



The Be Green case introduces air source heat pumps to provide space heating and domestic hot water in place of the gas boiler. A notional amount of PV is added too.

Table 17 Specification for the Be Green Case

	Space heating and domestic hot water Heating is provided by connection to communal air source heat pumps that also provide domestic hot water. The ASHPs are assumed to be 194% efficient.
	Photovoltaics 0.10kWp has been assigned to each apartment assuming a 30° south-facing pitch with no overshadowing. The PV is not connected to the dwelling's meter but does include an export-capable meter.

6.5 Be Green results

The Be Green case complies with all three metrics, demonstrating a significant improvement in DER/TER when compared to the Base and Be Lean cases. There is no change to the DFEE/TFEE (because the fabric parameters have not altered). The DPER/TPER improves by over 40% because the air source heat pump is more than twice as efficient as the base case gas boiler resulting in a lower primary energy demand.

Table 18 Average DER/TER and DFEE/TFEE results for the Be Green case

DER	TER	% variance	DFEE	TFEE	% variance	DPER	TPER	% variance
kgCO ₂ /yr			kWh/m ² /yr			kWh/m ² /yr		
3.81	12.68	69.95%	23.73	23.95	0.92%	41.33	70.09	41.03%

At this stage, it would be better to see a variance in DFEE/TFEE closer to 5% therefore it would be worth exploring opportunities to improve the dwelling fabric energy efficiency and the coefficient of performance (CoP) for the air source heat pump. Both the façade performance and the building services design will be subject to further development during the next stage to optimise energy efficiency in light of these preliminary findings.

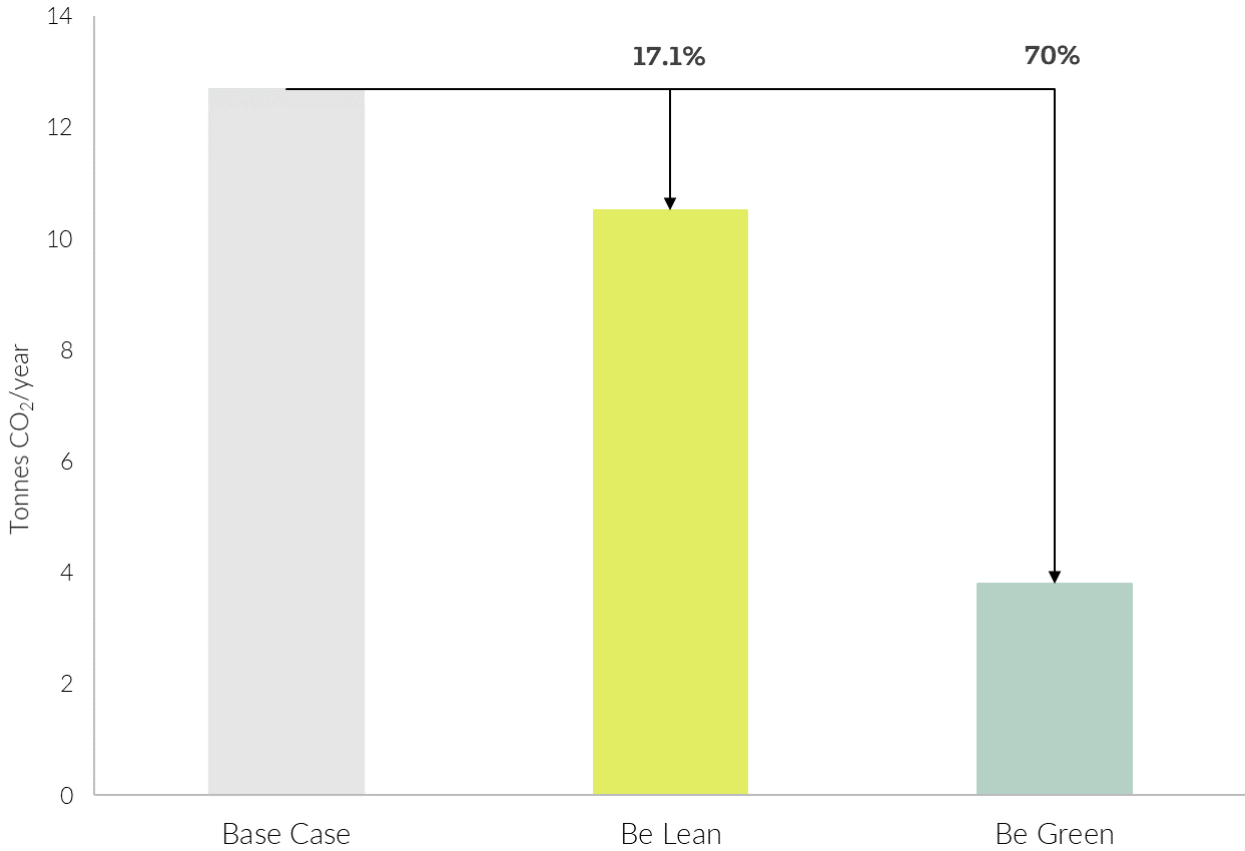


Figure 15 Improvement in average carbon emissions per dwelling for Be Lean and Be Green cases over the base case

6.6 Energy Hierarchy Overview

6.6.1 Dwelling Emission Rate/ Target Emission Rate

Figure 16 shows the average area-weighted Dwelling Emission Rate (DER) for each case compared to its relative Target Emission Rate (TER) shown in grey. All cases comply with this metric but the level of improvement increases as you move through the energy hierarchy.

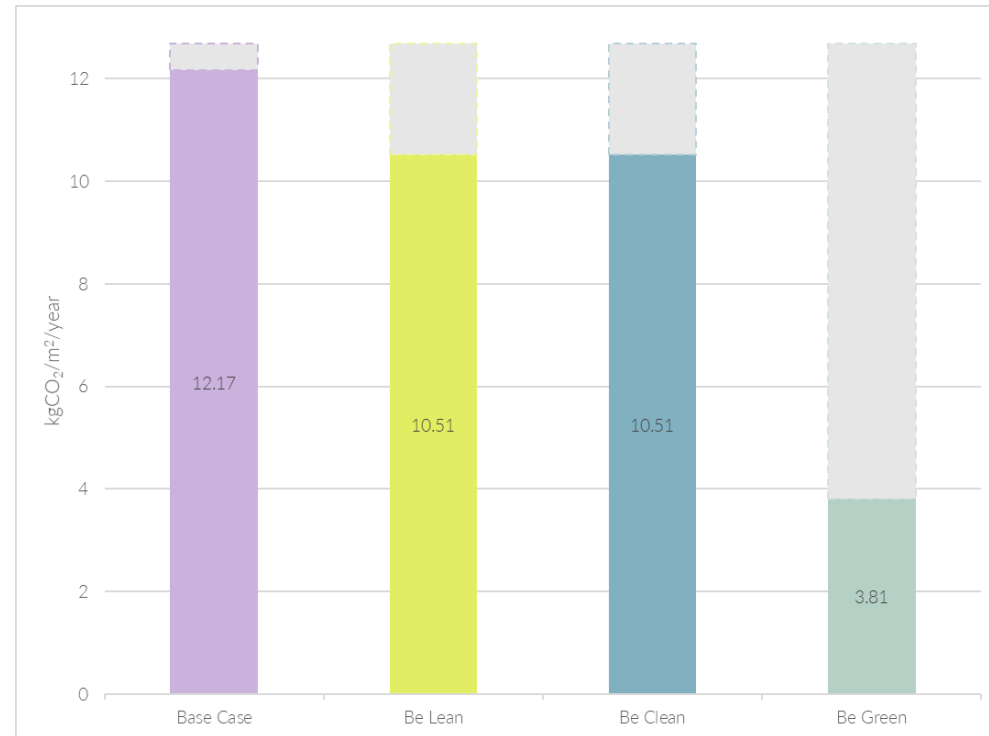


Figure 16 Average DER and TER performance per case

6.6.2 Dwelling Fabric Energy Efficiency/ Target Fabric Energy Efficiency

Figure 17 shows the average area-weighted Dwelling Fabric Energy Efficiency (DFEE) for each case compared to its relative Target Fabric Energy Efficiency (TFEE). The base case does not meet the TFEE, shown as a grey dashed line within the column, whereas the other cases achieve a marginal improvement, with the DFEE sitting just beneath the TFEE.

At this stage, it would be better to see an improvement in DFEE/TFEE closer to 5% therefore it would be worth exploring opportunities to improve this in the next stage of modelling. For example, it might be possible to improve the dwelling fabric energy efficiency by enhancing the insulation to improve thermal performance and increasing air tightness.

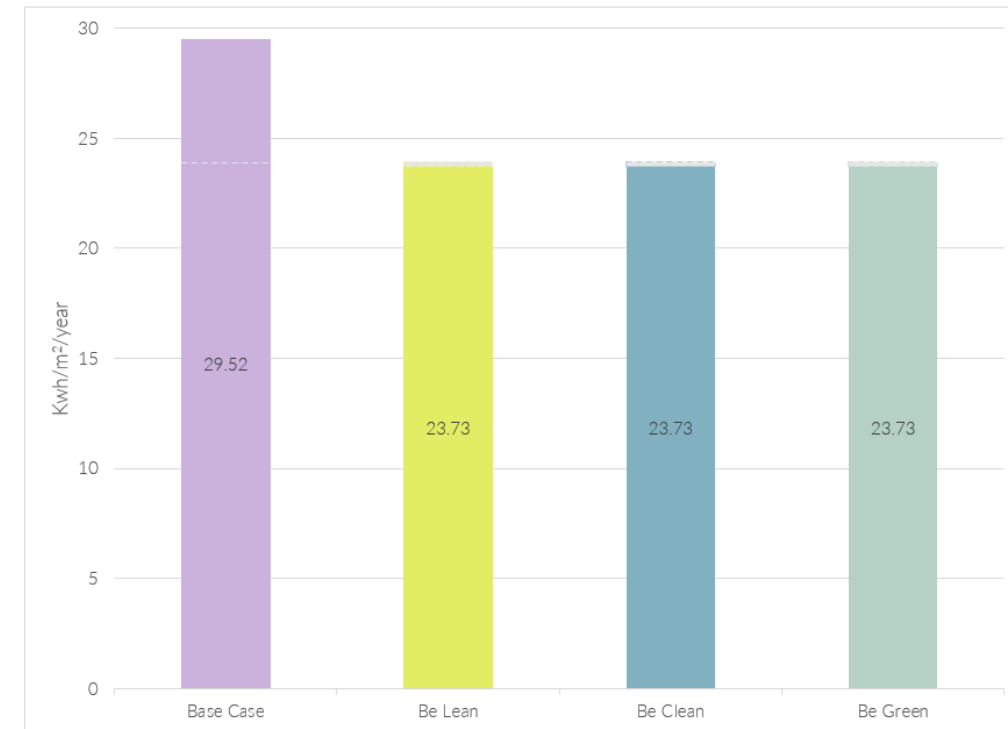


Figure 17 Average DFEE and TFEE per case

6.6.3 Dwelling Primary Energy Rate/ Target Primary Energy Rate

The base case does not meet the TPER, missing the target by ~ 10%. The Be Lean/Clean cases achieve >4% improvement, while the Be Green case achieves ~40% improvement due to the air source heat pump being 194% efficient, compared to the gas boiler at 89.5% efficiency.

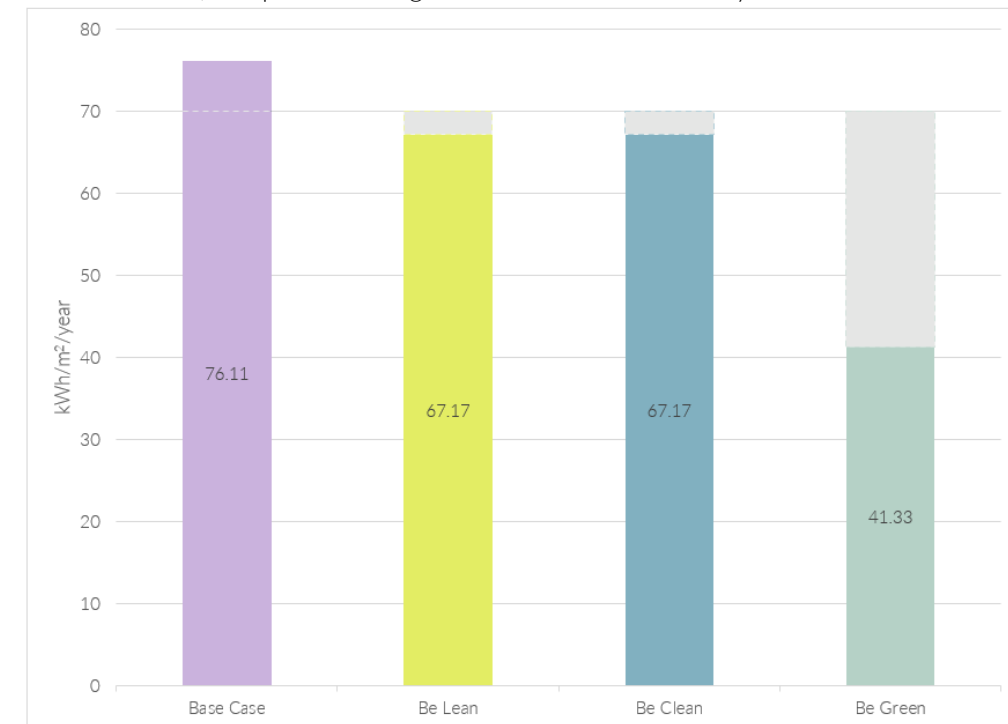


Figure 18 Average DPER and TPER per case

7. Conclusion

This energy strategy has been prepared on behalf of Oval Real Estate Ltd in support of the proposed Albert Bridge House development in Manchester.

This strategy summarises the relevant regulatory and planning policies and sets out how the development will address and achieve the relevant policy targets. The strategy responds to the UK planning and regulatory framework, and specifically to the Manchester Core Strategy policy documentation.

7.1 Planning Policy

The Manchester Core Strategy Policy EN6 states that residential development of 10 or more units and all other non-residential development over 1,000m² is expected as a minimum to meet the following targets (*unless this can be shown not to be viable*):

Table 19 CO₂ Emission Reduction Targets, Manchester Core Strategy

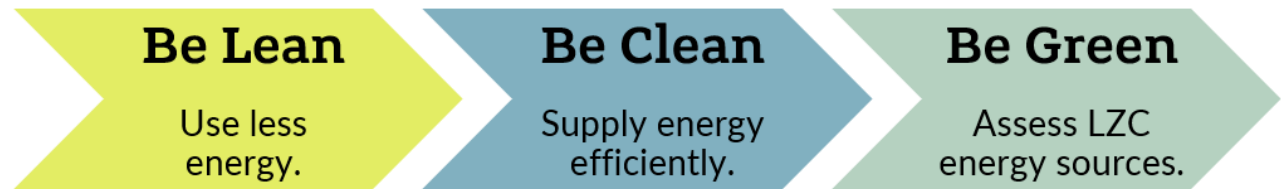
Target	% Minimum Requirement	
	Domestic	Non-domestic
Target 1: Network Development Area	CHP/ District heating anchor or connection or, where not feasible, a 15% increase on Part L 2010	CHP/ District heating anchor or connection or, where not feasible, a 15% increase on Part L 2010
Target 2: Electricity Intense Buildings	+ 10% increase on Part L 2010	+ 15% increase on Part L 2010
Target 3: Micro Generation Area	+ 15% increase on Part L 2010	+ 15% increase on Part L 2010

Each of the above targets require above a 10 or 15% increase (increase is understood to be a reduction over the target) on Part L 2010 emission rates. Broadly speaking, compliance with Part L 2013 required a 9% reduction in carbon emissions compared to Part L 2010. A new non-domestic building built to ADL 2021 standards will deliver a 27% reduction in CO₂ emissions on average across the new non-domestic building mix relative to ADL 2013, and a new domestic building will deliver a 31% reduction.

As such, compliance with Part L 2021 is expected to achieve compliance with the Planning Policy.

7.2 Approach

This report evaluates the Proposed Development against the energy hierarchy; be lean, be clean and be green.



Be Lean

The building fabric performance and engineering systems have been optimised in order to use less energy prior to the inclusion or consideration of Low and Zero Carbon (LZC) technology.

Be Clean

The be clean step of the energy hierarchy refers to the use of ‘clean energy supply’. This includes, but is not limited to, the use of Combined Heat and Power (CHP) and District Heat Networks. As the electricity grid is

being progressively decarbonised, the benefit of CHP has diminished and a suitable local DHN has not been identified for connection.

Be Green

The final step of the energy hierarchy is to utilise low and zero carbon technology. The energy strategy identified that the use of Air Source Heat Pumps (ASHP) in combination with energy generating PV panels can provide a substantial reduction in regulated carbon dioxide emissions.

Energy Strategy

Combining efficient fabric design and efficiency building services systems provides the following regulated carbon emission results.

7.2.1 Residential

The energy strategy indicates that the residential units could achieve ~70% reduction in carbon emissions over the Part L 2021 baseline.

The decarbonisation of the grid being reflected in the latest Building Regulations has helped the electrically-driven strategy to achieve greater margins than it would have under previous versions.

This level of performance exceeds the Core Strategy Policy requirement for ≥10% improvement over Part L 2010.

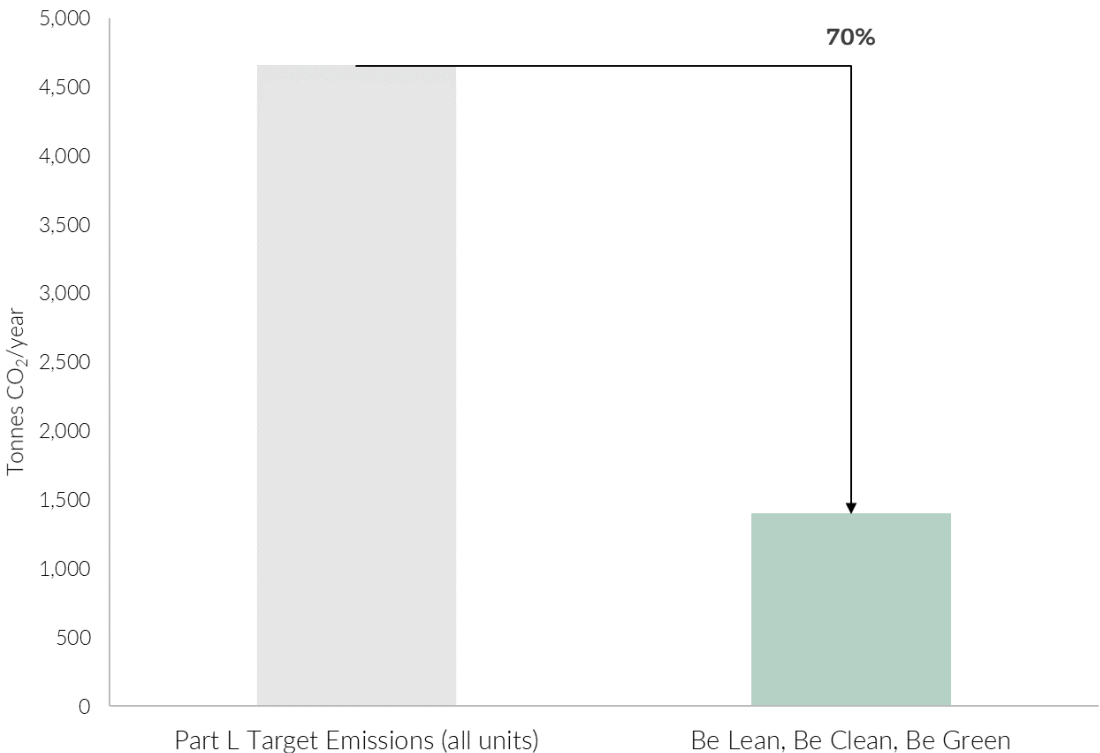


Figure 19 Energy Strategy summary for the residential units (pro-rated)

7.2.2 Commercial

Policy EN6 within the Manchester Core Strategy document requires a 15% betterment over Part L 2010. Since then, Part L has been updated twice, with the most recent Part L 2021 update requiring a 27% improvement over Part L 2013 for non-dwellings. The proposed development is required to comply with Part L 2021 therefore the projected 5-10% improvement over these latest regulations is considered to exceed the 15% betterment against Part L 2010 as required by Manchester's Core Strategy.

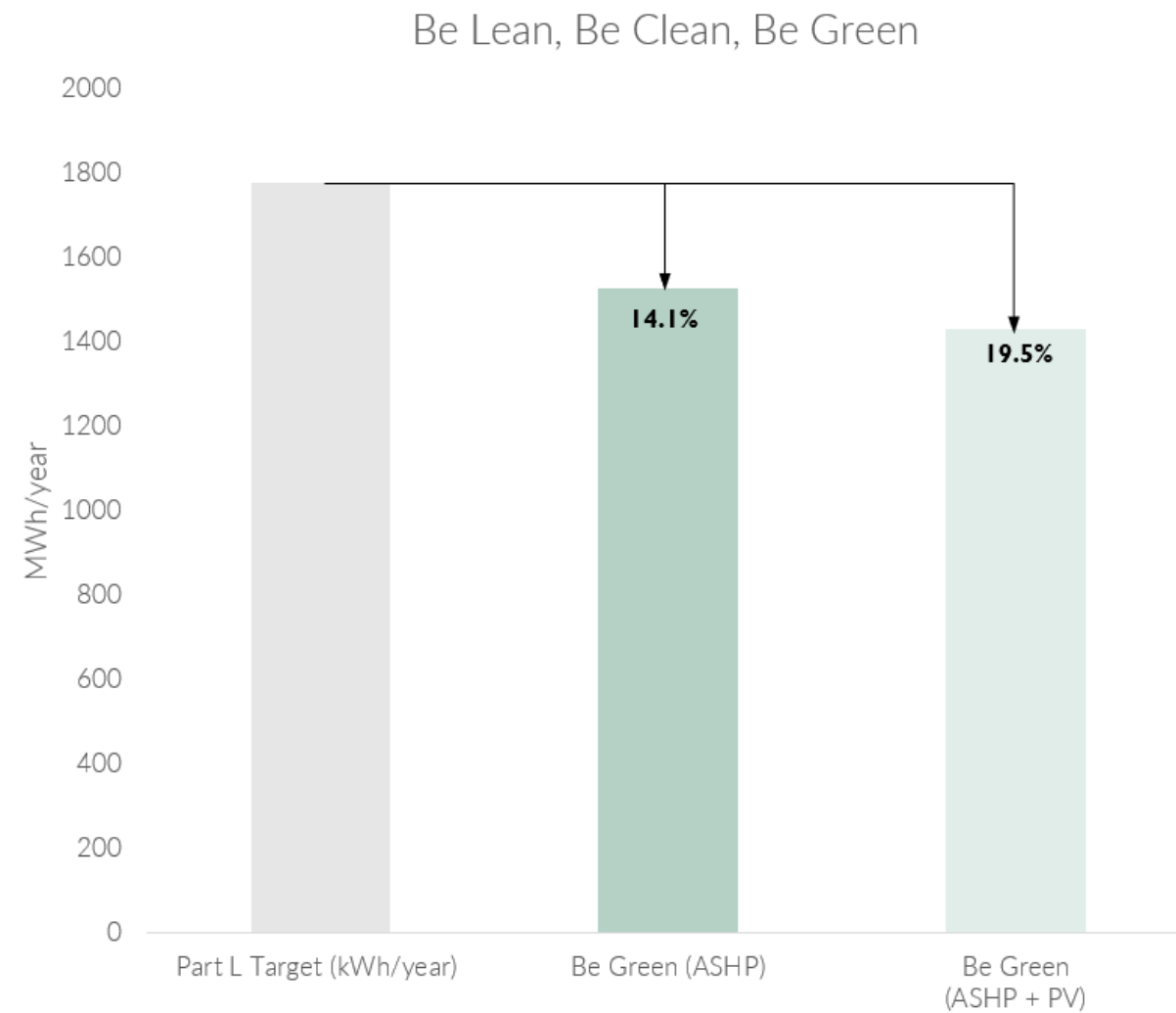


Figure 20 - Energy Strategy summary for the commercial building

The integration of passive design measures, introduction of ASHPs and renewable energy generation (PV) results in a 19.50% reduction in annual regulated carbon dioxide emissions compared to the Part L 2021 baseline. If observed independently, the PV panels contribute 5.4% towards the improvement above Part L standards.

Appendix B: Software Details

Compliance software and procedure

The proposed Albert Bridge House development has been assessed using the National Calculation Methodology to demonstrate compliance with Approved Document Part L.

Part L1A and L2A compliance

Simulation models were created to assess the design of the Albert Bridge House development.

Part L1A Residential

The residential units were assessed using SAP approved software (Design SAP 10). The results have been used to inform the energy strategy.

The calculations have been carried out based on drawings provided by SEW Architects, and the energy performance parameters identified within this energy strategy. A sample of thirteen different unit types was modelled to indicate preliminary results against the three primary metrics assessed under ADL 2021.

1. Carbon Emission Reductions (DER/TER).

The aggregate dwelling emission rate (DER) for each building should be equal or less than the aggregate target emission rate (TER) for each building before low and zero carbon technologies are taken into account.

2. Fabric Energy Efficiency Standards (DFEE/TFEE).

The aggregate dwelling fabric energy efficiency standard (DFEE) for each building should be equal or less than the aggregate target fabric energy efficiency standard (TFEE) for each building.

3. Primary Energy Rate (DPER/TPER)

The aggregate dwelling primary energy rate (DPER) for each building should be equal or less than the aggregate target primary energy rate (TPER) for each building.

Part L2A Non-Residential

Integrated Environmental Solutions Virtual Environment (IESve) is an approved Dynamic Simulations Modelling (DSM) software package which has the capabilities of enabling the user to create a virtual representation of a building. The results presented in this report for the Non-residential aspects were calculated using the approved compliance software IESve 2022 (v22.1.0.0).

The IESve models were drawn using information provided by the relevant architects.

IESve modelling disclaimer

Full certainty can only be achieved by measuring the performance of the building and associated systems after a period of use.

The actual energy usage for the buildings once occupied may vary from the calculated values submitted to Building Control. These differences will occur due to several variable parameters between the modelled building and the actual building. Such differences will include the hours, levels of occupancy, how the plant is used and the design criteria with regards to how the rooms are environmentally controlled.

Whilst the simulations have been undertaken in good faith using reasonable skill and care, Hoare Lea can take no responsibility for differences between the computer simulations and the actual performance of the completed buildings due to the inherent complexity and variability of the physics in a building and its environment.

It should be noted that the data generated by this work is obtained using approved calculations and computer simulations. These simulations are the best means of predicting the performance of the buildings at this stage.

The calculations produced by Hoare Lea have been carried out with the information provided by the architects to determine whether the Proposed Development can achieve compliance with Approved Document Part L2A of the Building Regulations.

Design SAP modelling disclaimer

A new version of Design SAP was released in August 2022, with several further batch releases continuing to be issued since then. As such, the software used to run our analysis is subject to ongoing development and the results from this initial analysis may change slightly when tested in the final version during the next stage.

For this early-stage analysis, certain simplifications have been applied in the SAP calculation to enable results to be processed efficiently. More detailed modelling will be completed during stage 3 when the following data entry points can be refined:

- Thermal Mass Parameter (TMP) has been taken as 250 kJ/m²K which was the value assigned to the notional dwelling in SAP 2012, for medium-weight construction.
- Thermal bridges have not been measured or assigned a psi value. Instead, a default thermal bridge value of 0.20 W/m²K has been used for the base case and the value previously taken in SAP 2005 for accredited thermal bridges (0.08 W/m²K) has been used for the Be Lean case and beyond.

During the next stage, the thermal bridge psi values will need to be calculated in line with BR497 as the default value won't achieve the required dwelling fabric performance and the 'approved' figures can no longer be used.

Appendix C: Input Parameters - commercial

Heating, Cooling and Ventilation systems

The table below details the systems associated with each space type:

Table 20: Input Parameters.

Template Name	NCM Activity	Heating	Cooling	Ventilation
Arrive	NCM Office: Office	VAV (ASHP) Displaced Ventilation	VAV (ASHP) Displaced Ventilation	Central Balanced Mechanical Ventilation System – Supply and Extract
Café - Prep	NCM Office: Office	VAV (ASHP) Displaced Ventilation	VAV (ASHP) Displaced Ventilation	Central Balanced Mechanical Ventilation System – Supply and Extract
Café - Seating	NCM Office: Office	VAV (ASHP) Displaced Ventilation	VAV (ASHP) Displaced Ventilation	Central Balanced Mechanical Ventilation System – Supply and Extract
Circulation - General	NCM Office: Circulation area	-	-	-
Circulation - General (Unheated)	NCM Office: Circulation area	None		-
Circulation - Lobby	NCM Office: Circulation area	None	-	-
Circulation - Stair	NCM Office: Circulation area	None	-	-
IT_Comms	NCM Office: Light Plant room (Office: Server)	Split System (DX)	-	-
Office – Core	NCM Office: Office	VAV (ASHP) Displaced Ventilation	VAV (ASHP) Displaced Ventilation	Central Balanced Mechanical Ventilation System – Supply and Extract
Office - Perimeter	NCM Office: Office	VAV (ASHP) Displaced Ventilation	VAV (ASHP) Displaced Ventilation	Central Balanced Mechanical Ventilation System – Supply and Extract
Plant	NCM Office: Light Plant room (Office: Server)	None	-	-
Reception	NCM Office: Reception	-	-	-
Retail	NCM Re: Sales area- general (Speculative)	VAV (ASHP) Displaced Ventilation	VAV (ASHP) Displaced Ventilation	Central Balanced Mechanical Ventilation System – Supply and Extract
Store - Cleaner	NCM Office: Cupboard	-	-	Central Balanced Mechanical Ventilation System – Supply and Extract

Template Name	NCM Activity	Heating	Cooling	Ventilation
WC - Lockers	NCM Office: Cupboard	-	-	Central Balanced Mechanical Ventilation System – Supply and Extract Supply to Lobbies / Extract from WCs
WC - Showers	NCM Office: Changing facilities	Electric Fan Convectors with Extract Ventilation	-	Central Balanced Mechanical Ventilation System – Supply and Extract
WC - Toilets	NCM Office: Toilet	Electric Fan Convectors with Extract Ventilation	-	Central Balanced Mechanical Ventilation System – Supply and Extract
Void (including Lifts, Risers)	Internal Void	-	-	-

System summary

	1_ASHP_disp_vent	4_DX_AC	5_Elec fan convector WC - Extract
System type	Indoor packaged cabinet (VAV)	Single room cooling system	Other local room heater - fanned
Heating source	ASHP	ASHP	Direct electric
Heating fuel	Elec	Elec	Elec
Heating efficiency ¹	3.42	3.93	1.00
Cooling System type	ASHP	ASHP	-
Cooling Fuel	Elec	Elec	-
Cooling Seasonal Energy Efficiency Ratio (SEER)	4.56	4.39	-
Cooling Nominal Energy Efficiency Ratio (EER)	2.90	4.39	-
Ductwork Leakage tested	Yes - Class B	Yes - Class B	Yes - Class B
AHU CEN Leakage Standards	Class L2	Class L2	Class L2
AHU Specific Fan Power	1.57	1.57	-
Pump Type	Variable speed multiple pressure sensors	-	-
System Metering	Yes	Yes	Yes
Out of Range warning	Yes	Yes	Yes
Ventilation Type	Central Balanced A/C Mech	Central Balanced A/C Mech	Central Balanced A/C Mech
Air Supply	-	-	0.70 W/l/s
Heat Recovery	Plate Heat Exchanger	Thermal Wheel	Plate heat exchanger
Seasonal Efficiency	80%	74%	80%
Variable Heat Recovery Efficiency	No	Yes	No
System Controls	Central Time Control Optimum Start/Stop Local Time Control Local Temp Control	-	-
Terminal Specific Fan Power ²	-	-	-
Extract	-	-	Yes
Extract Specific Fan Power:	-	-	0.48 W/l/s
Extract Flow Rate	-	6 ACH	10 ACH
Demand Controlled Ventilation (DCV)	Demand Control based on occupancy density	-	-
DCV Airflow Regulation	Speed Control	-	-
Zones served	Café, Retail, Offices (Core / Perimeter)	IT_Comms	Circulation, Stairs, Store, Cleaners, WC
Heating Radiant Fraction	0.20	0.00	0.00
Cooling Radiant Fraction	0.00	0.00	0.00

Air Handling Units (AHU): Ventilation Specific Fan Powers (SFPs)

Zones	AHU ref	SFP (W/l/s)	Minimum heat recovery efficiency (heating/cooling)
Landlord Areas	Main AHU	1.57	80%
Tenant Areas	Main AHU	1.57	80%
WCs / Changing	Main AHU	-	80%

Table 8.3: Ventilation Specific Fan Powers

Domestic Hot Water Systems

5_DHW_Office (20L Storage)	
Generator	Electric Instantaneous Seasonal efficiency: 100%
Storage	Storage volume: 720 litres Storage losses: 0.043 kWh/l/day

Lighting Parameters.

Table 1 shows the target installed power densities and lighting controls for each space. The values are specified as an average for these space types.
Lighting loads have been set at the W/m²/100 lux shown below. It is considered that this lighting level is achievable but needs to be confirmed at the next Stage.

Table 21 Lighting Installed Power Densities and Controls per Space Type

Template Name	NCM Lux	Design Lux (If higher)	Lamp Efficacy (lm/W)	Installed Power Density (W/m ² /100 lux)*	Light Output Ratio (LOR)	Radiant Fraction	Constant illuminance control	Lighting Controls *	Photoelectric (Daylight) Control	Total Parasitic Power (W/m ²)	Time Switch	Occupancy sensing
Arrive	100	100	110	-	1.0	0.45	No	Auto On – Off	-	0.10	-	-
Café - Prep	500	-	-	-	-	-	-	-	-	-	-	-
Café - Seating	200	500	110	-	1.0	0.75	No	None	None	-	-	-
Car park	75	150	110	-	1.0	0.45	No	Auto On – Off	Yes - Switching/Standalone	0.50	Yes	Yes
Circulation - General (Unheated)	100	100	110	-	1.0	0.45	No	Auto On – Off	None	0.10	-	-
Circulation - Lobby	100	100	110	-	1.0	0.45	No	Auto On – Off	None	0.10	-	-
Circulation - Stair	100	100	110	-	1.0	0.45	No	Auto On – Off	None	0.10	-	-
IT_Comms	200	500	110	-	1.0	0.45	No	Auto On – Off	None	0.10	-	-
Office – Core	300	300	110	-	1.0	0.45	No	Auto On – Off	None	0.10	-	-
Office - Perimeter	300	300	110	-	1.0	0.45	No	Auto On – Off	Yes – Switching/Addressable*	0.10	Yes	-
Office Speculative (meeting, staff room)	300	300	110	-	1.0	0.45	No	Auto On – Off	Yes – Switching/Addressable*	0.10	-	-
Plant	200	200	110	-	1.0	0.45	No	Man On – Auto Off	None	0.10	-	-
Reception	300	300	110	-	1.0	0.45	No	None	None	-	-	-
Retail (Office NCM)	200	200	110	-	1.0	0.45	No	Auto On – Off	Yes – Switching/Addressable*	0.10	-	-
Store - Cupboard	100	100	110	-	1.0	0.45	No	None	None	-	-	-
Store – Cycle Hub	75	150	108.75	-	1.0	0.75	No	Auto On – Off	None	0.10	Yes	-
WC - Lockers	75	150	108.75	-	1.0	0.75	No	Auto On – Off	None	0.10	Yes	-
WC - Showers	100	100	100	-	1.0	0.45	No	Auto On – Off	None	0.10	-	Yes
WC - Toilets	200	200	110	-	1.0	0.45	No	Auto On – Off	None	0.10	-	-
Void (including Lifts, Risers)	-	-		-	-	-	-	-	-	-	-	-

* Lighting Controls are defined as follows:

Auto On – Auto Off: Specifies presence detection sensors within the space which automatically switches lighting on when occupants are detected and switches lighting off when the space is detected to be unoccupied.

Manual On – Auto Off: Specifies absence detection sensors within the space. Lighting is required to be manually switched on. Automatically switches lighting off when the space is detected to be unoccupied.

Photoelectric (Daylight) Control: Yes – Dimming/Standalone*: Where this has been specified the following profile has been assumed is the IES model **ramp(e1,0,1,400,0.2)**

This formula modulates the lighting gain as a function of the illuminance on the working plane, e1. The value of the profile falls from 1 at zero illuminance to 0.2 at illuminance 400 lux, thereafter, remaining constant at this value.
The value 0.2 represents the fraction of the space's lighting gain which is not subject to daylight control. The illuminance e1 has been computed using the link to Radiance for each zone.

Appendix D: Input Parameters – residential

	Parameter	Base Case	Be Lean (where different to previous case)	Be Green (where different to previous case)
Fabric	Air Permeability	5 m³/h/m²	3 m³/h/m²	
	Curtain Wall U-value (W/m².K)	1.00	0.83	
	Roof U-value (W/m²K)	0.11		
	Exposed Floor U-value (W/m²K)	0.13		
	Glazing g-value	0.80	0.40	
	Party wall (W/m²K)	0.00 (i.e. no net heat losses between apartments)		
	Thermal Mass Parameter	Medium (250)		
	Thermal bridging y-value (W/m²K)	Default (0.20)	Approved (0.08)	
Space heating	Type	Gas boiler 84% efficient in summer and 75% efficient in winter, radiators, 55°C flow temperature, central heating pump 2013 or later in heated space		Space and water combined: Communal Air Source Heat Pump
	Efficiency	89.5%		194%
	Controls	Programmer, room thermostat and TRVs		Charging system linked to use of community heating, programmer and at least two room thermostats
Water heating	Water Heating	From mains		Heat network
	Water Use	<=125l / person / day		
Ventilation	MVHR System	Nuaire MRXBOXAB-ECO5		
	Duct Type	Level 2 insulation, rigid		
Lighting	Lighting	100% energy efficient light bulbs		
Renewables	Photovoltaics			0.1kWp per dwelling, 30° pitch, south facing, no overshadowing

No change

Notes: Although waste water heat recovery (36% recovery efficiency and utilisation of 0.98) is included in the notional dwelling, it has not been included in the modelling at this stage.



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