



Boddingtons, Manchester

Energy Statement

DN0107-WW-ZZ-ZZ-RP-CS-00002



LATIMER
by Clarion Housing Group

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Appendix A - SBEM & SAP

Issue / Revision Record

Issue	Date	By	Checked	Comment
1	23.11.21	MG	FTC	Draft
2	24.11.21	MG	FTC	For Planning
3	03.12.21	FTC	SOH	Additional Comments incorporated
P04	04.07.23	JR/FTC	DES/DY	Update including stair core variation. For Comment.
P05	28.07.23	JR/FTC	DES/DY	Document updated incorporating team comments.
P06	17.08.23	JR/FTC	DES/DY	Document updated incorporating comments issue for Planning.

Executive Summary

The Energy Statement has been prepared by Wallace Whittle on behalf of Latimer developments Ltd to support a full detailed planning application for a phased development comprising:

- Erection of two buildings to create a mixed-use development comprising residential uses (Use Class C3) with commercial uses (Use Class E) provided at the ground floor level, together with a new courtyard pocket park, landscaping, cycle parking, accessible parking spaces, highways work, access arrangements, and other associated works.

This Energy Statement has been prepared to support the planning application.

Development quantum (refer to accommodation schedule for further details):

- Residential Floors: 32,062 m² (NIA) / 41,623.7m² (GIA)
- Commercial: 679.5 m² (NIA) / 694m² (GIA)
- Ancillary: 0m² (NIA) / 1,326.6m² (GIA)
- Site wide summary: 32,741.5 m² (NIA) / 43,644.3m² (GIA)
- Total of 505 Mix tenure units.

This Statement is based on the client approved strategy submitted at RIBA Design Stage 2 and demonstrates how the proposals will comply with the objectives of Manchester City Council Local Plan: Core Strategy in terms of energy and Carbon emissions reduction targets. These are set out in section 2 below.

The calculations supporting the Energy Statement were undertaken to assess the site's carbon dioxide (CO₂) emissions and to identify the most appropriate energy efficient solutions and appropriate low and zero carbon technologies.

The Energy Hierarchy stages of 'Be Lean', 'Be Clean' and 'Be Green' (illustrated in the figure below) are set to maximise the reduction of Carbon Dioxide (CO₂) emissions of the proposed scheme. 'Be Lean', incorporates passive design measures and assesses energy efficient equipment for 'unregulated' emissions. 'Be Clean', incorporates the efficient supply of energy within a development and 'Be Green' incorporates the use of low and zero carbon generating technologies into a development.



Image 1 - Energy Hierarchy

This Statement demonstrates that the proposed scheme is compliant with the local energy policy requirements through the combination of the 'Be Lean', 'Be Clean' and 'Be Green' measures.

The 'Be Lean' design measures include U-values, glazing g-values, and air permeability rates which are performing better than the notional model under Part L (Volume 1 for Domestic and Volume 2 for non-domestic) 2021. Furthermore, the incorporation of A+ rated white goods will reduce 'unregulated' emissions.

'Be Clean' technologies include exploring a connection to an existing or new district heat network. This has been reviewed but has been deemed unfeasible because the site is not located within close proximity of any district heating networks.

'Be Green' technologies include exploring the integration of various renewable technologies into the proposed scheme's design. It has been identified that currently the most practical technology is Solar Photovoltaics (PV) and Low Carbon Air Source Heat Pumps (ASHP) for domestic hot water (DHW) generation. PV provision has been maximised to allocate approximately an active 180m² PV array to serve the non-domestic elements of the development.

The application of the PV array and ASHP hot water in combination with the 'Be Lean/Be Clean' design measures, would result for a total estimated Carbon Dioxide reduction of 71.1% against a Part L 2021 baseline compliant building when assessed through passive and energy saving technologies.

The contribution from LZCT is provided from DHW heat pumps and Photovoltaic panels. The 180m² active PV array and the DHW heat pump on every domestic unit is providing a 31.6% CO₂ reduction.

The results of the CO₂ emissions savings assessment (presented in the table below) confirm that the proposals show a theoretical reduction of approximately 81% when compared to the emissions levels in Part L 2010. This confirms compliance with Core Strategy Policy EN6 which requires a 15% improvement.

The table below presents the predicted CO₂ savings for the combined site 'domestic & non-domestic' wide assessment (regulated SAP and SBEM/DSM emissions):

Energy Hierarchy	Total Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)		
	Domestic	Non-Domestic	TOTAL
A - Baseline Emissions of Development (pre-improvement)	418	3.14	421.12
B - Be Lean	247	2.95	250.43
C - Be Clean	247	2.95	250.43
D - Be Green	121	0.47	121.61
E - Total Reduction in Carbon (KgCO ₂ /yr) from Baseline	297	2.67	299.52
F - Percentage Improvement in Carbon Emissions (against Building Regs 2021)	71.0%	85.0%	71.1%
C-D - Percentage Contribution from LZC Technologies	30.2%	79.2%	31.6%

Table 1 - Summary of CO₂ emissions reductions (as calculated with SAP and SBEM)

1.0 Introduction

Wallace Whittle have been appointed to develop the energy strategy; mechanical, electrical, and public health services strategies; utilities assessments and vertical transportation appraisals for the new domestic led mixed-use scheme at former Boddingtons site, Manchester.

This Energy Statement has been prepared by Wallace Whittle on behalf of Latimer developments Ltd to support a full planning application for a phased development comprising:

- Erection of two buildings to create a mixed-use development comprising residential uses (Use Class C3) with commercial uses (Use Class E) provided at the ground floor level, together with a new courtyard pocket park, landscaping, cycle parking, accessible parking spaces, highways work, access arrangements, and other associated works.

The illustrative masterplan is shown below:

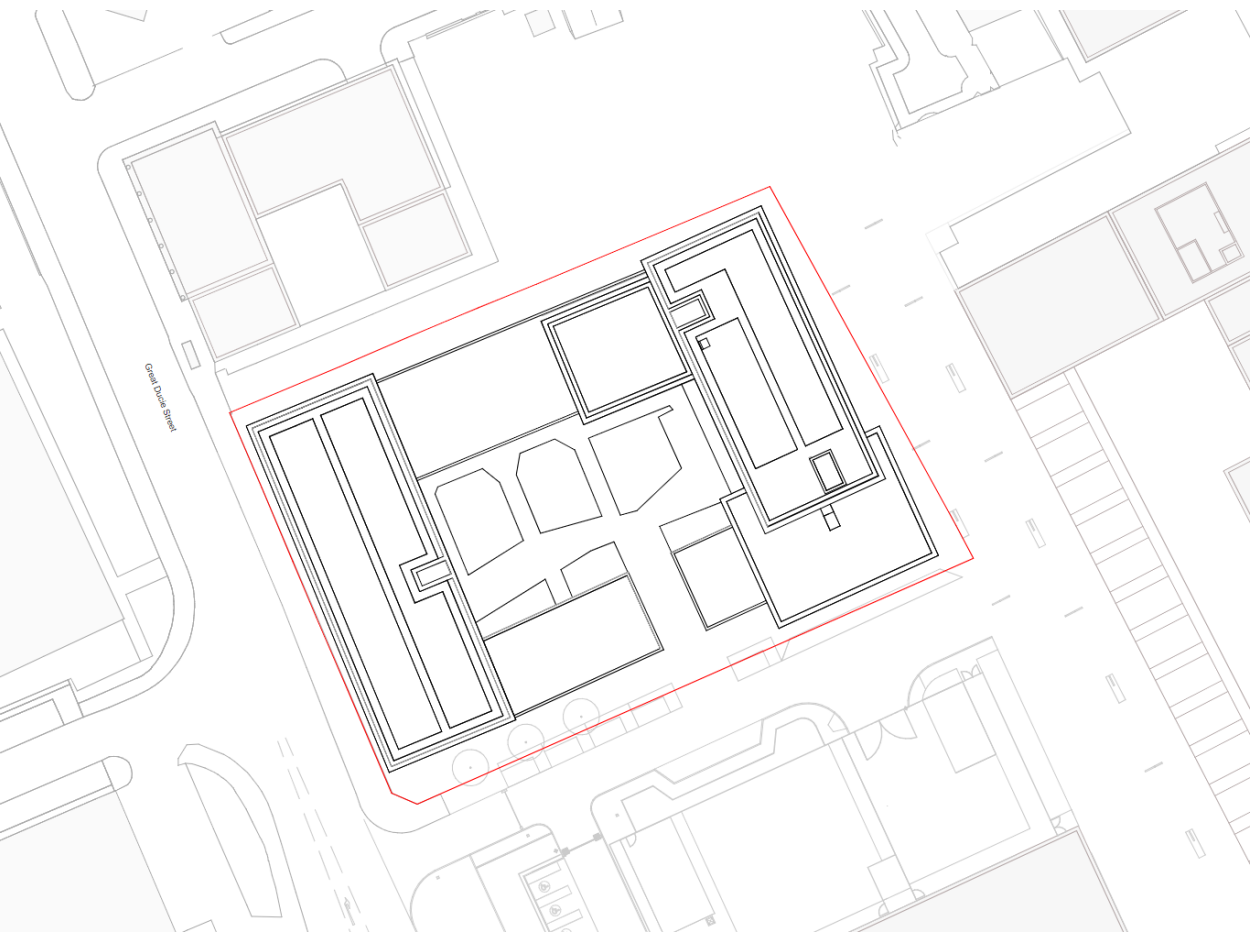


Image 2 - Site Plan Proposed (A3564-ASA-XX-XX-DR-A-0101-P06)

The purpose of this report is to summarise the approach to energy conservation and the adoption of the low and zero carbon energy sources (LZC) for the development in response to the planning objectives of Manchester City Council Local Plan: Core Strategy in terms of energy CO₂ reduction targets. In particular, the following policies apply:

- Core Strategy Policy EN4 - Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development.

- Core Strategy Policy EN5: Strategic Areas for low and zero carbon decentralised energy infrastructure
- Core Strategy Policy EN6 – Target Framework for CO₂ Reductions from Low and Zero Carbon Energy Supplies which requires a minimum 15% CO₂ reduction against Part L 2010.
- Core Strategy Policy EN7 – Promote use of Energy infrastructure opportunities
- Core Strategy Policy EN8 – Adaptation to Climate Change.

This statement provides a summary of the energy strategy to provide a fully serviced scheme across both phases of the site in line with the requirements of Manchester City Council Core Strategy. The proposed scheme layout, engineering systems and the provision of energy services have been designed for each dwelling with low carbon and passive measures approach being adopted.

A range of energy low and zero carbon generating technologies have been appraised as potential on-site energy regeneration in relation to the proposed development. These comprise:

- Solar Hot Water
- Solar Photovoltaics
- Biomass heating
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Fuel cells
- Wind turbines
- Combined Heat and Power (CHP)

1.1

Site and Surroundings

The proposed development is located on a former industrial brownfield site formerly the Boddington brewery site. Most of the site has been cleared with existing buildings surrounding the site occupied and in situ. Great Ducie Street a main arterial route out of Manchester, is in the proximity of the site. The site is within walking distance of Manchester City Centre.

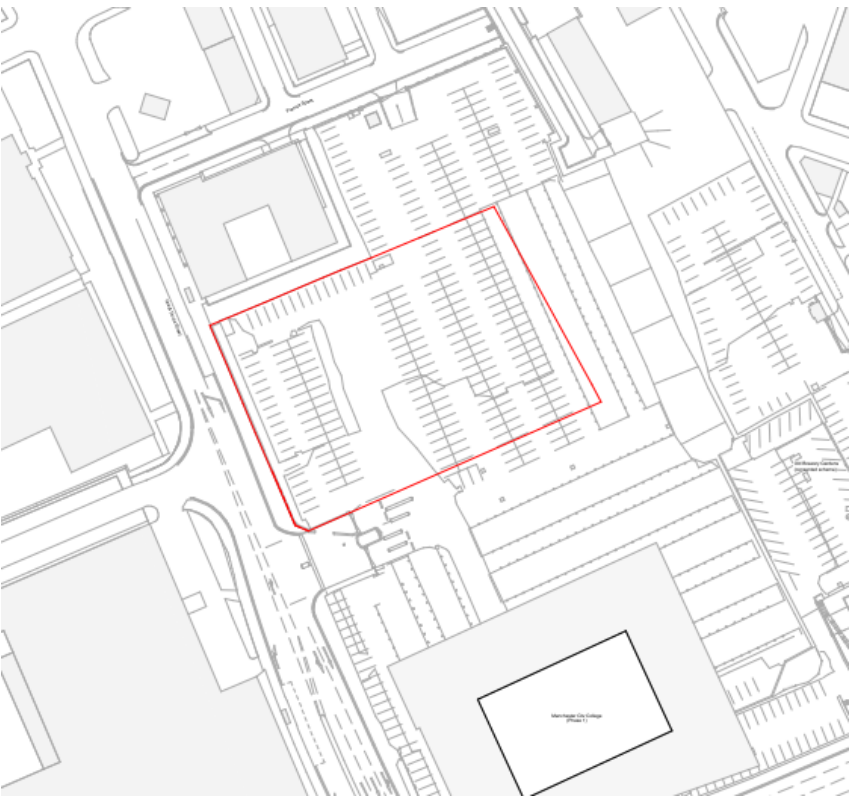


Image 3 - Site Location Plan (A3564-ASA-XX-XX-DR-A-0100 P06)

1.2 Development Description

This Energy Statement has been prepared to support the Full Planning Application (the application) comprising of:

Development quantum (refer to accommodation schedule for further details A3564-ASA-ZZ-ZZ-SH-A-0701-P02):

- Residential Floors: 32,062 m² (NIA) / 41,623.7m² (GIA)
- Commercial: 679.5 m² (NIA) / 694m² (GIA)
- Ancillary: 0m² (NIA) / 1,326.6m² (GIA)
- Site wide summary: 32,741.5 m² (NIA) / 43,644.3m² (GIA)
- Total of 505 Mix tenure units

1.3 Objectives

The objective of this statement is to demonstrate how the proposed design for the development complies with the Manchester Local Plan: Core Strategy, promotes sustainable development, energy and CO₂ savings as detailed in Section 2.0 of this report and follows the agreed energy strategy for the former Boddington site development “The Development”.

1.4 Limitations

This report has been prepared based on the current knowledge of the proposed scheme. Whilst the information used is taken from the planning drawings, the final performance will be dependent on the final commissioning results and actual operation of the building.

The Domestic and non-Domestic areas use a Notional and Actual Building calculation methodology as set out in the Government’s Standard Assessment Procedure (SAP10.2) and Dynamic Simulation Modelling (DSM) operational parameters as required by Building Regulations - Part L V1 & V2 2021. This allows a ‘like for like’ analysis under the Building Regulations. The results presented in this report are therefore not valid for ‘Real’ building operation.

It must be noted that Core Strategy Policy EN6 requires a 15% improvement in Part L 2010, given that the assessment presented in this report was completed using Part L 2021 a theoretical improvement was calculated. This was based on BRE’s data which confirmed that Part L 2013 applied a 6% Improvement over Part L 2010 and Part L 2021 applied a 31% improvement over 2013.

An overheating assessment has been completed for Block A and B using Dynamic Simulation Modelling (DSM) software. And the domestic element of the proposed Development was assessed against the requirements set out under Approved Document O: Overheating.

2.0 Policy and Legislative Compliance

This statement provides a response to the Manchester City Council Core Strategy Development Plan 2012 and Building Regulations relating to reduction of CO₂ emissions and energy use. This section presents the targets set out by the local planning and regulatory frameworks.

2.1 Planning Policy

Manchester City Council Core Strategy (2012)

Core Strategy Policy EN 4

Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development: This policy targets the reducing of CO₂ emissions through following of the Energy Hierarchy framework; firstly, reducing the need for energy through efficient design measures, followed by clean energy and lastly, the application of renewable or LZC technologies.

Core Strategy Policy EN 5

Strategic Areas for low and zero carbon decentralised energy infrastructure: This policy encourages applicable developments, should give detailed consideration to the role of low and zero carbon infrastructure and decentralized energy networks, where feasible.

Core Strategy Policy EN 6

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 sqm will be expected as a minimum to provide onsite renewable energy of 20% of the final site energy demand and CO₂ emissions. 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. The development is to demonstrate a 15% reduction in CO₂ emissions against Part L 2010.

Core Strategy Policy EN 7

Energy infrastructure opportunities: This policy encourages mayor developments to use low and zero carbon decentralised energy schemes.

Core Strategy Policy EN 8

Adaptation to Climate Change: All new developments to be adaptable to climate change in terms of its design, layout, siting, and function of both building associated external spaces.

2.2 Building Regulations Targets

The proposed development will be required to comply with the UK Building Regulations Part L: Conservation of Fuel and Power; In new dwellings Part L V1 applies and Part L V2 for all non-domestic areas.

This report covers Building Regulations compliance for the domestic and non-domestic elements of the proposed development. All CO₂ emissions calculations and results presented in this document were obtained through UK Building Regulations approved calculations methodologies.

3.0 Calculation Methodology

The following section describes the methodology and software used to assess the regulated energy performance of the development in line with Manchester Local Plan: Core Strategy.

3.1 Methodology for Dwellings (SAP) & Non-Dwellings (SBEM)

The Standard Assessment Procedure (SAP) and Simplified Building Energy Model and Dynamic Simulation Model (SBEM/DSM) is an analysis process used to estimate the environmental impact and energy consumption of a dwelling/ non-dwelling so it can be assessed and compared with other dwellings/buildings. And it is used to demonstrate compliance with the UK Building Regulations Part L Conservation of Fuel and Power. SAP and SBEM/DSM calculates the Target Emissions Rate (TER) and Dwelling/Building Emissions Rate (DER/BER) and then assesses the dwelling/building performance based on these calculations. Building Regulations state that each building must have a (DER/BER) that equals or is lower than the (TER).

SAP/SBEM quantifies a dwelling or building performance in terms of energy use per unit floor area, a fuel cost based energy efficiency rating (the SAP rating) and CO₂ emissions. It takes into account the energy needed to provide space heating, lighting, domestic hot water and cooling systems as well as estimating the heat loss through construction materials. The reports generated by SAP/SBEM/DSM provides engineers and architects with information to ensure that dwellings/buildings are built to the required efficiency standards. Importantly the calculations done at these early stages can be taken forward into full building regulations if the planning application is successful. SAP 10.2/SBEM/DSM software has been used for calculations within this assessment for Part L 2021 compliance.

3.2 SAP/SBEM Weather Data

Following the Energy Performance Certificate conventions for conducting energy assessments, due to the location of the development the SAP weather profile 'North West Region' has been selected for the dwellings within the SAP 10.2 software.

3.3 Dynamic Simulation Modelling (DSM)

The non-domestic element of the proposed development compliance with Part L V2 has been completed using the Dynamic Simulation Model (DSM). Integrated Environmental Solutions Virtual Environment (IES Ve) Version 2022 DSM software has been used to complete this assessment; it must be noted that this software is an approved National Calculation Method (NCM) simulation software.

This methodology can base its performance calculations upon incremental time steps as low as 1 minute. This allows realistic variations in fabric thermal storage (thermal mass effects), weather conditions, occupancy, internal and solar gains to be considered and their implications upon building/plant operation to be modelled effectively.

DSM uses zone specific operational profiles (occupancy, lighting, ventilation and domestic hot water (DHW) demand) and heating, ventilation and air conditioning (HVAC) plant performance data to effectively model and predict the energy performance of a building.

The 3D geometry and building construction materials were modelled based on the architectural plans and elevations. The 3D model describes the building:

- Orientation
- Geometry of building form and all associated exposure of surfaces
- Material constructions
- Windows and glazing
- The 3D geometry has been subdivided into generic zone types as per the National Calculation Method (NCM) requirements.



Image 4 - South Elevation (A3564-ASA-XX-XX-DR-A-0402-P07)

This comprehensive approach is considered best practice for assessing building non-domestic energy performance.

3.4 Dynamic Weather Data

To accurately model the dynamic nature of the buildings' thermal response, hourly recorded weather data is used in dynamic thermal simulations. Such weather data contains records of radiation, temperature, humidity, sunshine duration and additionally wind speed and direction.

A CIBSE weather file Test Reference Year (TRY) for Manchester was used for the Part L V2 compliance analysis as per the National Calculation Method requirements.

CIBSE weather file Design Summer Year (DSY) 1, weather file for Manchester have been used for this overheating analysis as per the TM49, TM52 and TM59 Calculation Method requirements.

3.5 Overheating

In response to Core Strategy Policy EN 8: Adaptation to Climate Change and the new requirements under Approved Document O: Overheating (ADO). A dynamic overheating analysis has been conducted on the proposed Block A and B. Proposed schemes are required to adopt measures that reduce the demand for artificial cooling as follows:

- Minimising internal heat generation through energy efficient design.
- Reducing the amount of heat entering the building during the summer.
- Use passive ventilation.
- Use mechanical ventilation.

Wallace Whittle's Dynamic Overheating Assessment details the methodologies used in assessing the overheating potential of the scheme and identifies possible overheating risk areas and design strategies for overheating reduction. All recommendations from the Dynamic Overheating Assessment have been adopted by the design team to mitigate any overheating risk to the proposed scheme.

Domestic overheating has not always been a problem in the UK but climate change, increased urbanisation, construction of high-rise apartment blocks and winter energy efficiency measures have all contributed in the amplification of high internal temperatures.

A CIBSE weather file DSY 1 (moderately warm summer, with a return period of seven years) (2020) for Manchester has been used for this analysis.

The overheating performance for the development has been assessed at a high level against the requirements under ADO and CIBSE TM49, TM59 Design methodology for overheating in homes which contains three criteria for overheating in domestic developments:

- a) *Criteria (a) For living rooms, kitchens and bedrooms:* the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.
- b) *Criteria (b) For bedrooms only:* the guaranteed comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more the 1% of annual hours.
- c) *Criteria for homes predominantly mechanically ventilated:* all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours.

A sample assessment has been carried out at this stage to test the ventilation strategies against the ADO requirements and CIBSE TM59. This sample includes apartments on the lower, middle and top part of the building with different orientations.

The sample included the following:

- 5 Apartments Block A 1st Floor
- 8 Apartments Block B 1st Floor
- 5 Apartments Block A 11th Floor
- 8 Apartments Block B 19th Floor
- 4 Apartments Block B 23rd Floor .
- 2 Apartments Block B 28th Floor.

The assessment has taken into consideration the detail Part O acoustic assessment carried out by Cundall (1032195 MEMO AS-001). This assessment has identified key areas where windows cannot be used at night to mitigate against overheating (as shown in image 5).

For the purpose of the assessment all windows serving the bedrooms in the sample apartment tested have been set to be closed between 22:00 and 07:00.

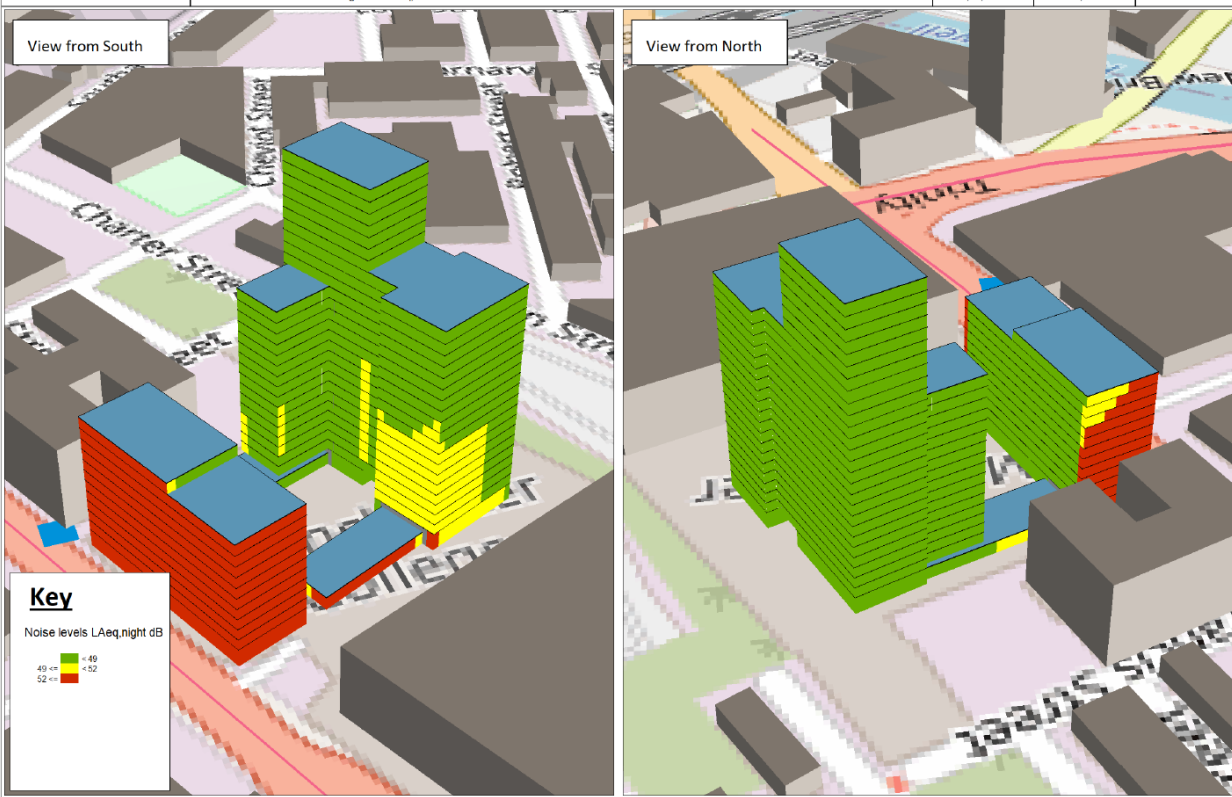


Image 5 - Boddingtons ADO Risk Assessment Night-time LAeq,T Noise Levels. Cundall (1032195 MEMO AS-001)

The ventilation strategy for the proposal includes the following overheating mitigation measures:

- A deep (336mm) window revel has been applied to all windows in the proposed development.
- The glazing g-value for all windows to the domestic element is proposed to be no higher than 0.40 throughout the elevations.
- G-values to the non-domestic element is proposed to be no higher than 0.35 throughout the elevations.
- Enhanced MVHR Units providing a summer bypass and overheating additional flow rates are to be installed in all units of the proposed development.
- The initial 100mm opening restriction referred to in the Employers Requirements (ERs section 7.3) will need to be overridden during summer, providing an opening of at least 350mm to all windows in order to mitigate overheating, and ensure compliance with ADO.
- In apartments were for acoustic reason windows cannot be used as an overheating mitigation measures and the MVHR cannot provide at least 3ACH, the following mitigation measures will be explored during the next stages of design:
- Incorporation of a purge fan removing additional air from each bedroom with natural make up from the common fresh air intake ducts. (this system to be completed with in-line attenuation to prevent night-time noise break in from ductwork installation.

The simulations results for the current DSY 1 weather files for Manchester are summarised below. This table confirms that the strategy complies with the ADO requirements.

Sample Apartments	DSY 1 Results
5 Apartments - Block A 1st Floor	Criteria (a) – All apartments Comply. Criteria (b) – All bedrooms Comply

Sample Apartments	DSY 1 Results
8 Apartments - Block B 1st Floor	Criteria (a) – All apartments Comply. Criteria (b) – All bedrooms Comply
5 Apartments - Block A 11th Floor	Criteria (a) – All apartments Comply. Criteria (b) – All bedrooms Comply
8 Apartments - Block B 19st Floor	Criteria (a) – All apartments Comply. Criteria (b) – All bedrooms Comply
4 Apartments Block B 23th Floor	Criteria (a) – All apartments Comply. Criteria (b) – All bedrooms Comply
2 Apartments Block B 28th Floor	Criteria (a) – All apartments Comply. Criteria (b) – All bedrooms Comply

Table 1.1 - CIBSE TM59 and Part O Assessment Results summary

4.0 Energy Consumption and CO₂ Emissions

The 'Baseline' energy consumption and CO₂ emissions are based on the entire site emissions of the proposed development scheme. The planning policy context advocates the following Energy Hierarchy to ensure that carbon requirements are met in the most efficient manner when assessed against Part L of Building Regulations 2021.

The images above show the amount of CO₂ that can be saved through adopting each stage of the energy hierarchy when assessed against Part L 2021 of the Building Regulations.

4.1 Calculating the Baseline Scenario

The 'Baseline' energy consumption and CO₂ emissions are based on the site emissions of the proposed development. The baseline is the Target Emission Rate (TER) as defined by prescribed Government approved software SAP and SBEM.

The CO₂ emissions were calculated using Government approved software to generate the 'target' emissions for the Domestic elements as dictated by the Building Regulations Part LV1 2021. Non-Domestic elements are dictated by Part L V1 2021 of the Building Regulations. The combined results were used to form the baseline for the entire site against which savings are to be calculated.

Table 2 below shows the domestic performance of a range of dwelling types across the development. The baseline Domestic figures have been taken from these results.

Sample Apartment	No of Units	Area (m ²)	TER (kgCO ₂ /m ² .yr)	Total Emissions (kgCO ₂ .yr)
1B2P (A4) GF	6	50.37	16.31	4,929
1B2P (A4) MF	54	50.37	13.16	35,795
1B2P (A4) TF	5	50.37	16.31	4,929
2B3P (A7) GF	5	61.04	14.64	4,468
2B3P (A7) MF	45	61.04	12.31	33,813
2B3P (A7) TF	5	61.04	15.11	4,612
2B4P (A5) GF	1	89.72	13	1,166
2B4P (A5) MF	9	89.72	10.55	8,519
2B4P (A5) TF	1	89.72	13.33	1,196
1B2P (A4) GF	6	50.37	16.31	4,929
1B2P (A4) MF	59	50.37	13.16	39,109
1B2P (A4) TF	6	50.37	16.31	4,929
2B3P (B2) GF	17	65.81	14.78	16,535
2B3P (B2) MF	161	65.81	12.64	133,926
2B3P (B2) TF	17	65.81	15.21	17,016
2B4P (B6) GF	10	79.91	13.41	10,716
2B4P (B6) MF	68	79.91	11.34	61,620
2B4P (B6) TF	10	79.91	13.87	11,084
3B5P (B15) GF	1	85.49	13.42	1,147
3B5P (B15) MF	17	85.49	11.25	16,350
3B5P (B15) TF	1	85.49	13.96	1,193
Total				417,983

Table 2 - Calculation of baseline CO₂ emissions for the domestic development

Table 3 below shows the SBEM performance of a range of building types across the development.

The baseline figures have been taken from these results.

Baseline	Modelled Floor Area (m ²)	(TER) Total CO ₂ emissions	CO ₂ Regulated total (kgCO ₂ .yr)
Non-residential	920.1	3.41	3,137.54

Table 3 - Calculation of baseline CO₂ emissions for the non-domestic development

Based on these modelling calculations the following Target Baseline emissions have been established for the proposed scheme as Table 4 below:

Energy Hierarchy	Total Regulated CO ₂ Emissions
	(kgCO ₂ .yr)
A – Domestic Baseline Emissions of Development (pre-improvement)	417,983
G - Commercial Baseline Emissions of Development (pre-improvement)	3,137.54
M (A+G) – Total Baseline Emissions of Development (pre-improvement)	421,120.54

Table 4 - Calculation of total baseline CO₂ emissions for the domestic and non-domestic development

4.2 'Be Lean' Energy Efficiency Measures

The 'Be Lean' measures proposed will reduce the energy consumption and CO₂ emissions for the proposed scheme so that the proposed dwellings achieve a substantial reduction beyond Part L 2021 without the reliance on 'Be Clean and Be Green' measures. The proposed scheme has focused on 'lean' design measures by maximising the opportunities available in energy efficient design.

The 'Be Lean' measures include:

- Improved U-values beyond minimum Part L 2021 compliance
- Improved glazing g-values beyond minimum Part L 2021 compliance.
- Significant reduction in Part L 2021 Air Permeability levels
- Introduction of an air source heat pump on the domestic hot water system
- Lean design measures were applied to the baseline design to reduce the overall energy demands.

The following sections outline the proposed thermal fabric performance requirements to ensure compliance with both minimum Fabric Energy Efficiency (FEE) requirements of Part L 2021 and the 'Be Lean' requirements of the Energy Hierarchy and Core Strategy EN4 and 6 policies.

4.2.1 Proposed Fabric & Thermal Performance

The tables below present the proposed specific thermal and fabric performance requirements for all Domestic and non-Domestic units across all the plots to achieve Part L V1 and 2 2021 compliance and to meet Manchester Core Strategy Policy EN4 and EN6:

Domestic Design Parameters

Element	Proposed performance
External Wall U-value	0.15 W/m ² K
Ground contact floor and exposed floors	0.10 W/m ² K
Roof (flat roofs)	0.10 W/m ² K
Terrace Roof	0.10 W/m ² K
Exposed floors to unheated spaces	0.10 W/m ² K
Windows	1.20 W/m ² K (Frame Included) g-value not to exceed 0.40.
Party Wall	0.20 W/m ² K
Air permeability	≤ 3.0 m ³ /m ² hr @50 Pa
Thermal Bridging	Psi values to be calculated.

Table 5 - Fabric Thermal Performance all Domestic Blocks

Non- Domestic Design Parameters

Element	Proposed performance
External Wall U-value	0.15 W/m ² K
Ground contact floor and exposed floors	0.10 W/m ² K
Roof (flat roofs)	0.10 W/m ² K
Terrace Roof	0.10 W/m ² K
Exposed floors to unheated spaces	0.10 W/m ² K
Windows	1.20 W/m ² K (Frame Included) g-value not to exceed 0.35.
Party Wall	0.20 W/m ² K
Air permeability	≤ 3.0 m ³ /m ² hr @50 Pa
Thermal Bridging	Psi values to be calculated.

Table 6 - Fabric Thermal Performance Non-Domestic blocks

The materials construction within the thermal models are all compliant with and exceed the notional U-values stipulated in the Building Regulations Part L 2021.

4.2.2 Part L 2021 – Fabric Energy Efficiency (FEE) rate

Specific attention should be given to compliance with Criterion 2 (Regulation 26A) of Part L 2021. This criterion concerns the average Fabric Energy Efficiency Rate (FEE) of each Domestic dwelling within the scheme and is assessed using SAP10.2.

This regulation has been introduced into Part L 2021 to appropriately limit heat gains and losses through the building's structure by calculating the total CO₂ emissions arising from fabric performance. Similarly, to Criterion 1; the calculated Dwelling Fabric Energy Efficiency Rating (DFEE) rate must not be greater than the Target Fabric Energy Efficiency (TFEE).

The proposed fabric parameters confirm the Target Fabric Energy Efficiency Rating (TFEE) is achieved when assessed on an area weighted block average basis.

4.2.3 Domestic Party Wall Definition

The SAP conventions extract below outlines criteria that categorises the u-value of party walls between dwellings and other heated spaces based on their construction type.

#	Limitations	Topic	Conventions	Issue date
5.03		Party wall U-values	In the context of U-values, 'party wall' includes any wall between the dwelling and another heated space which can be: - another dwelling - commercial premises - a heated corridor or stairwell in a block of flats - a heated common area Note. A heated corridor is one with controlled fixed heaters. Heat from distribution pipes is to be disregarded. The only U-values at present for party walls are 0, 0.2 and 0.5. This applies to both flats and houses regardless of construction type (masonry, timber frame etc). U = 0.5 should be used for party walls unless documentary evidence is provided, in which case: A solid party wall has U = 0. To qualify for U = 0.2 (effective edge sealing): - the sealing must prevent air going in or out of any cavity - the sealing is required top and bottom and vertically. To qualify for U = 0: - any cavity must be sealed as above, and - any cavity must be fully filled Framed systems (timber or metal) may have more than one cavity.	Sept 2010 amended March 2011 amended October 2015

Table 7 - SAP Conventions

Our calculations have determined the party walls in the Domestic component of the development design must qualify for the 0.00 W/m²K U-value to demonstrate compliance with the criteria of Building Regulations Part L 2021 and with respect to the 'Be Lean' stage of the Energy Hierarchy. This is based on heated corridors.

4.2.4 Air Permeability

Air permeability rates of 3m³/h.m² @ 50Pa have been set for the entire development on the Domestic and non-Domestic buildings. To ensure this value is achieved, early advice should be undertaken to ensure that air barrier continuity is maintained across each dwelling and building. All dwellings must be tested.

4.2.5 Thermal Bridging

The design team is working to minimise thermal bridging to prevent the loss of heat and the development of cold spots which can lead to mould build up and uncontrolled heat loss. The current scheme assumes that all linear thermal bridging details will be assessed, and its associated thermal bridging values will be achieved for this development as a minimum standard. The final construction details will be developed to ensure insulation continuity enhancing thermal bridging.

4.2.6 Ventilation

Windows are considered on the models to be openable and designed to be secured and rain protected. Domestic dwellings will utilise mechanical ventilation incorporating heat recovery (MVHR). The MVHR systems have been included within the calculations to operate a Specific Fan Power of <0.6 / (W/litre/sec) and Heat Exchanger Efficiency of 90+%.

This approach is an efficient method of reducing energy consumption within the dwellings whilst contributing to the mitigation of any overheating issues by increasing air change rates.

4.2.7 Cooling

The hierarchy to minimize the need for artificial cooling is summarised as:

- Minimise internal heat generation (i.e. reduce the demand for cooling)

- Reduce the heat entering the building in summer
- Manage heat within the building Passive ventilation
- Mechanical ventilation
- Active cooling systems (Include use of FCU's / Comfort cooling)

The design for the development benefits from passive design solutions including reduction of single aspect apartments, deep reveals providing shading to Domestic dwellings, windows glazing, g-values and other measures. The glazing has been specified with low g-values limiting the amount of heat entering dwellings as per Section 4.2.1.

When feasible, corridors will benefit from natural ventilation. However, when natural ventilation is not feasible, they will have environmental control systems, extracting internal air from corridors through the smoke extract system dispelling excess heat maintaining constant comfortable temperatures to avoid the risk of overheating. These measures will limit the amount of active cooling required across the scheme.

The overheating results indicate that the dwellings will typically comply with the parameters above and any short periods of exceedance are within tolerance.

4.2.8 Heat Generation and Distribution

The proposed scheme will be provided with high efficiency electric panel heaters for space heating and heat pumps to generate domestic hot water (DHW).

The space heating will be controlled by the resident via suitable energy programmers and appliance thermostats. The DHW will have a cylinder thermostat and controls for the heat pump operation.

4.2.9 Lighting

It is recommended that all light fittings are specified as dedicated energy efficient lights (LED). For the Domestic elements the efficacy of all fittings should be >110lumens/circuit Watt. For the non-Domestic elements the efficacy of all fittings should be >110lumens/circuit Watt. Appropriate controls such as PIR/ movement and daylight controls should be fitted where practicable.

4.2.10 Solar Control Glazing

Solar controlled glazing with low g-values will limit the amount of solar gain transmittance into a dwelling. For compliance with Criterion 3 of Part L Building Regulations a g-value 0.40 for all elevations has been used for the overheating calculation for the dwellings.

The g-value also limits the impact of overheating within the dwelling and contributes to Fabric Energy Efficiency (FEE) compliance by reducing heat demand through the capitalisation of solar heat gains. The scheme has incorporated design features that would limit overheating as the majority of dwellings are dual aspect and will benefit from cross ventilation for rapid heat mitigation.

4.2.11 'Unregulated Emissions'

'Unregulated Emissions', i.e. those not covered by the Building Regulations assessments, are uncontrolled and are occupant led energy consumptions. The energy consumption and associated carbon dioxide emissions from corridor lighting, external lighting, small power and equipment within dwellings are considered insignificant for the purposes of this assessment.

4.2.12 'Be Lean' Results

The results in Table 8 below show a significant reduction through the incorporation of 'Be Lean' design measures on the Domestic element of the development.

Sample Apartment	No of Units	Area (m ²)	Be Lean - Dwelling Emission Rate (DER) (kgCO ₂ /m ² .yr)	Total Emissions (kgCO ₂ .yr)
1B2P (A4) GF	6	50.37	9.10	2,750
1B2P (A4) MF	54	50.37	7.87	21,406
1B2P (A4) TF	5	50.37	9.10	2,750
2B3P (A7) GF	5	61.04	8.69	2,652
2B3P (A7) MF	45	61.04	7.64	20,986
2B3P (A7) TF	5	61.04	8.66	2,643
2B4P (A5) GF	1	89.72	7.39	663
2B4P (A5) MF	9	89.72	6.10	4,926
2B4P (A5) TF	1	89.72	7.14	641
1B2P (A4) GF	6	50.37	9.10	2,750
1B2P (A4) MF	59	50.37	7.87	23,388
1B2P (A4) TF	6	50.37	9.10	2,750
2B3P (B2) GF	17	65.81	7.98	8,928
2B3P (B2) MF	161	65.81	7.58	80,313
2B3P (B2) TF	17	65.81	8.67	9,700
2B4P (B6) GF	10	79.91	7.68	6,137
2B4P (B6) MF	68	79.91	6.73	36,570
2B4P (B6) TF	10	79.91	7.80	6,233
3B5P (B15) GF	1	85.49	7.83	669
3B5P (B15) MF	17	85.49	6.85	9,955
3B5P (B15) TF	1	85.49	7.73	661
Total				247,472

Table 8 - 'Be Lean' Energy Efficiency reduction and CO₂ emission savings from a SAP compliant dwelling

Table 8 demonstrates that through the energy efficiency measures described in Section 4.2 "Be Lean Energy Efficiency Measures", a 40.8% Improvement (domestic only) on site CO₂ emissions is predicted to be achieved from the Baseline scheme. (Please note that the baseline and Be Lean domestic model was developed with an all-electric heating and DHW strategy (electric panel heaters and direct electric DHW system). Please refer to appendix a below for the sample SAP calculations.

The results in Table 9 below show a significant reduction through the incorporation of 'Be Lean' design measures on the non-Domestic element of the development. Please refer to appendix a for the Be lean BRUKL for the commercial units assessed.

Be Lean	Floor Area (m ²)	(TER) Total CO ₂ emissions	CO ₂ Regulated total (kgCO ₂ .yr)
Non-residential	920.1	3.21	2,953.52

Table 9 - 'Be Lean' Energy Efficiency reduction and CO₂ emissions from an SBEM compliant building

Based on these modelling calculations the following Be Lean emissions have been established for the proposed scheme as Table 10 below:

Be Lean	Regulated CO ₂ Emissions (kgCO ₂ .yr)
B – Domestic Be Lean Emissions of Development	247,472
H - Commercial Be Lean Emissions of Development	2,953.52
N (B+H) – Total Be Lean Emissions of Development	250,425.52

Table 10 - Calculation of total 'Be Lean' CO₂ emissions for the Domestic and non-Domestic development.

Table 10 demonstrates that through the energy efficiency measures described in Section 4.2 "Be Lean Energy Efficiency Measures", a 40.5% reduction (domestic and non-domestic) on site CO₂ emissions is predicted to be achieved from the Baseline scheme (170,7 TonnesCO₂/yr).

4.3 'Be Clean' Energy Efficiency Measures

The 'Be Clean' measures will not include connection to an existing or new district heating system. District heating works by the supply of hot water distributed from a central source, typically a CHP / Boiler set within a large-scale energy distribution centre. There are no existing DHN's in close proximity to this development. Please refer to Section 5.0 for further details.

4.3.1 'Be Clean' Results

For the reasons set out in section 5 below the 'Be Clean' results are the 'Be Lean' results. There is therefore no change.

4.4 'Be Green' Renewables

A range of technologies have been studied to identify the most adequate renewable energy generation system for the proposed scheme. These include:

- Site mounted wind turbines
- Roof mounted wind turbines
- Solar Photovoltaics (PV)
- Solar Hot Water
- Ground Source Heat Pumps
- Biomass
- Direct Air Source Heat Pumps
- Fuel cells

A renewable energy options assessment has been undertaken to evaluate which of these technologies would be feasible in terms of economic, political, environmental and practical considerations. The study provides a clear understanding of the constraints and opportunities associated with a variety of different renewable energy technologies.

The choice of technology will be dependent upon a range of factors including orientation, height, window size, surrounding buildings and environment, site size and layout, geology, conservation and biodiversity.

The general feasibility of the technologies which were discounted are shown in Table 11.

Renewable Technology	Unfeasible due to
Solar Thermal	- Priority of the roof space has been given to PV panels, as they offer the more significant savings. - The Development's large domestic hot water is better served by a central DHN system. Or a dedicate low carbon technology as the proposed heat pumps.
Biomass Heating	- High risk of air pollution issues associated with a biomass flue emissions. - Risk and reliability of fuel supply. - Impact on local air quality of RGB. - Large area for fuel storage and frequent deliveries. - Specialist maintenance knowledge. - High noise impact from deliveries.

Renewable Technology	Unfeasible due to
Fuel Cells	- Viability of equipment. - Unavailable reliable source of non-fossil fuel hydrogen for the site. - Significant safety concern due to the volatile properties of the fuel.
Wind Turbines	Impact within an urban environment: - Size and appearance. - Noise. - Appropriate positioning. - Unpredictable and varying wind speeds. - Cost. Maintenance.
Ground Source Heat Pumps (GSHP)	The application of this technology was discounted due to the size of the development and its associated heat loads. The size of ground collectors and other technical consideration relating to the unknown quality of the ground on site deemed this technology financially and technically unfeasible.
Façade Solar Photovoltaics	- Low efficiency compared to traditional PV. - Large areas of arrays required to generate the same electricity. - Technology mainly applied to commercial buildings.

Table 11 - Discounted Renewable Technologies

4.4.1 Renewable Technologies

A desktop study has considered the following technologies for this project:

4.4.1.1 Solar Thermal Hot Water

Solar hot water uses a heat collector, usually as panels on the roof, in which liquid is heated by the sun. In a typical system, a heat transfer medium (generally a water/antifreeze mixture) travels through a series of heat conducting tubes known as a heat collector.



Image 6 - Solar Hot Water

During its circulation through the tubes, the fluid picks up heat from the sun which is then transferred to the domestic hot water supply as it passes through a coil in an appropriate storage cylinder.

These systems do not generally provide space heating and are often described as ‘solar thermal’ systems. They are among the most cost-effective renewable energy systems that can be installed to developments in urban environments.

A basic solar thermal collector comprises of a translucent cover, an absorption plate, and the heat transfer system. In the UK, there are two main types of collectors, known as evacuated tube and flat-plate.

The proposed scheme’s relatively large DHW demand can be achieved more efficiently via connection to a heat pump integral within each Hot Water cylinder. Routing of solar thermal pipework through to each flat would cause significant problems. Therefore, the specification of a solar system is deemed inappropriate for this scheme.

4.4.1.2 Biomass

Biomass is a feasible ‘green’ technology. Biomass systems differ from other renewable sources because they emit carbon dioxide when the fuel is burnt. However, the amount is equal to the carbon absorbed when the biomass material was growing, leading them to be classified as carbon neutral. For large scale projects there are three types of wood fuel that are generally used: wood pellets, wood chips and biodiesel.



Image 7 - Biomass Boiler

The success of such a system is dependent on securing a reliable, preferably local source of fuel. The biomass boiler would generally be used in conjunction with a gas CHP. Operating under this strategy, the system should have the potential to further reduce site wide carbon emissions but by a limited amount as the space heat demand has been significantly reduced through best practice passive measures.

To achieve a meaningful carbon emission reduction, the biomass system would have to be used instead of a gas CHP and would provide a similar overall site carbon emission reduction. However, there are several issues associated with biomass district heating that led to this being discounted for the site:

- High risk of air pollution issues associated with the flue emissions
- Risk and reliability of fuel supply
- Manchester City Council is a smoke-controlled area
- Large area for fuel storage or frequent deliveries
- Specialist maintenance knowledge
- Convenient access for delivery vehicles – either walking floor or covered bulk heavy goods vehicles, typically require a 26m turning circle
- Noise from deliveries – deliveries could be up to 10 times per month
- A district heat network is not proposed for this site, as an all-electric solution with heat pumps is proposed.

Due to the reasons stated above, biomass is deemed inappropriate for this scheme.

4.4.1.3 Fuel Cells

Fuel cells deliver electricity via hydrogen. Current research indicates that although the technology is developing commercially, the viability of equipment and reliable sources of non-fossil fuel hydrogen are not yet available on a commercial scale that would suit the demands of the proposed scheme.



Image 8 - Fuel Cells

Large storage tanks with hydrogen would also have to be located within the site. This is considered a significant safety concern due to the flammability properties of hydrogen gas, which is the main constituent in the fuel cells. Additionally, there is limited protocol on the suitable method of thermally modelling this technology within DSM analysis and SAP. It is not proposed for this scheme due to all reasons mentioned above.

4.4.1.4 Site Mounted Large Wind Turbines

Due to the proximity to existing and future Domestic developments and associated poor wind speeds in urban environments, this technology is deemed unsuitable in this instance.

The noise associated with large scale wind turbines could have a potential impact with adjacent Domestic developments. A 300 – 500 kW turbine could potentially reach a sound level of 100 dB at 8 m/s wind speed.



Image 9 - Wind Turbines

4.4.1.5 Roof Mounted Wind Turbines

The feasibility of the roof mounted wind turbines has been studied in terms of:

- Size and visual impact on the building
- Power output
- Noise generation

Wind turbines extract energy from the wind using a rotor which usually comprises of two or three blades similar in profile to the wing of an airplane. Most small wind turbines generate direct current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity to AC.



Image 10 - Roof-mounted small-scale wind turbine

Wind systems can also be connected to the national grids. A special inverter and controller convert DC electricity to AC at a quality and standard acceptable to the grid, hence no expensive battery storage is required. Any unused or excess electricity may be able to be exported to the grid and sold to the local electricity supply company.

The average on site wind speed is 4.6 m/s at 10m as shown in image 09 below. For a turbine to be feasible a wind speed of at least 6m/s is required to produce a satisfactory energy output.

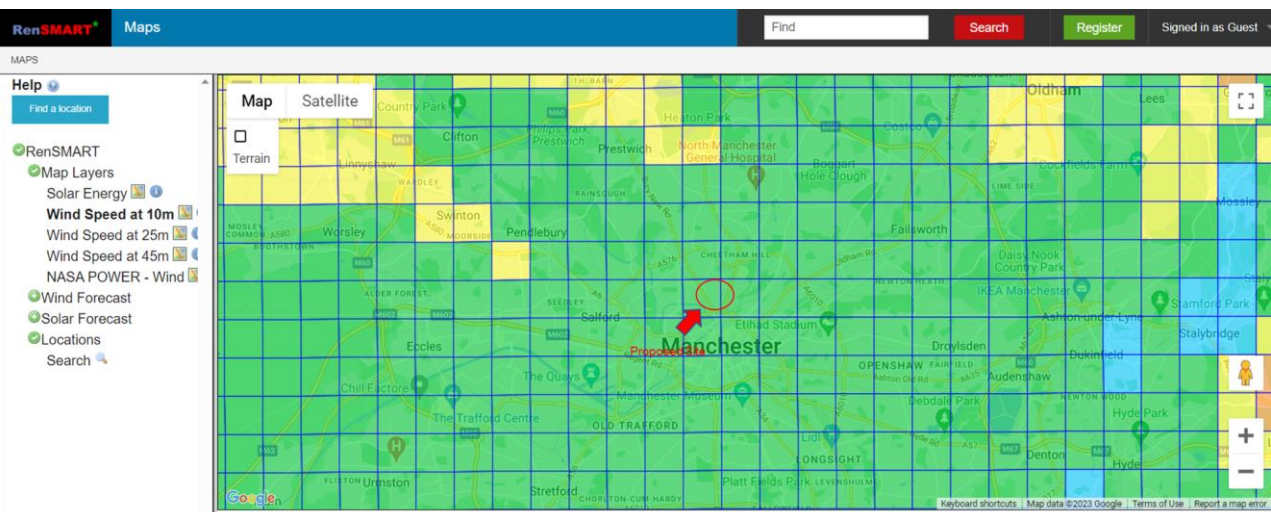


Image 11 - On site Average Wind Speed

Based on 10No. 6 kW turbines it has been estimated that the scheme could potentially save 31tCO₂. However, due to low wind speeds, aesthetic impact and potential detrimental impact on wildlife, roof mounted wind turbines are not considered suitable for this application.

4.4.1.6 Ground Source Heat Pump (GSHP)

GSHPs provide extracted heat from the ground or water during the winter months via a heat pump and circulate hot water into a building to provide space-heating and pre-heated domestic hot water. In the summer months the process can be reversed to provide cooling.



Image 12 - GSHP

GSHPs are not considered an appropriate technology for this scheme for the following reasons:

- Extraction licences would need to be applied for from the Environment Agency and local water-way management body to use any source of water required for the heating process
- High risk to contaminate underground water sources
- A substantial amount of land, either via slinky or bore holes would be required resulting in the technology becoming cost prohibited.
- High cost of centralised heating / cooling generation and distribution systems.
- Dependant on the suitability of the ground conditions and the usable area available.
- High maintenance and running cost.

4.4.1.7 Air Source Heat Pump (ASHP)

This assessment has identified that full Air Source Heat Pumps (ASHPs) would only be viable with a district heat network solution to produce heating and domestic hot water (DHW). ASHPs utilise low grade heat in the air, as similar in the refrigeration process, enabling them to produce hot water, typically at around 45°C.

Heat pumps for the hot water systems only are considered a viable option and are proposed for use on this development.



Image 13- ASHP Unit

Individual heat pumps will be installed on the apartment hot water systems (DHW) to assist with low carbon technology and reducing CO₂ emissions.

4.4.1.8 Façade Solar Photovoltaics (FPV)

Façade Solar Photovoltaics uses thin-film PV technology to manufacture ss. The material is ideal for building integrated solutions, enabling to produce transparent or opaque solar PV panels, ideal for façades, canopies, skylights or curtain walls. Designed specifically for Building Integrated (BI) applications, thin-film technology offers performance advantages through:

FPV can operate at non-optimal angles therefore offering greater potential for installation locations such as the vertical side of a building.

FPV has a small annual yield generation, ideally large installations are required for best benefits. This technology operates down to 10% of sunlight, extending the number of hours over the year in which to produce electricity providing a more consistent energy yield. Additionally, FPV alignment makes panels less affected by shading.



Image 14 - Façade Solar Photovoltaics

FPV has low efficiency compared with traditional PV applications, therefore feasible application requires large façade areas connected centrally. FPV technology mainly applies to commercial buildings. Due to the proposed Domestically led scheme and technology constraints to allocate generation to individual dwellings, this technology is deemed inadequate for the proposed scheme.

4.4.1.9 Solar Photovoltaics (PV)

PV uses energy from light to create electricity for the running of appliances and lighting. The PV cell consists of one of the two layers of a semi conducting material, usually silicon (normally Monocrystalline, Polycrystalline and Amorphous silicon).

When light shines on the cell it creates an electric field across the layers causing electricity to flow. The greater the light intensity, the greater the flow of electricity.

Individually PV cells only provide a small amount of electricity and they are generally grouped together into a module for convenience and higher output.

PV is most suitable where electricity is generated at the point of use and the energy loss and costs with transmission and distribution are avoided.

A key advantage of PV in the urban environment is their potential to be integrated into the fabric of the building. No extra land space is required, and they can either blend into the building and surrounding environment making them either very discreet or giving a clear indication of 'green' credentials.



Image 15 - Solar Photovoltaics (PV)

For the Non-domestic areas it has been calculated that the Solar PV array would have an active area of 180m². This amount of PV would be orientated to face South to South West and pitched at 10°.

The Solar PV is proposed to be situated on the roof of Block B as they have no overshadowing from adjacent towers.

4.4.2 'Be Green' Results

This assessment has identified that Solar Photovoltaics is the most suitable technology for the proposed scheme.

The arrays will be incorporated into the roof design where they will operate at their maximum potential and not restrict other plant space or roof access.

Air source heat pumps are also included in the design proposal to provide the Domestic Hot Water (DHW) within each apartment.

The Solar Photovoltaics and DHW Heat Pump will meet the Manchester City Council's EN4 & EN4 policy, requiring all developments to provide a reduction of CO₂ emissions through on-site renewable energy generation.

The results in Table 12 below show a significant reduction through the incorporation of 'Be Green' design measures on the domestic element of the development.

Sample Apartment	No of Units	Area (m ²)	Be Green DER (kgCO ₂ /m ² .yr)	Total Emissions (kgCO ₂ .yr)
1B2P (A4) GF	6	50.37	4.64	1,402
1B2P (A4) MF	54	50.37	3.38	9,194
1B2P (A4) TF	5	50.37	4.64	1,402
2B3P (A7) GF	5	61.04	4.71	1,437
2B3P (A7) MF	45	61.04	3.66	10,053
2B3P (A7) TF	5	61.04	4.70	1,434
2B4P (A5) GF	1	89.72	4.31	387
2B4P (A5) MF	9	89.72	3.01	2,431
2B4P (A5) TF	1	89.72	4.08	366
1B2P (A4) GF	6	50.37	4.64	1,402
1B2P (A4) MF	59	50.37	3.38	10,045

Sample Apartment	No of Units	Area (m ²)	Be Green DER (kgCO ₂ /m ² .yr)	Total Emissions (kgCO ₂ .yr)
1B2P (A4) TF	6	50.37	4.64	1,402
2B3P (B2) GF	17	65.81	4.07	4,553
2B3P (B2) MF	161	65.81	3.67	38,885
2B3P (B2) TF	17	65.81	4.76	5,325
2B4P (B6) GF	10	79.91	4.32	3,452
2B4P (B6) MF	68	79.91	3.37	18,312
2B4P (B6) TF	10	79.91	4.46	3,564
3B5P (B15) GF	1	85.49	4.62	395
3B5P (B15) MF	17	85.49	3.65	5,305
3B5P (B15) TF	1	85.49	4.54	388
Total				121,136

Table 12 - Be Green Renewable CO₂ saving contribution

Table 12 shows that through the energy efficiency measures described in Section 4.2 and the "Be Green Energy Efficiency Measures", 121 TonnesCO₂ savings are predicted which equates to 30.2% reduction (domestic only) on site CO₂ emissions from the "Be Green" scheme. (please refer to appendix a below for the sample SAP Calculations for the dwellings)

The results in Table 13 below show the reduction through the incorporation of 'Be Green' design measures on the non-domestic element of the development.

Be Green	Floor Area (m ²)	(TER) Total CO ₂ emissions	CO ₂ Regulated total (kgCO ₂ .yr)
Non-residential	920.1	0.5	460.05

Table 13 - 'Be Green' Energy Efficiency reduction and CO₂ emissions from an SBEM compliant building

Based on these modelling calculations the following Be Green emissions have been established for the proposed scheme as Table 14 below (please refer to appendix a below for the Be Green commercial BRUKL document).

Be Green	Regulated CO ₂ Emissions (kgCO ₂ .yr)
C – Domestic Be Green Emissions of Development	121,136
I – Non-Domestic Be Green Emissions of Development	460.05
O (C+I) – Total Be Green Emissions of Development	121,596

Table 14 - Calculation of total 'Be Green' CO₂ emissions for the Domestic and non-Domestic development.

The Energy Hierarchy results are presented in the table below.

Energy Hierarchy	Total Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)		
	Domestic	Non-domestic	Total
A - Baseline Emissions of Development (pre-improvement)	418	3.14	421.12
B - Be Lean	247	2.95	250.43
C - Be Clean	247	2.95	250.43
D - Be Green	121	0.47	121.61
E - Total Reduction in Carbon (KgCO ₂ /yr) from Baseline	297	2.67	299.52
F - Percentage Improvement in Carbon Emissions (above Building Regs 2021)	71.0%	85.0%	71.1%
C-D - Percentage Contribution from LZC Technologies#	30.2%	79.2%	31.6%

Table 15 - Site Wide CO₂ Reduction Summary.

Table 15 presents the savings estimated through the energy hierarchy and energy efficiency measures described this report The “Be Green Energy Efficiency Measures” suggest, a 71.1% reduction (domestic and non-domestic) on site CO₂ emissions when compared to the Part L 2021 baseline with an estimated site CO₂ reduction contribution of 31.6% through LZC technologies surpassing the 20% CO₂ reduction in the MCC EN6 policy requirements.

The results of the CO₂ emissions savings assessment (presented in the table above) confirm that the proposals show a theoretical reduction of approximately 81% when compared to the emissions levels in Part L 2010. This confirms compliance with Core Strategy Policy EN6 which requires a 15% improvement. The table below presents the theoretical estimate carried out to assess how the current (Part L 2021) proposals performance under Part L 2010.

As note above the Core Strategy Policy EN6 requires a 15% improvement in Part L 2010, The results of the CO₂ emissions savings assessment (presented in the table below) confirm that the proposals show a theoretical reduction of approximately 81% when compared to the emissions levels in Part L 2010. This confirms compliance with Core Strategy Policy EN6 which requires a 15% improvement.

Regulations	TER (Tonnes CO ₂)	BER (Tonnes CO ₂)	Cumulative Improvement
Part L 2021	421.12	121.61	71.1%
Part L 2013*	610.32		80.1%
Part L 2010**	649.28		81.3%

Table 16 – Part L 2010 Improvement.

*Part L 2021 includes an additional 31% improvement over Part L 2013.

**Part L 2013 includes an additional 6% improvement over Part L 2010.

Note: The table above presents the results of the CO₂ emissions savings assessment us to estimate the equivalent CO₂ savings under Part L 2010 regs.

5.0 District Heating Networks

In response to the Core Strategy Policy EN5 and EN7 this section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the development in line with the energy hierarchy.

5.1 Decentralised Heating Networks

The energy policy EN4 reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

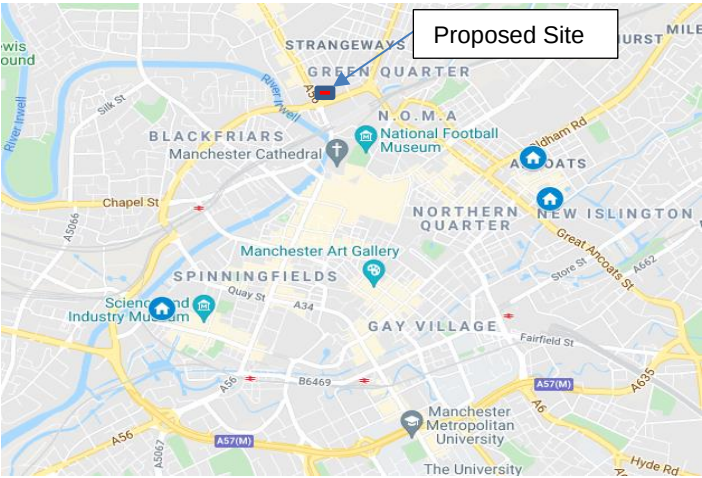
One of priorities for reducing CO₂ emissions is to reduce reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de-centralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long-term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

However, there are currently no existing district heating networks near to the site. An extract from the ADE District Heating Installation Map¹ has been highlighted in Image 15 indicating the nearest networks at Manchester Victoria Square and Royal Mills which are around 500m from the proposed development site.



 District Heating Network Locations around Manchester

Image 16 - Location of site in relation to existing and proposed heat networks

¹ <https://www.theade.co.uk/resources/publications/district-heating-installation-map>

6.0 Sustainability

This statement considers many aspects of sustainable design and construction of the development. Sustainable developments arise as a result of user interaction (or management operation) with the environment, buildings and their associated building services.

Achieving sustainable development requires action on four main fronts:

1. Promotion and encouragement of sustainable lifestyles.
2. Design and construction of quality buildings and building services and its surroundings.
3. Use, operation and maintenance of buildings, building services and its surroundings.
4. Selection and use of other sustainable equipment and surroundings incl. adoption of lifestyle changes, new methods and embracing the challenges ahead.

In addition, by adopting the philosophies below the development can be developed sustainably:

- Designing buildings and surrounding environments that are easy to operate and maintain.
- Pre-installing sustainable and energy efficient equipment and/or advising on such.
- Providing guidance on the efficient and sustainable use of the buildings and surroundings.

6.1 Sustainable Design & Construction

The design currently includes a number of components that gives the scheme a head start in relation to the sustainability. The list below is not exhaustive:

Energy

- The development will be designed and constructed to achieve low energy and carbon dioxide emissions, improving upon current Building Regulations Part L 2021 using the Be Lean, Be Clean, Be Green energy hierarchy. Manchester policy is a 20% uplift in Building Regs.
- Sub-metering of all major energy consuming systems will be provided to differentiate between energy loads for heating and hot water, lighting and small power consumption.
- Dedicated energy efficient lighting will be installed internally and externally. Movement and daylight controlled lighting will be introduced, where practicable. The efficacy and colour rendering index ratings will be considered.

Water

- Internal water consumption will be reduced using low flush/ flow appliances. This will include appliances such as aerated/ flow regulated taps, low-flow showers, low-flush WC's, low-flush urinals, PIR control on main water supply to all toilet areas, etc. and where practicable.
- Where areas use more than 10% of the buildings predicted total water usage, sub-metered pulsed output meters will be considered.
- Flow control devices will be installed to sanitary fittings, where practicable.

Materials

- All building and construction materials used on the schemes will aim to be sought from environmentally managed accreditation schemes, (such as EMAS/ ISO 14001 accreditation). All timber will be sourced from a certified chain of custody. Overall, at least 80% of all material sourced on this project will be responsibly sourced, and where practical.
- The building will incorporate suitable durability and protection measures or designed features/solutions to prevent damage to vulnerable parts of the internal and external building and landscaping elements
- Insulation will have low environmental impact in use and during manufacture. This is measured via the insulation index rating.

Pollution

- The units will be provided with electrical heating (and cooling) systems only to ensure NOx emissions are eliminated.
- Reduction of night-time light pollution using ILE compliant light fittings will be installed, where practicable.

Waste

- Dedicated colour coded bins will be provided for recycling of paper/ card, metal, plastic and cans, food waste, etc. External bin storage space will meet the requirements of the Local authority.
- The aim will be to divert as much waste from landfill as possible by reducing construction waste and re-use or recycling waste, wherever possible.

Health and Wellbeing

- Daylight and view of sky will be optimised reducing the requirement to consume energy from electric lighting. Based on the layout and extent of the glazing, these credits are certainly achievable, subject to detailed design.
- Landscaping and usable garden/ leisure space will be maximised to provide occupants with an aesthetic external environment, where practicable.
- Safety issues will incorporate recommendations from a CPDA or ALO input, wherever practicable.

Management

- A comprehensive Building User Guide (BUG) will be issued for the tenants and facilities managers.
- The contractor will manage and monitor environmental issues during construction process. This will include monitoring and management of energy and water consumption of site activities, separation, streaming and recycling of waste, the reduction of air, dust and ground pollution.

Ecology and Land-use

- The contractor will enlist the help of a suitably qualified person to recommend appropriate ecological features that will positively enhance the ecology of the site, where practical.
- Protection and mitigation measures will be introduced, where practicable, to reduce the impact of the development on the existing site and to enhance the development.
- Ecological improvement will be undertaken to enhance the ecological value of the site once the development is built, wherever practicable.
- Where possible provision of trees may provide carbon dioxide sequestration opportunities.

6.2 Sustainability Conclusion

The scheme will ensure that a quality sustainable new development is created. This will offer building occupiers, and the whole community added benefits in terms of quality of living standards and life, lower energy and water bills and enhanced/improved surroundings and facilities.

A holistic approach to sustainable design and construction has been provided from the outset of this development, which has helped to influence and develop the proposals. The proposals may change as the design progresses and changes could affect the financial viability of the proposed development, but by considering the findings of this report the contractor (once appointed) can endeavour to adopt the principles, wherever practicable.

7.0 Conclusions

This Energy Statement has outlined the measures to reduce the carbon emissions for the proposed development and resulting savings at each stage of the Energy Hierarchy.

Through the integration of the measures outlined in this strategy, the CO₂ emissions arising from the building energy consumption can be reduced by a total of 71.1% beyond a compliant Part L 2021 Baseline.

A number of passive measures including improved U-Values and air permeability, low g-value, energy efficient lighting, a mixed mode ventilation strategy combining natural ventilation and MVHR, connection to efficient electric heating and all DHW heat requirements to be provided by integrated heat pumps, coupled with solar PV array with 180m² active area to serve the non-domestic blocks provide a means to reduce energy consumption and onsite CO₂ emissions.

The Table 16 below summarises the energy consumption and CO₂ emissions for the scheme for a compliant 'Be Lean', 'Be Clean', 'Be Green' approach.

Energy Hierarchy	Total Regulated CO2 Emissions (Tonnes CO2/Yr)		
	Domestic	Non-domestic	Site Wide
A - Baseline Emissions of Development (pre-improvement)	418	3.14	421.12
B - Be Lean	247	2.95	250.43
C - Be Clean	247	2.95	250.43
D - Be Green	121	0.47	121.61
E - Total Reduction in Carbon (KgCO ₂ /yr) from Baseline	297	2.67	299.52
F - Percentage Improvement in Carbon Emissions (above Building Regs 2021)	71.0%	85.0%	71.1%
C-D - Percentage Contribution from LZC Technologies#	30.2%	79.2%	31.6%

Table 17 - Summary of CO₂ emissions reductions (as calculated with SAP 10.2 and SBEM)

Please note that the Domestic contribution from LZCT includes the improvement from the heat pump on the Domestic Hot Water side (DHWHP). With this factored in the renewables and LZCT contribution significantly exceeds Manchester Core Strategy EN6 20% CO₂ reduction requirement.

This Energy Statement for the proposed development shows that the combined measures proposed will reduce the CO₂ emissions of the scheme by at least 71.1% from the combined 'Be Lean', 'Be Clean' and "Be Green" when compared against a Baseline emissions case.

As note above the Core Strategy Policy EN6 requires a 15% improvement in Part L 2010, The results of the CO₂ emissions savings assessment confirm that the proposals show a theoretical reduction of approximately 81% when compared to the emissions levels in Part L 2010. This confirms compliance with Core Strategy Policy EN6 which requires a 15% improvement.

The contribution from LZCT is provided from HW heat pumps and Photovoltaic panels. The 180m² active PV array and the HW heat pump on every domestic unit is providing a 31.6% CO₂ reduction. Which is compliant with the MCC EN6 Planning Policy.

Recommendations proposed to overcome any issues with overheating were considered at an early design stage and implementation of these recommendations have been effective, as demonstrated in this study.

8.0 Glossary of Terms

Reference	Meaning
CHP	Combined heat and power
HVAC	Heating, ventilation, and air conditioning (HVAC)
DHW	Domestic Hot Water
TER	Target CO ₂ Emission Rate expressed as kgCO ₂ /(m ² year)
BER	Building CO ₂ Emission Rate expressed as kgCO ₂ /(m ² year)
DER	Dwelling CO ₂ Emission Rate expressed as kgCO ₂ /(m ² year)
TFEE	Target fabric energy efficiency rate expressed as kWh/(m ² year)
DFEE	Dwelling fabric energy efficiency rate expressed as kWh/(m ² year)
FEE	Fabric Energy Efficiency
FEES	Fabric Energy Efficiency Standard
PV	Solar Photovoltaics
CO ₂	Carbon Dioxide
BCB	Building Control Body – a local authority or an approved inspector
BRUKL	Building Regulations UK Part L
SAP	Standard Assessment Procedure
U-value	Measurement of heat loss through building element in W/m ² K
g-value	Measurement of solar energy transmittance of ss
Psi-value	Measurement of heat loss across a thermal bridge W/m ² K
Building Regulations	ADL 1 and ADL 2 2021
Party Walls Zero Heat Loss	To qualify for the proposed zero heat loss u-value of 0.00 W/m ₂ .K the party walls must either be solid with no cavity or cavities must be fully filled with insulation

Reference	Meaning
Air Permeability	The physical property used to measure airtightness of the building fabric. It is defined as air leakage rate per hour per square metre of envelope area at the test reference pressure differential of 50 Pascals (50 N/m ²)
Air Permeability	The envelope area, or measured part of the building, is the total area of all floors, walls and ceilings bordering the internal volume that is the subject of the pressure test. This includes wall as and floors below external ground level Overall internal dimensions are used to calculate this envelope area and no subtractions are made for the area of the junctions of internal walls, floors and ceilings with exterior walls, floors and ceilings. Air permeability is measured in m³/m²/hr

Appendices

Appendix A - SAP & SBEM

A selection of typical SAP calculations are detailed below:

Summary for Input Data



Property Reference	Be Lean	Issued on Date	04/07/2023
Assessment Reference	A4 1B2P MF_Be Lean	Prop Type Ref	Block A SAP Calcs 20221129
Property	Block A Flat , A1, Great Ducie Street , Manchester , M3 1PT		

SAP Rating	72 C	DER	7.87	TER	13.16
Environmental	95 A	% DER < TER			40.20
CO ₂ Emissions (t/year)	0.38	DFEE	18.78	TFEE	19.21
Compliance Check	See BREL	% DFEE < TFEE			2.23
% DPER < TPER	-17.20	DPER	84.43	TPER	72.04

Assessor Details	Mr. Matthew Borthwick	Assessor ID	AV93-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southwest	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	6	
2.0 Number of Storeys	1	
3.0 Date Built	2025	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m²	0.00 m
Ground floor:	14.16 m	50.37 m²	2.40 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	23.75	m²
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9.0 External Walls											
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type	
External Wall 1	System Build	Solid wall : dense plaster, insulation, any outside structure	0.15	17.00	15.43	8.30	0.00	None	7.13	Enter Gross Area	
External Wall 2 (stair)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	12.69	12.69	2.10	Stairwell	Stairwell 1	0.00	
External Wall 3 (riser)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	4.34	4.34	2.10	Stairwell	Stairwell 1	0.00	
										Enter Gross Area	

9.1 Party Walls							
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Steel frame	0.00	20.00	34.22	0.00	None

10.1 Party Ceilings			
Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	50.37

11.1 Party Floors

Summary for Input Data



Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	50.37

12.0 Opening Types										
Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)	
Window - Single	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.69	1.20	
Window - Sliding Door	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.75	1.20	
Window - Double	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.64	1.20	

13.0 Openings					
Name	Opening Type	Location	Orientation	Area (m²)	Pitch
W1	Window - Double	External Wall 1	South East	5.08	0
W2	Window - Single	External Wall 1	South East	2.05	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging		Calculate Bridges			
17.1 List of Bridges					
Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	3.17	0.03	0.03	No
E3 Sill	Independently assessed	3.17	0.03	0.03	No
E4 Jamb	Independently assessed	9.00	0.02	0.02	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	28.32	0.10	0.10	No
E18 Party wall between dwellings	Independently assessed	2.40	0.09	0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	28.52	0.00	0.00	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	7.20	-0.03	-0.03	No
Y-value	0.10			W/m²K	

18.0 Pressure Testing	Yes	
Designed AP ₅₀	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP ₅₀	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	Mechanical Ventilation
Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	2
Manufacturer SFP	0.88
Duct Type	Rigid
MVHR Efficiency	91.00
Wet Rooms	2
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
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22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	109.17	23	2507	7

elmhurst
energy

25.0 Main Heating 2	None
26.0 Heat Networks	None

28.0 Water Heating	
Water Heating	Independent
SAP Code	903
Fuel Type	Electricity
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Immersion Heater	Single
Summer Immersion	No
Cold Water Source	From mains
Bath Count	1
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1	Combi boiler or unvented hot water system	11.00		No	
Shower 2	Combi boiler or unvented hot water system	11.00		No	

29.0 Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	201.00 L
Loss	1.61 kWh/day

34.0 Small-scale Hydro	None	kWh/Year
Electricity Generated	0.00	
Apportioned	0.00	
Connected to dwelling's electricity meter	Yes	
Electricity Generation	Annual	

Recommendations
Lower cost measures
 None
Further measures to achieve even higher standards
 None

Summary for Input Data



Property Reference	Be Lean	Issued on Date	04/07/2023
Assessment Reference	B1 2B3P MF_Be Lean	Prop Type Ref	Block A SAP Calcs 20221129
Property	Block A Flat , A1, Great Ducie Street , Manchester , M3 1PT		

SAP Rating	69 C	DER	7.89	TER	13.30
Environmental	94 A	% DER < TER			40.68
CO ₂ Emissions (t/year)	0.49	DFEE	25.06	TFEE	26.18
Compliance Check	See BREL	% DFEE < TFEE			4.29
% DPER < TPER	-14.46	DPER	84.08	TPER	73.46

Assessor Details	Mr. Matthew Borthwick	Assessor ID	AV93-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southeast	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, End-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	18	
2.0 Number of Storeys	1	
3.0 Date Built	2025	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m²	0.00 m
Ground floor:	24.72 m	65.81 m²	2.40 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	22.64	m²
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9.0 External Walls											
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type	
External Wall 1	System Build	Solid wall : dense plaster, insulation, any outside structure	0.15	17.00	38.76	27.53	0.00	None	11.23	Enter Gross Area	
External Wall 2 (lifts)	Solid Wall	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	15.74	15.74	2.50	Stairwell	Stairwell 2	0.00 Enter Gross Area	
External Wall 3 (risers)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	4.82	4.82	2.50	Stairwell	Stairwell 2	0.00 Enter Gross Area	

9.1 Party Walls							
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Steel frame	0.00	20.00	6.69	0.00	None

10.1 Party Ceilings			
Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	65.81

11.1 Party Floors

Summary for Input Data



Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	65.81

12.0 Opening Types										
Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)	
Window - Single	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.69	1.20	
Window - Sliding Door	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.75	1.20	
Window - Double	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.64	1.20	

13.0 Openings					
Name	Opening Type	Location	Orientation	Area (m²)	Pitch
W1	Window - Single	External Wall 1	South West	2.05	0
W2	Window - Sliding Door	External Wall 1	North West	5.08	0
W3 & W4	Window - Single	External Wall 1	North West	4.09	0

14.0 Conservatory	None
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15.0 Draught Proofing	100	%
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16.0 Draught Lobby	No
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17.0 Thermal Bridging	Calculate Bridges
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17.1 List of Bridges						
Bridge Type	Source Type	Length	Psi	Adjusted Reference:		Imported
E2 Other lintels (including other steel lintels)	Independently assessed	4.99	0.03	0.03		No
E3 Sill	Independently assessed	2.73	0.03	0.03		No
E4 Jamb	Independently assessed	18.00	0.02	0.02		No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	49.44	0.10	0.10		No
E16 Corner (normal)	Independently assessed	9.60	0.08	0.08		No
E18 Party wall between dwellings	Independently assessed	2.40	0.09	0.09		No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	13.38	0.00	0.00		No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.40	0.00	0.00		No

Y-value	0.11	W/m²K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP ₅₀	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	Mechanical Ventilation
Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	3
Manufacturer SFP	1.07
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	3
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
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22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	109.17	23	2507	7

Summary for Input Data



24.0 Main Heating 1

Percentage of Heat

100.00

%

Database Ref. No.

0

Fuel Type

Electricity

SAP Code

691

In Winter

100.00

In Summer

100.00

Controls SAP Code

2605

Delayed Start Stat

No

HETAS approved System

No

Oil Pump Inside

No

Fan Assisted Flue

No

Boiler Interlock

No

25.0 Main Heating 2

None

26.0 Heat Networks

None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

28.0 Water Heating

Water Heating

Independent

SAP Code

903

Fuel Type

Electricity

Flue Gas Heat Recovery System

No

Waste Water Heat Recovery Instantaneous System 1

No

Waste Water Heat Recovery Instantaneous System 2

No

Waste Water Heat Recovery Storage System

No

Solar Panel

No

Water use <= 125 litres/person/day

Yes

Immersion Heater

Single

Summer Immersion

No

Cold Water Source

From mains

Bath Count

1

Supplementary Immersion

No

Immersion Only Heating Hot Water

No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1	Combi boiler or unvented hot water system	11.00		No	
Shower 2	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Cylinder Stat

Yes

Cylinder In Heated Space

Yes

Independent Time Control

Yes

Insulation Type

Measured Loss

Cylinder Volume

201.00

L

Summary for Input Data



Loss

1.61

kWh/day

Pipes insulation

Fully insulated primary pipework

In Airing Cupboard

No

31.0 Thermal Store

None

34.0 Small-scale Hydro

Electricity Generated

0.00

Apportioned

0.00

kWh/Year

Connected to dwelling's electricity meter

Yes

Electricity Generation

Annual

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Recommendations
Lower cost measures
None
Further measures to achieve even higher standards
None

Summary for Input Data



Property Reference	Be Lean	Issued on Date	04/07/2023
Assessment Reference	B15 3B5P MF_Be Lean	Prop Type Ref	Block A SAP Calcs 20221129
Property	Block A Flat , A1, Great Ducie Street , Manchester , M3 1PT		

SAP Rating	71 C	DER	6.85	TER	11.25
Environmental	94 A	% DER < TER			39.11
CO ₂ Emissions (t/year)	0.55	DFEE	22.81	TFEE	23.28
Compliance Check	See BREL	% DFEE < TFEE			2.03
% DPER < TPER	-18.20	DPER	72.98	TPER	61.74

Assessor Details	Mr. Matthew Borthwick	Assessor ID	AV93-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Northwest	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, End-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	9	
2.0 Number of Storeys	1	
3.0 Date Built	2025	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m²	0.00 m
Ground floor:	26.68 m	85.49 m²	2.40 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	25.24	m²
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9.0 External Walls											
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type	
External Wall 1	System Build	Solid wall : dense plaster, insulation, any outside structure	0.15	17.00	53.83	40.56	0.00	None	13.27	Enter Gross Area	
External Wall 2 (smoke shaft)	Solid Wall	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	6.77	6.77	2.50	Stairwell	Stairwell 2	0.00 Enter Gross Area	
External Wall 3 (stairs)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	8.23	8.23	2.50	Stairwell	Stairwell 2	0.00 Enter Gross Area	

9.1 Party Walls							
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Steel frame	0.00	20.00	6.69	0.00	None

10.1 Party Ceilings			
Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	85.49

11.1 Party Floors

Summary for Input Data



Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	85.49

12.0 Opening Types										
Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)	
Window - Single	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.69	1.20	
Window - Sliding Door	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.75	1.20	
Window - Double	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.64	1.20	

13.0 Openings					
Name	Opening Type	Location	Orientation	Area (m²)	Pitch
W1	Window - Double	External Wall 1	South West	5.08	0
W2, W3, W4, & W5	Window - Single	External Wall 1	South East	8.19	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging		Calculate Bridges				
17.1 List of Bridges						
Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported	
E2 Other lintels (including other steel lintels)	Independently assessed	5.90	0.03	0.03	No	
E3 Sill	Independently assessed	5.90	0.03	0.03	No	
E4 Jamb	Independently assessed	22.50	0.02	0.02	No	
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	57.36	0.10	0.10	No	
E16 Corner (normal)	Independently assessed	7.20	0.08	0.08	No	
E18 Party wall between dwellings	Independently assessed	2.40	0.09	0.09	No	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	14.06	0.00	0.00	No	
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.40	0.00	0.00	No	

Y-value	0.11	W/m²K
---------	------	-------

18.0 Pressure Testing	Yes	
Designed AP ₅₀	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP ₅₀	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	Mechanical Ventilation
Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	3
Manufacturer SFP	1.07
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	3
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
---------------------------	----

22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	109.17	23	2507	7

Summary for Input Data



24.0 Main Heating 1

SAP table

100.00

%

Database Ref. No.

0

Fuel Type

Electricity

SAP Code

691

In Winter

100.00

In Summer

100.00

Controls SAP Code

2605

Delayed Start Stat

No

HETAS approved System

No

Oil Pump Inside

No

Fan Assisted Flue

No

Boiler Interlock

No

25.0 Main Heating 2

None

26.0 Heat Networks

None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

28.0 Water Heating

Water Heating

Independent

SAP Code

903

Fuel Type

Electricity

Flue Gas Heat Recovery System

No

Waste Water Heat Recovery Instantaneous System 1

No

Waste Water Heat Recovery Instantaneous System 2

No

Waste Water Heat Recovery Storage System

No

Solar Panel

No

Water use <= 125 litres/person/day

Yes

Immersion Heater

Single

Summer Immersion

No

Cold Water Source

From mains

Bath Count

1

Supplementary Immersion

No

Immersion Only Heating Hot Water

No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1	Combi boiler or unvented hot water system	11.00		No	
Shower 2	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder

Yes

Yes

Yes

Measured Loss

201.00

L

1.61

kWh/day

SAP 10 Online 2.7.11

Page 3 of 4

Summary for Input Data

Pipes insulation

Fully insulated primary pipework

In Airing Cupboard

No

31.0 Thermal Store

None

34.0 Small-scale Hydro

None

0.00

0.00

Yes

Annual

kWh/Year

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Recommendations
Lower cost measures
None
Further measures to achieve even higher standards
None

SAP 10 Online 2.7.11

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Summary for Input Data

Property Reference	Bodd Sample SAPs 28/06		Issued on Date	04/07/2023
Assessment Reference	B15 3B5P MF	Prop Type Ref	Block A SAP Calcs 20221129	
Property	Block A Flat , A1, Great Ducie Street , Manchester , M3 1PT			

SAP Rating	85 B	DER	3.65	TER	11.11
Environmental	97 A	% DER < TER			67.15
CO ₂ Emissions (t/year)	0.27	DFEE	22.81	TFEE	23.28
Compliance Check	See BREL	% DFEE < TFEE			2.03
% DPER < TPER	36.93	DPER	38.48	TPER	61.02

Assessor Details	Mr. Matthew Borthwick	Assessor ID	AV93-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Northwest		
Property Tenure	ND		
Transaction Type	6		
Terrain Type	Urban		
1.0 Property Type	Flat, End-Terrace		
Position of Flat	Mid-floor flat		
Which Floor	9		
2.0 Number of Storeys	1		
3.0 Date Built	2025		
4.0 Sheltered Sides	1		
5.0 Sunlight/Shade	Average or unknown		
6.0 Thermal Mass Parameter	Precise calculation		
Thermal Mass	N/A	kJ/m²K	
7.0 Electricity Tariff	Standard		
Smart electricity meter fitted	Yes		
Smart gas meter fitted	Yes		

7.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Basement:	0.00 m	0.00 m²	0.00 m
	Ground floor:	26.68 m	85.49 m²	2.40 m
	1st Storey:	0.00 m	0.00 m²	0.00 m
	2nd Storey:	0.00 m	0.00 m²	0.00 m
	3rd Storey:	0.00 m	0.00 m²	0.00 m
	4th Storey:	0.00 m	0.00 m²	0.00 m
	5th Storey:	0.00 m	0.00 m²	0.00 m
	6th Storey:	0.00 m	0.00 m²	0.00 m
	7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	25.24	m²
-----------------	-------	----

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	System Build	Solid wall : dense plaster, insulation, any outside structure	0.15	17.00	53.83	40.56	0.00	None	13.27	Enter Gross Area
External Wall 2 (smoke shaft)	Solid Wall	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	6.77	6.77	2.50	Stairwell	Stairwell 2	0.00 Enter Gross Area
External Wall 3 (stairs)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	8.23	8.23	2.50	Stairwell	Stairwell 2	0.00 Enter Gross Area

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Steel frame	0.00	20.00	6.69	0.00	None

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	85.49

11.1 Party Floors

Summary for Input Data

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	85.49

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window - Single	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.69	1.20
Window - Sliding Door	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.75	1.20
Window - Double	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.64	1.20

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
W1	Window - Double	External Wall 1	South West	5.08	0
W2, W3, W4, & W5	Window - Single	External Wall 1	South East	8.19	0

14.0 Conservatory	None
15.0 Draught Proofing	100 %
16.0 Draught Lobby	No

17.0 Thermal Bridging		Calculate Bridges			
17.1 List of Bridges					
Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	5.90	0.03	0.03	No
E3 Sill	Independently assessed	5.90	0.03	0.03	No
E4 Jamb	Independently assessed	22.50	0.02	0.02	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	57.36	0.10	0.10	No
E16 Corner (normal)	Independently assessed	7.20	0.08	0.08	No
E18 Party wall between dwellings	Independently assessed	2.40	0.09	0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	14.06	0.00	0.00	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.40	0.00	0.00	No
Y-value	0.11			W/m²K	

18.0 Pressure Testing	Yes	
Designed AP ₅₀	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP ₅₀	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	
Mechanical Ventilation	
Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	3
Manufacturer SFP	1.07
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	3
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
---------------------------	----

22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	109.17	23	2507	7

Summary for Input Data



24.0 Main Heating 1

SAP table

Percentage of Heat

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Controls SAP Code

Delayed Start Stat

HETAS approved System

Oil Pump Inside

Fan Assisted Flue

Boiler Interlock

100.00

0

Electricity

691

100.00

100.00

2605

No

No

No

No

No

%

25.0 Main Heating 2

Database

Percentage of Heat

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Model Name

Manufacturer

Controls

Delayed Start Stat

Burner Control

HETAS approved System

Oil Pump Inside

FI Case

Flue Type

Fan Assisted Flue

Flow Temperature

Combi boiler type

Combi keep hot type

0.00

190006

Electricity

0

0.00

0.00

EDL200UK-630

GDC Group Ltd

2100

No

Modulating

No

No

0.00

None or Unknown

No

Enter value

Standard Combi

None

%

26.0 Heat Networks

None

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Main Heating 2

914

No

No

No

No

No

Yes

Summary for Input Data



Summer Immersion

Cold Water Source

Bath Count

Supplementary Immersion

Immersion Only Heating Hot Water

No

From mains

1

No

No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1	Combi boiler or unvented hot water system	11.00		No	
Shower 2	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Cylinder Stat

Cylinder In Heated Space

Independent Time Control

Insulation Type

Cylinder Volume

Loss

Pipes insulation

In Airing Cupboard

Hot Water Cylinder

Yes

Yes

Yes

Measured Loss

201.00

1.61

Fully insulated primary pipework

No

L

kWh/day

31.0 Thermal Store

None

34.0 Small-scale Hydro

Electricity Generated

Apportioned

Connected to dwelling's electricity meter

Electricity Generation

None

0.00

0.00

Yes

Annual

kWh/Year

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Summary for Input Data



Property Reference	Bodd Sample SAPs 28/06		Issued on Date	04/07/2023
Assessment Reference	A4 1B2P MF	Prop Type Ref	Block A SAP Calcs 20221129	
Property	Block A Flat , A1, Great Ducie Street , Manchester , M3 1PT			

SAP Rating	89 B	DER	3.38	TER	12.93
Environmental	98 A	% DER < TER			73.86
CO ₂ Emissions (t/year)	0.15	DFEE	18.78	TFEE	19.21
Compliance Check	See BREL	% DFEE < TFEE			2.23
% DPER < TPER	49.21	DPER	35.94	TPER	70.77

Assessor Details	Mr. Matthew Borthwick	Assessor ID	AV93-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southwest	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	6	
2.0 Number of Storeys	1	
3.0 Date Built	2025	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m²	0.00 m
Ground floor:	14.16 m	50.37 m²	2.40 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	23.75	m²
-----------------	-------	----

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	System Build	Solid wall : dense plaster, insulation, any outside structure	0.15	17.00	15.43	8.30	0.00	None	7.13	Enter Gross Area
External Wall 2 (stair)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	12.69	12.69	2.10	Stairwell	0.00	Enter Gross Area
External Wall 3 (riser)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	4.34	4.34	2.10	Stairwell	0.00	Enter Gross Area

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Steel frame	0.00	20.00	34.22	0.00	None

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	50.37

11.1 Party Floors

Summary for Input Data



Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	50.37

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window - Single	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.69	1.20
Window - Sliding Door	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.75	1.20
Window - Double	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.64	1.20

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
W1	Window - Double	External Wall 1	South East	5.08	0
W2	Window - Single	External Wall 1	South East	2.05	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging		Calculate Bridges			
17.1 List of Bridges					
Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	3.17	0.03	0.03	No
E3 Sill	Independently assessed	3.17	0.03	0.03	No
E4 Jamb	Independently assessed	9.00	0.02	0.02	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	28.32	0.10	0.10	No
E18 Party wall between dwellings	Independently assessed	2.40	0.09	0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	28.52	0.00	0.00	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	7.20	-0.03	-0.03	No
Y-value	0.10			W/m²K	

18.0 Pressure Testing	Yes	
Designed AP ₅₀	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP ₅₀	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	
Mechanical Ventilation	
Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500140
Configuration	2
Manufacturer SFP	0.88
Duct Type	Rigid
MVHR Efficiency	91.00
Wet Rooms	2
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
---------------------------	----

22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	109.17	23	2507	7

Summary for Input Data



24.0 Main Heating 1

SAP table

Percentage of Heat

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Controls SAP Code

Delayed Start Stat

HETAS approved System

Oil Pump Inside

Fan Assisted Flue

Boiler Interlock

100.00

0

Electricity

691

100.00

100.00

2605

No

No

No

No

No

%

25.0 Main Heating 2

Database

Percentage of Heat

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Model Name

Manufacturer

Controls

Delayed Start Stat

Burner Control

HETAS approved System

Oil Pump Inside

FI Case

Flue Type

Fan Assisted Flue

Flow Temperature

Combi boiler type

Combi keep hot type

0.00

190006

Electricity

0

0.00

0.00

EDL200UK-630

GDC Group Ltd

2100

No

Modulating

No

No

0.00

None or Unknown

No

Enter value

Standard Combi

None

%

26.0 Heat Networks

None

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Main Heating 2

914

No

No

No

No

No

Yes

Summary for Input Data



Summer Immersion

Cold Water Source

Bath Count

Supplementary Immersion

Immersion Only Heating Hot Water

No

From mains

1

No

No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1	Combi boiler or unvented hot water system	11.00		No	
Shower 2	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Cylinder Stat

Cylinder In Heated Space

Independent Time Control

Insulation Type

Cylinder Volume

Loss

Pipes insulation

In Airing Cupboard

Hot Water Cylinder

Yes

Yes

Yes

Measured Loss

201.00

1.61

Fully insulated primary pipework

No

L

kWh/day

31.0 Thermal Store

None

34.0 Small-scale Hydro

Electricity Generated

Apportioned

Connected to dwelling's electricity meter

Electricity Generation

None

0.00

0.00

Yes

Annual

kWh/Year

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

SAP Rating	85 B	DER	4.12	TER	13.13
Environmental	97 A	% DER < TER			68.62
CO ₂ Emissions (t/year)	0.24	DFEE	25.06	TFEE	26.18
Compliance Check	See BREL	% DFEE < TFEE			4.29
% DPER < TPER	40.27	DPER	43.33	TPER	72.54

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

7.0 Measurements			
	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	24.72 m	65.81 m ²	2.40 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

9.0 External Walls											
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type	
External Wall 1	System Build	Solid wall : dense plaster, insulation, any outside structure	0.15	17.00	38.76	27.53	0.00	None	11.23	Enter Gross Area	
External Wall 2 (lifts)	Solid Wall	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	15.74	15.74	2.50	Stairwell	Stairwell 2	0.00	Enter Gross Area
External Wall 3 (risers)	System Build	Solid wall : dense plaster, insulation, any outside structure	0.20	17.00	4.82	4.82	2.50	Stairwell	Stairwell 2	0.00	Enter Gross Area

11.1 Party Floors

2.0 Opening Types									
Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window - Single	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.69	1.20
Window - Sliding Door	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.75	1.20
Window - Double	Manufacturer	Window	Double glazed		Air Filled	0.40	Wood	0.64	1.20

17.0 Thermal Bridging Calculate Bridges

Y-value W/m²K

19.0 Mechanical Ventilation

20.0 Fans, Open Fireplaces, Flues

SAP 10 Online 2.7.11

Summary for Input Data



24.0 Main Heating 1

SAP table

Percentage of Heat

100.00

%

Database Ref. No.

0

Fuel Type

Electricity

SAP Code

691

In Winter

100.00

In Summer

100.00

Controls SAP Code

2605

Delayed Start Stat

No

HETAS approved System

No

Oil Pump Inside

No

Fan Assisted Flue

No

Boiler Interlock

No

25.0 Main Heating 2

Database

Percentage of Heat

0.00

%

Database Ref. No.

190006

Fuel Type

Electricity

SAP Code

0

In Winter

0.00

In Summer

0.00

Model Name

EDL200UK-630

Manufacturer

GDC Group Ltd

Controls

2100

Delayed Start Stat

No

Burner Control

Modulating

HETAS approved System

No

Oil Pump Inside

No

FI Case

0.00

Flue Type

None or Unknown

Fan Assisted Flue

No

Flow Temperature

Enter value

Combi boiler type

Standard Combi

Combi keep hot type

None

26.0 Heat Networks

None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

28.0 Water Heating

Water Heating

Main Heating 2

SAP Code

914

Flue Gas Heat Recovery System

No

Waste Water Heat Recovery Instantaneous System 1

No

Waste Water Heat Recovery Instantaneous System 2

No

Waste Water Heat Recovery Storage System

No

Solar Panel

No

Summary for Input Data



Water use <= 125 litres/person/day

Yes

Summer Immersion

No

Cold Water Source

From mains

Bath Count

1

Supplementary Immersion

No

Immersion Only Heating Hot Water

No

28.1 Showers	Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1		Combi boiler or unvented hot water system	11.00		No	
Shower 2		Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder

Cylinder Stat

Yes

Cylinder In Heated Space

Yes

Independent Time Control

Yes

Insulation Type

Measured Loss

Cylinder Volume

201.00

L

Loss

1.61

kWh/day

Pipes insulation

Fully insulated primary pipework

In Airing Cupboard

No

31.0 Thermal Store

None

34.0 Small-scale Hydro

None

Electricity Generated

0.00

Apportioned

0.00

kWh/Year

Connected to dwelling's electricity meter

Yes

Electricity Generation

Annual

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Recommendations
Lower cost measures
None
Further measures to achieve even higher standards
None

Typical Commercial Unit

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shell and Core

Boddingtons_Baselen Be Lean and Be Clean

As designed

Date: Tue Jul 04 08:05:24 2023

Administrative information

Building Details

Address: Manchester , City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.19

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.19

BRUKL compliance module version: v6.1.e.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 920.07

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	3.41
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	3.21
Target primary energy rate (TPER), kWh _{pe} /m ² annum	36.28
Building primary energy rate (BPER), kWh _{pe} /m ² annum	34.43
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.15	0.15	00000001:Surf[9]
Floors	0.18	0.1	0.1	00000001:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	0000000F:Surf[17]
Windows** and roof windows	1.6	1.2	1.2	00000001:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	2.2	2.2	00000001:Surf[6]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -Calc = Calculated maximum individual element U-values [W/(m²K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- 000 Retail S+C System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.2	5.25	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- 001 DHW POU

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
00. Commercial 1		-	-	-	1.4	-	-	-	-	-	-	N/A
00. Commercial 2		-	-	-	1.4	-	-	-	-	-	-	N/A
00. Commercial 3		-	-	-	1.4	-	-	-	-	-	-	N/A
00. Residents Entrance		-	-	-	1.4	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
00. Commercial 1	YES
00. Commercial 2	YES
00. Commercial 3	YES
00. Residents Entrance	NO
00. Residents Entrance/Co Working Building B	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00. Commercial 1	120	120	1.25

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00. Commercial 2	120	120	1.25
00. Commercial 3	120	120	1.25
00. Residents Entrance	120	-	-
00. Residents Entrance/Co Working Building B	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00. Commercial 1	NO (-4.6%)	NO
00. Commercial 2	NO (-49%)	NO
00. Commercial 3	NO (-6.4%)	NO
00. Residents Entrance	NO (-84.6%)	NO
00. Residents Entrance/Co Working Building B	NO (-46.3%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m²]	920.1	920.1	82	Retail/Financial and Professional Services
External area [m²]	2017	2017		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	MAN	MAN	18	Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	590.82	686.53		Storage or Distribution
Average U-value [W/m²K]	0.29	0.34		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				Residential Institutions: Residential Schools
				Residential Institutions: Universities and Colleges
				Secure Residential Institutions
				Residential Spaces
				Non-residential Institutions: Community/Day Centre
				Non-residential Institutions: Libraries, Museums, and Galleries
				Non-residential Institutions: Education
				Non-residential Institutions: Primary Health Care Building
				Non-residential Institutions: Crown and County Courts
				General Assembly and Leisure, Night Clubs, and Theatres
				Others: Passenger Terminals
				Others: Emergency Services
				Others: Miscellaneous 24hr Activities
				Others: Car Parks 24 hrs
				Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.17	7.78
Cooling	2.49	1.41
Auxiliary	3.45	1.98
Lighting	7.69	11.34
Hot water	1.97	1.77
Equipment*	23.61	23.61
TOTAL**	22.78	24.29

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	110.43	101.34
Primary energy [kWh _{PE} /m²]	34.43	36.28
Total emissions [kg/m²]	3.21	3.41

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	77	33.4	7.2	2.5	3.5	2.98	3.73	3.2	5.25
	Notional	77.9	23.5	7.8	1.4	2	2.78	4.63	----	----

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shell and Core

Boddingtons_Be Green

As designed

Date: Tue Jul 04 08:15:23 2023

Administrative information

Building Details

Address: Manchester , City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.19

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.19

BRUKL compliance module version: v6.1.e.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 920.07

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²·annum	3.41
Building CO ₂ emission rate (BER), kgCO ₂ /m²·annum	0.51
Target primary energy rate (TPER), kWh _{pe} /m²·annum	36.28
Building primary energy rate (BPER), kWh _{pe} /m²·annum	3.27
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

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Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	0000000F:Surf[17]
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Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	2.2	2.2	00000001:Surf[6]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
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Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- 000 Retail S+C System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.2	5.25	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- 001 DHW POU

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
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E	Local balanced supply and extract ventilation units
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NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
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00. Commercial 2		-	-	-	1.4	-	-	-	-	-	-	N/A
00. Commercial 3		-	-	-	1.4	-	-	-	-	-	-	N/A
00. Residents Entrance		-	-	-	1.4	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
00. Commercial 1	YES
00. Commercial 2	YES
00. Commercial 3	YES
00. Residents Entrance	NO
00. Residents Entrance/Co Working Building B	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00. Commercial 1	120	120	1.25

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00. Commercial 2	120	120	1.25
00. Commercial 3	120	120	1.25
00. Residents Entrance	120	-	-
00. Residents Entrance/Co Working Building B	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00. Commercial 1	NO (-4.6%)	NO
00. Commercial 2	NO (-49%)	NO
00. Commercial 3	NO (-6.4%)	NO
00. Residents Entrance	NO (-84.6%)	NO
00. Residents Entrance/Co Working Building B	NO (-46.3%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m²]	920.1	920.1	82	Retail/Financial and Professional Services
External area [m²]	2017	2017		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	MAN	MAN	18	Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	590.82	686.53		Storage or Distribution
Average U-value [W/m²K]	0.29	0.34		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				Residential Institutions: Residential Schools
				Residential Institutions: Universities and Colleges
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				Non-residential Institutions: Crown and County Courts
				General Assembly and Leisure, Night Clubs, and Theatres
				Others: Passenger Terminals
				Others: Emergency Services
				Others: Miscellaneous 24hr Activities
				Others: Car Parks 24 hrs
				Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.21	7.78
Cooling	2.49	1.41
Auxiliary	3.45	1.98
Lighting	7.69	11.34
Hot water	1.97	1.77
Equipment*	23.61	23.61
TOTAL**	22.81	24.29

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	21.28	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>21.28</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	110.81	101.34
Primary energy [kWh _{PE} /m²]	3.27	36.28
Total emissions [kg/m²]	0.51	3.41

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	77.4	33.5	7.2	2.5	3.5	2.98	3.73	3.2	5.25
	Notional	77.9	23.5	7.8	1.4	2	2.78	4.63	----	----

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Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type



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