

NOMA 2 & 3 Angel Square

Energy Statement

2AS-BHE-XX-XX-RP-N-1000

0050930

30 May 2022

Revision P03

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date **6th June 2022**

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date **6th June 2022**

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Glossary

Term	Definition
AHU	Air Handling Unit
BER	Building Emission Rate
BRUKL	Building Regulations United Kingdom Part L
CHP	Combined Heat and Power
DPD	Development Plan Document
DHW	Domestic Hot Water
DX	Direct Expansion
EPC	Energy Performance Certificate
GIA	Gross Internal Area
GSHP	Ground Source Heat Pump
LZC	Low Zero Carbon
MCC	Manchester City Council
MVHR	Mechanical Ventilation Heat Recovery
NIA	Net Internal Area
O&M	Operation and Maintenance
PV	Photovoltaic
SBEM	Simplified Building Energy Model
TER	Target Emission Rate
VRF	Variable Refrigerant Flow

1 Executive Summary

This document outlines the energy strategy proposed for the NOMA 2 & 3 Angel Square commercial development in Manchester. It describes the route to achieving the client's energy and sustainability targets, as well as targets set out in Manchester City Council's (MCC) core strategy for electricity intense buildings. The statement sets out the energy and sustainability strategy for the proposed development, with the following target for each building:

- At least **10%** improvement on Building Regulations **Part L2A 2010** – equating to at least a **6%** improvement over Building Regulations **Part L2A 2013** – as per Policy EN6: Target Framework for CO2 reductions from low or zero carbon energy supplies

The results from Building Regulations Part L2A calculations for the proposed buildings demonstrated that the design strategy has the potential to reduce the regulated carbon emissions by **42.9%** for 2 Angel Square and **44.8%** for 3 Angel Square over Part L2A 2013 utilising Low and Zero Carbon (LZC) technologies and so are sufficient to meet the planning requirements. While these savings against Part L2A are likely to change as the design develops in RIBA Stage 3, this demonstrates that the scheme will easily meet the requirements set out in EN6.

Beyond the regulatory and planning requirements, there are aspirations for the development to achieve the following energy-focussed targets, which may be subject to change during design development:

- BREEAM 'Outstanding' rating
- EPC-A rating
- NABERS UK 5 Star rating

To achieve the targets, the MEAN, LEAN and GREEN approach has been followed, where:

- MEAN – passive design measures to reduce energy consumption and carbon emissions, via optimisation of the building's construction and fabric
- LEAN – active design measures to reduce energy consumption and carbon emissions, via use of energy efficient building systems
- GREEN – maximisation of opportunity for renewable energy by producing and using renewable energy on-site.

The following MEAN and LEAN energy efficiency strategies are proposed in the current design:

- Improving the proposed envelope thermal performance over the requirements of Part L
- Optimise the façade form to reduce unwanted solar gain whilst maximising the potential for daylight
- Designing the ventilation system to minimize fan energy
- Efficient heat recovery within the central ventilation system
- Efficient lighting and lighting controls
- Energy efficient fans and pumps
- Metering and monitoring provisions for all systems

The following GREEN energy generation strategy is proposed:

- Roof mounted PV to generate electricity for use in the building

Compliance with Part L2A 2021

Further to the MCC core strategy target, compliance with the new version of Part L2A 2021 will be required, which is expected to come into effect from 15th June 2022. However, as SBEM-accredited software which can demonstrate compliance with the new regulations has not yet been released, an energy model directly referencing Part L2A 2021 compliance criteria cannot currently be produced. It is therefore currently not physically possible to demonstrate compliance with the new Part L2A version.

It is widely regarded that compliance with Part L2A 2021 equates to a **30%** improvement over Part L2A 2013. Therefore, if a building can show **at least** this margin over Part L2A 2013 it can be assumed to be demonstrating compliance with Building Regulations Part L2A 2021.

The proposed development is aspiring to meet exemplary energy performance targets, such as a NABERS UK 5 Star rating and an EPC-A rating, which far exceed both the industry standard and the energy targets within the MCC core strategy target. The margins shown in the results of this report indicate that the proposed development will meet the conditions required to comply with Building Regulations Part L2A 2021.

Shell and core space compliance

Following the guidance of paragraph 2.34 of Approved Document L2A the developer should demonstrate that the building shell and core as offered for fit-out can meet the energy efficiency requirements. Utilising the same design philosophy and systems as the main building, it has been demonstrated that individual shell and core spaces can achieve Part L2A compliance under the most onerous “restaurant” typology.

2 Introduction

2.1 Overview

This report details the route to compliance with the 2013 edition of the Building Regulations Part L2A for the proposed NOMA 2 & 3 Angel Square commercial development. Compliance with Part L2A has been assessed using the Approved Document L2A for the proposed new building. Following the guidance within the Approved Document L2A the shell and core spaces on the building's ground floor have also been tested for compliance.

The aim of this assessment is to demonstrate that the proposed design solution achieves:

- Compliance with **MCC Core Planning Strategy** by achieving at least **10%** improvement on Building Regulations **Part L2A 2010** – equating to at least a **6%** improvement over Building Regulations **Part L2A 2013** – as per Policy EN6: Target Framework for CO2 reductions from low or zero carbon energy supplies.

2.2 Description of development

The application site comprises of Plots M and N of the NOMA Masterplan as defined in the NOMA Strategic Regeneration Framework Update 2020. The proposed development comprises the erection of two high quality commercial office buildings of 13 and 14 storeys, alongside public realm, car parking, extensive cycle parking facilities, and associated highways and access arrangements.

A breakdown of buildings' floor space is detailed below:

Table 2.1: NOMA 2 Angel Square

Level	Use	Area (GIA m ²)	Notes
Level 13/Roof	Plant Area	228	
Level 12	Open office, meeting rooms, and terrace	1,447	GIA inc. toilets, building plant & building core
Level 11	Open office & meeting rooms	1,944	GIA inc. toilets, building plant & building core
Level 10	Open office & meeting rooms	1,900	GIA inc. toilets, building plant & building core
Level 09	Open office & meeting rooms	1,900	GIA inc. toilets, building plant & building core
Level 08	Open office & meeting rooms	1,900	GIA inc. toilets, building plant & building core
Level 07	Open office & meeting rooms	1,856	GIA inc. toilets, building plant & building core
Level 06	Open office & meeting rooms	1,856	GIA inc. toilets, building plant & building core
Level 05	Open office & meeting rooms	1,856	GIA inc. toilets, building plant & building core
Level 04	Open office & meeting rooms	1,900	GIA inc. toilets, building plant & building core
Level 03	Open office & meeting rooms	1,900	GIA inc. toilets, building plant & building core
Level 02	Open office & meeting rooms	1,900	GIA inc. toilets, building plant & building core
Level 01	Open office & meeting rooms	1,944	GIA inc. toilets, building plant & building core
Upper Ground	Open office & meeting rooms	1,408	GIA inc. toilets, building plant & building core

	Commercial units		
Lower Ground	Entrance	1,855	GIA inc. Reception
	Carpark		
	Plant		
	Refuse		
	Changing & cycle store		GIA inc. Toilets, Showers, Changing Rooms
	Circulation		
Total		25,794	

Table 2.2: NOMA 3 Angel Square

Level	Use	Area (GIA m ²)	Notes
Level 12/Roof	Plant Area	252	
Level 11	Open office & meeting rooms, and	2,182	GIA inc. toilets, building plant & building core
Level 10	Open office & meeting rooms	2,414	GIA inc. toilets, building plant & building core
Level 09	Open office & meeting rooms	2,414	GIA inc. toilets, building plant & building core
Level 08	Open office & meeting rooms	2,414	GIA inc. toilets, building plant & building core
Level 07	Open office & meeting rooms	2,387	GIA inc. toilets, building plant & building core
Level 06	Open office & meeting rooms	2,387	GIA inc. toilets, building plant & building core
Level 05	Open office & meeting rooms	2,387	GIA inc. toilets, building plant & building core
Level 04	Open office & meeting rooms	2,414	GIA inc. toilets, building plant & building core
Level 03	Open office & meeting rooms	2,414	GIA inc. toilets, building plant & building core
Level 02	Open office & meeting rooms	2,414	GIA inc. toilets, building plant & building core
Level 01	Open office & meeting rooms	2,481	GIA inc. toilets, building plant & building core
Upper Ground	Open office & meeting rooms	1,769	GIA inc. toilets, building plant & building core
	Commercial Units		
Lower Ground	Entrance	2,423	GIA inc. Reception
	Carpark		
	Plant		
	Refuse		
	Changing & Bikes		GIA inc. Toilets, Showers, Changing Rooms
	Circulation		
Total		30,752	

2.3 Planning context

2.3.1 MCC Core Strategy Development Plan Document

It has been identified that to achieve planning consent the building is to comply with the guidelines set by the MCC described in the Manchester Core Strategy Development Plan Document (DPD). Energy performance requirements are stated under Policy EN6 Target Framework for CO2 reductions from low or zero carbon energy supplies.

The policy stipulates applications for developments over 1,000m² will be expected as a minimum to meet the target shown in the table below, unless this can be shown not to be viable. The proposed buildings fall into Target area 2 – Electrically intense buildings. Note that the policy document was approved and adopted before the Part L2A 2013 came into force. A 10% improvement over above the Part L2A 2010 may be equivalent to achieving 6% compliance with Part L2A 2013 standard, based on the government impact assessment study for the wider sectors.

Target area	Target % minimum improvement	Applicable to the project?
Target 1: Network development area	CHP/District heating anchor or connection Or where feasible, a 15% improvement on Part L2A 2010	No
Target 2 Electricity intense buildings (applies to commercial uses with a high proportion of emissions from electricity use.	10% improvement on Part L2A 2010 (6% improvement on Part L2A 2013)	Yes
Target 3 Micro generation area	15% improvement on Part L2A 2010	No

A target improvement of achieving Part L2A 2013 compliance set as required by the DPD. The proposed building shall achieve the commitment to 10% improvement on Part L2A 2010, as required by 'Target 2' above. A 10% improvement over above the Part L2A 2010 is widely regarded as equivalent to achieving 6% compliance with Part L2A 2013 standard, based on the government impact assessment study for the wider sectors.

2.3.2 Building Regulations 2021

Further to the DPD requirement, compliance with the new version of Part L2A 2021 is necessary, which is expected to be coming into effect from 15th June 2022. However, as SBEM-accredited software which can demonstrate compliance with the new regulations has not yet been released, an energy model directly referencing Part L2A 2021 compliance criteria cannot currently be produced. It is therefore currently not physically possible to demonstrate compliance with the new Part L2A version.

It is widely regarded that compliance with Part L2A 2021 equates to a **30%** improvement over Part L2A 2013. Therefore, if a building can show **at least** this margin over Part L2A 2013 it can be assumed to be demonstrating compliance with Building Regulations Part L2A 2021.

The proposed development is currently aspiring to meet exemplary energy performance targets, such as a NABERS UK 5 Star rating and an EPC-A rating, which far exceed both the industry standard and the energy targets within the MCC core strategy target. The margins shown in the results of this report indicate that the proposed development will meet the conditions required to comply with Building Regulations Part L2A 2021.

3 Energy Strategy

This section describes the steps taken for the proposed 4 Angel Square building design to achieve all set energy targets and contribute to the achievement of the Greater Manchester Combined Authority's 5-year Environment Plan in a meaningful way.

The following information describes the steps taken for the proposed design, based on three key principles:

1. A passive-first approach: Energy demand reduction has taken the highest priority.
2. Future-proofed development: An electric-led development with resilience to climate change
3. Maximising low and zero carbon technologies.

The following sections outline the detail of the energy strategy using the "Be Mean", "Be Lean", and "Be Green" philosophy: Where "Be Mean" incorporates demand reduction through passive measures and building fabric optimisation; "Be Lean" is the integration and specification of energy efficient systems and low carbon technology; and "Be Green" utilises renewable technology. This framework has been adopted as it ensures that passive design is prioritised to reduce the demand for energy in the first instance.

3.1 Passive Design approach

The strategy approach can be generally summarised as per the figure below.

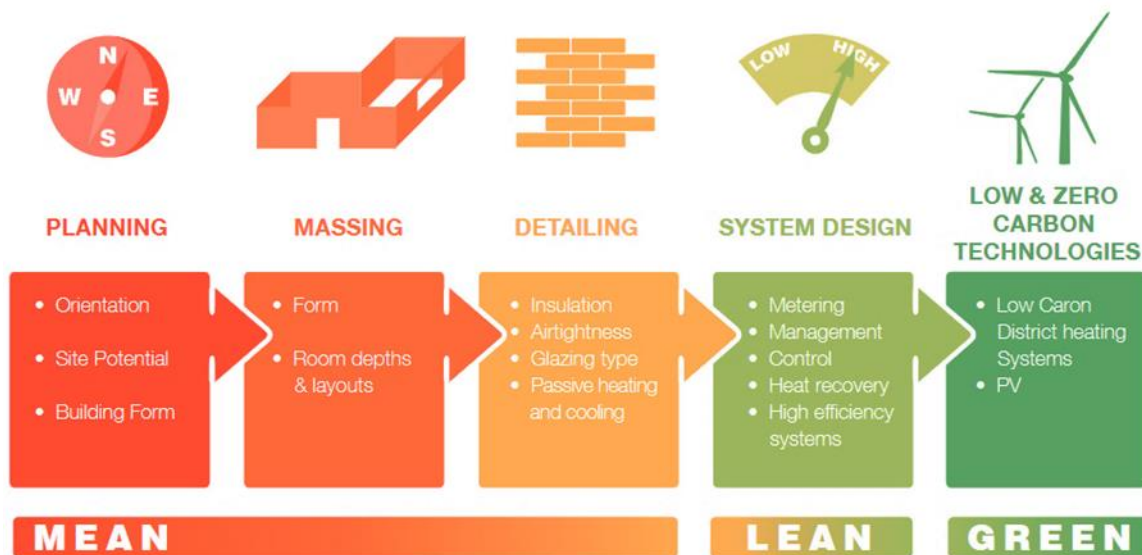


Figure 3-1 passive design approach

3.1.1 Passive Design Solutions (Mean)

The design intention is to reduce the building demand for natural resources by utilising passive design measures. This design approach has been applied when developing the building's structure and façade constructions.

The energy demand of the building can be reduced through optimisation of the building's construction and fabric, and through the implementation of the following passive design measures:

- **Building Fabric** – all externally exposed fabric will be insulated to achieve U-Values surpassing the mandatory standards required by Part L.
- **Optimised glazing area** – thermal analysis has been carried out to determine the glazing area on each elevation. For example, north-facing elevations have a higher glazing percentage than south-facing elevations.
- **High Performance Glazing** – high-quality double glazing will be present across the constructions, again achieving U-Values surpassing the mandatory standards required by Part L. Additionally, low-emissivity film could be applied to provide a reduction in solar gains which will reduce risk of overheating during summer months.
- **Improved Air Tightness** – it is proposed that the building's envelope airtightness will be designed to high standards, minimising unintentional inward or outward leakage, and therefore reducing potential for excess heat losses during the winter months.
- **Natural Daylight** – generous glazing areas have been applied to the building's occupied areas, to maximise available natural daylight and reduce the energy consumption of artificial light systems.
- **Zoning** - The control of the HVAC system will be thoughtfully zoned to allow different thermal and fresh air demands to be compartmentalised, permitting optimum flexibility and load balancing.

The performance of the building fabric in the current design can be found in Appendix A; these may be adjusted as the design develops during RIBA Stage 3.

3.1.2 Active Design Solutions (Lean)

Energy and carbon demand can be further reduced using energy efficient building services systems, such as:

- **Air Source Heat Pumps (ASHP)** – Specifically selected to meet project requirements, the plant generates heating and cooling at high efficiencies and ensures efficient delivery throughout the building distribution, minimising loss. This compliments the passive fabric strategy and further reducing building energy and fuel use.
- **Heat Recovery** - High efficiency heat recovery devices harness the energy within exhausted air and recirculate it back into the building to reduce heating and cooling loads.
- **Free Cooling** – by utilising chilled air delivery strategies in the offices and stage areas, there is a significant opportunity for free cooling when the external temperature is below the design condition temperatures.
- **Demand Controlled Ventilation** - Methods of controlling ventilation air flow may be utilised to respond to occupancy and internal temperature. These controls will be linked to the building management system and CO₂ and temperature sensors will be provided to occupied zones.
- **Energy Efficient Lighting** - LED lighting can incorporate automatic controls that respond to daylight and human presence to minimise the buildings electrical lighting load.

3.1.3 Renewable Energy (Green)

Once all options for passive and active systems have been exhausted, low and zero carbon (LZC) technologies may be considered to supply energy to the building.

- **PV Technology** – a PV array shall be installed at roof level of both stage areas, allowing green onsite energy production for the new building.

3.2 LZC Technology appraisal

A preliminary Low-zero carbon technology feasibility study has been produced. The following table provides a comparison of LZC technologies within the context of the proposed building. To allow the comparison of technologies to include less quantifiable issues such as visual impact, a “traffic light” matrix has been developed to highlight the key benefits and disadvantages of each technology.

Table 3—1 LZC comparison matrix

Category	Solar thermal	Solar PV	ASHP	CHP	Biomass	GSHP
Capital cost value	●	●	●	●	●	●
CO2 reduction potential	●	●	●	●	●	●
LZC energy contribution	●	●	●	●	●	●
Return on investment	●	●	●	●	●	●
Spatial Requirements	●	●	●	●	●	●
System integration	●	●	●	●	●	●
Planning and regulatory risk	●	●	●	●	●	●
Operation and maintenance	●	●	●	●	●	●

Key:

- Good performance within given category
- Average performance within given category
- Poor performance within given category

The desktop analysis in the Low Zero Carbon Technology Feasibility Study shows that the provision of solar PV would be the most applicable LZC technology for the proposed building. The other appraised LZC options have been ruled out for the following reasons:

- Biomass systems have characteristics which render the technologies unsuited for this project such as air quality concerns.
- Solar thermal systems come with high standing losses, which heavily offset the benefit of the systems.
- Biomass systems have characteristics which render the technologies unsuited for this project such as air quality concerns.
- Due to the height of the building, ground-source heat pumps are unable to meet the heating and cooling loads of the building and would have to be combined with air-source heat pumps; it is therefore more cost effective and better for embodied carbon to just use air-source heat pumps.
- The use of CHP would prove unfeasible as the proposed building is predicted to have a low and intermittent hot water demand.

4 Compliance Energy Modelling

Following the identification of targets and the best system solutions a Part L2A model has been created using approved software package IES VE 2021 by an experienced energy assessor. Part L2A results presented in this report are based on the latest architectural drawings sent by Cartwright Pickard on 30th April 2022. The assumptions for system and fabric performances used in the simulations model can be found in Appendix A. The proposed development comprises both 2 and 3 Angel Square.

In terms of Part L2A assessment methodology, testing compliance translates into comparing Actual and Notional building carbon emissions represented by calculated Building Emission Rating (BER) and Target Emission Rating (TER). To achieve minimum compliance, the BER for each building must be lower than its relevant TER.

4.1 Main building Part L2A modelling results

Following Approved Part L2A methodology and the design philosophy as detailed in the previous section, the two buildings were modelled.

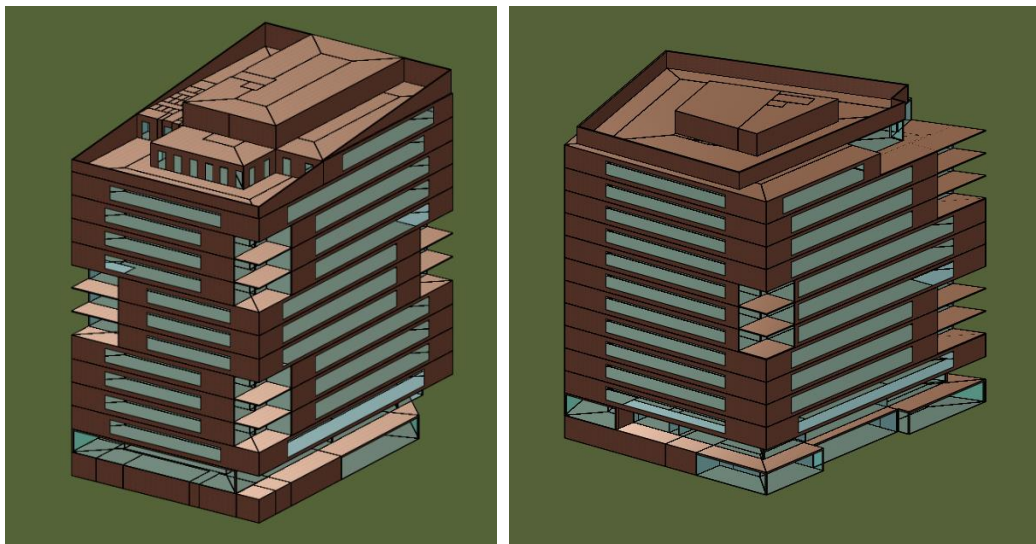


Figure 4-1 Part L2A model 3D views for 2 Angel Square (left) and 3 Angel Square (right).

The results of the Part L2A energy modelling can be found in the table below. As can be seen, for 2 Angel Square and 3 Angel Square, the proposed design solution exceeds the target emission rate.

Building	BER (kgCO ₂ /m ² /year)	TER (kgCO ₂ /m ² /year)	% Improvement
2 Angel Square	13.3	23.3	42.9%
3 Angel Square	12.8	23.2	44.8%

Note: The compliance margin may be subject to change following design development, for example changes in equipment efficiencies or revisions to building geometry and/or fabric.

4.2 BRUKL Report summary

4.2.1 2 Angel Square

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

2 Angel Square

As designed

Date: Mon May 16 14:32:59 2022

Administrative information

Building Details

Address: Manchester, M4 4AF

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: BuroHappold Engineering

Telephone number: Phone

Address: 2nd Floor Eastgate, 2 Castle Street, Castelfield, Manchester, M3 4LZ

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13.3
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.31	2.27	LG000002:Surf[6]
Floor	0.25	0.2	0.22	GF000002:Surf[5]
Roof	0.25	0.15	0.15	LW000027:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	PL000007:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	22802.8	22802.8		A1/A2 Retail/Financial and Professional services
External area [m ²]	15033.2	14763.3		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN	100	B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	8575.08	8290.41		B8 Storage or Distribution
Average U-value [W/m ² K]	0.57	0.56		C1 Hotels
Alpha value* [%]	10.15	10		C2 Residential Institutions: Hospitals and Care Homes
				C2 Residential Institutions: Residential schools
				C2 Residential Institutions: Universities and colleges
				C2A Secure Residential Institutions
				Residential spaces
				D1 Non-residential Institutions: Community/Day Centre
				D1 Non-residential Institutions: Libraries, Museums, and Galleries
				D1 Non-residential Institutions: Education
				D1 Non-residential Institutions: Primary Health Care Building
				D1 Non-residential Institutions: Crown and County Courts
				D2 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

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.38	1.28
Cooling	2.85	8.05
Auxiliary	9.27	11.4
Lighting	8.67	21.67
Hot water	5.58	4.6
Equipment*	42.71	42.71
TOTAL**	27.75	47

* 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	1.46	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	57.16	121.63
Primary energy* [kWh/m ²]	83.05	135.78
Total emissions [kg/m ²]	13.3	23.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

4.2.2 3 Angel Square

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2013

Project name

3 Angel Square

As designed

Date: Mon May 16 14:35:00 2022

Administrative information

Building Details

Address: Manchester, M4 4AF

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: BuroHappold Engineering

Telephone number: Phone

Address: 2nd Floor, Eastgate, 2 Castle Street, Castlefield, Manchester, M3 4LZ

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	12.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

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Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
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Floor	0.25	0.25	0.77	DM000001:Surf[0]
Roof	0.25	0.15	0.15	GF000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	GR000002:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	27144.5	27144.5		A1/A2 Retail/Financial and Professional services
External area [m ²]	15893	15956.6		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN	100	B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	10334.4	0		B8 Storage or Distribution
Average U-value [W/m ² K]	0.65	0		C1 Hotels
Alpha value* [%]	10.02	10		C2 Residential Institutions: Hospitals and Care Homes
				C2 Residential Institutions: Residential schools
				C2 Residential Institutions: Universities and colleges
				C2A Secure Residential Institutions
				Residential spaces
				D1 Non-residential Institutions: Community/Day Centre
				D1 Non-residential Institutions: Libraries, Museums, and Galleries
				D1 Non-residential Institutions: Education
				D1 Non-residential Institutions: Primary Health Care Building
				D1 Non-residential Institutions: Crown and County Courts
				D2 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

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.33	1.22
Cooling	4.84	7.98
Auxiliary	8.92	11.41
Lighting	8.6	21.66
Hot water	5.49	4.61
Equipment*	40.25	40.25
TOTAL**	29.18	46.89

* 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	3.74	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	82.5	120.12
Primary energy* [kWh/m ²]	87.33	135.32
Total emissions [kg/m ²]	12.8	23.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

4.3 Criterion 3 – Limiting Solar Gains in Summer

For each room that is either occupied or comfort cooled the solar gain through glazing should not exceed limits set by a reference room of the same shape. All occupied and comfort cooled rooms have achieved these requirements with an acceptable margin as indicated in the design stage BRUKL.

It should be noted that satisfying this criterion is NOT evidence that the internal climate of the building will be comfortable since factors such as internal gains and ventilation provision that will influence comfort are not tested by this criterion.

5 Designing for Performance

5.1 Closing the Performance Gap

MEPC and Federated Hermes have acknowledged that there is an inherent issue with handover of buildings from the project delivery team to the operational team. MEPC are working on improving the handover process by incorporating several measures including engaging the operational teams in the design and construction process.

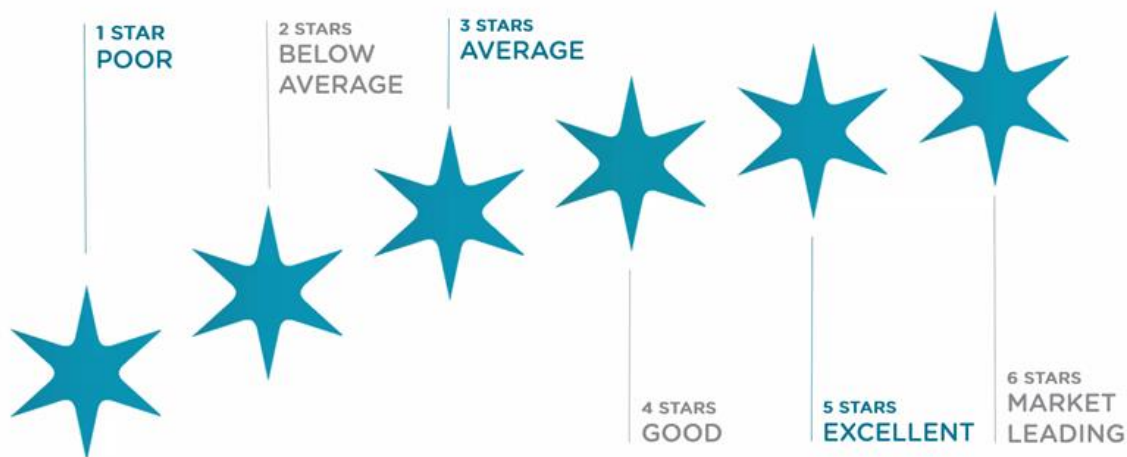
MEPC understand that while it is important that buildings are designed and constructed to minimise energy use, it's also fundamental that buildings are managed effectively. Poorly managing buildings is one of the leading causes of excessive energy use and a significant element of the 'performance gap'.

Practical steps which can be taken to deliver results from improved management behaviours include:

- **Visibility:** performance is measured, managed, and seen so that the impact of any action can be observed and rewarded where appropriate. This can be achieved through good data gathering, analysis and presentation.
- **Continuous review:** one-off campaigns are only likely to have a limited period of approximately three months before behaviours revert to their previous norms.
- **Balancing occupant control:** Whilst occupant satisfaction is improved with a level of control, the impact on efficiency can be limited by placing bounds on these controls whilst maintaining the benefits associated with them.

5.2 NABERS UK

NABERS UK is rating system where buildings are assessed on their actual energy use in operation. Buildings are awarded between 1 and 6 stars; the lower the energy use, the more stars are awarded. Multi-tenanted buildings are rated based on landlord energy use, which excludes tenant lighting and tenant electrical equipment.

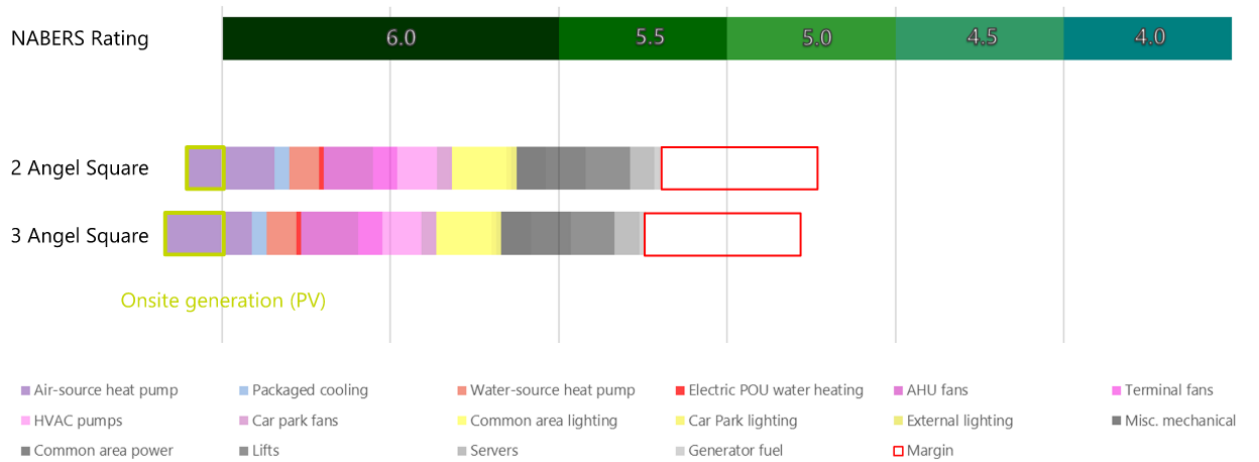


5.3 Design for Performance

The Design for Performance (DfP) initiative is an industry funded and backed project established to tackle the 'performance gap' and provide an approach, based on measurable performance outcomes, to ensure new office developments deliver on their design intent.

5.4 Estimated Performance at RIBA Stage 2

A performance energy model has been carried out based on the design at the end of RIBA Stage 2; the chart below illustrates the expected energy breakdown, and highlights that each building is expected to be capable of achieving a 5-star rating under NABERS UK, with potential to stretch to a 5.5-star rating.



6 Summary

Based on the measures and modelling results detailed in this report, it is anticipated that the development, as proposed, will achieve energy performance requirements as stated within the MCC Core Planning Strategy Policy EN6, that is:

- Compliance with MCC Core Planning Strategy by achieving at least 10% improvement on Building Regulations Part L2A 2010 – equating to at least a 6% improvement over Building Regulations Part L2A 2013

To achieve the targets, the following MEAN and LEAN energy efficiency strategies are proposed in the design including:

- Improving the proposed envelope thermal performance over the requirements of Part L
- Optimise the façade form to reduce unwanted solar gain whilst maximising the potential for daylight
- Efficient heat recovery within the central ventilation system
- Utilisation of highly efficient integral heat pumps to temper air supply from air handling units (AHUs)
- Efficient lighting and lighting controls
- Energy efficient fans and pumps
- Metering and monitoring provisions for all systems

The following GREEN energy generation strategy is proposed:

- Roof mounted PV to generate electricity for use in the building

As the detailed design is developed the elements in the above strategy will be fine-tuned such that the final as-constructed building achieves the targets set.

Risks to compliance

Achieving the identified energy targets will be subject to carefully implementing design parameters and considerations detailed in Appendix A of this report. This design achieves a good compliance margin, so meeting Building regulation targets is not deemed to be a risk at this stage in the design. The following features have been identified as having a large impact on building energy performance so compromising any of them may result in lower Part L2A compliance margin.

- Compromising achieving cooling and heating seasonal efficiencies.
- Compromised ventilation controls.
- Compromised water pumping type.
- Compromised DHW design.
- Compromising achieving the efficient lighting design, daylight, and occupancy sensing controls.
- Poor building air permeability performance.
- Failure to provide effective internal shading for office spaces.
- Compromised fabric or glazing U-values.

Risk Mitigation

To prevent further design development affecting the proposed energy targets and operational performance of the completed building, the following measures are proposed:

- Rational and intelligent approach to finance and building element procurement. Identified performance and efficiency targets should drive system and fabric selection.
- Careful monitoring of on-construction works to ensure highest quality craftsmanship and compliance with all relevant standards and regulations. Special care should be taken when installing external openings as a poorly sealed façade will have a detrimental effect on system operation and occupant wellbeing.
- Mechanical Electrical and Plumbing system commissioning undertaken before handover. Testing and adjusting is undertaken to ensure that the whole system uses no more fuel and power than is reasonable in the circumstances and demonstrate all performance and regulation requirements are met.

A detailed Operation & Maintenance (O&M) Manual should be handed over to the Client on building completion. The O&M Manual should include a detailed description of works; Details of each system such as its location, model number, all relevant manufacturers' operation and maintenance information. The O&M should lay down a maintenance schedule for all installed systems throughout the building, with references to the manufacturers' information where appropriate.

Appendix A Part L2A Modelling Assumptions

This section describes the inputs to the energy models at the end of RIBA Stage 2; these inputs will be subject to adjustment during RIBA Stage 3.

A.1 Part L2A Modelling Assumptions

Building fabric standards

The tables below summarise the minimum building fabric standards that has resulted in a building regulations Part L2A compliant building.

Table 6-1 building fabric U-values.

Building Fabric	Units	Proposed building	Notes
U-values			
External wall	W/m²K	0.15	Applies to all opaque wall constructions
Ground floor	W/m²K	0.15	
Roof	W/m²K	0.15	
External glazing including glazed doors	W/m²K	1.4	
Glazing properties			
Glazing	g value	0.4	
	Light T	0.71	
Air permeability and cold bridging			
Air permeability	m³/hr/m² @ 50pa	3.0	
Thermal bridging coefficient	W/m²K	Varied	'Default' thermal bridging coefficients have been applied to all construction and opening types.
Light T = Light transmittance, g value = solar transmittance			

Room activity definition

Room activities have been set based on the planning class B1: Office or Workshop (Office).

HVAC system definition

HVAC systems have been applied to the building and are detailed in the following tables.

Table 6-2 heating and cooling system standards

Heating and cooling	Unit	Office FCUs	Wet radiators	DX
NCM system		Fan coil systems	Central heating using water: radiators	Split or multi split system
Serving		All office areas, entrance lobbies	WCs, showers, circulation	Comms room
Heating				
Fuel		Electricity		
Generator		Heat pump (electric): Air source	Heat pump (electric): Air source	Heat pump (electric): Air source
Emitter		Fan coil unit	Radiator	Fan coil unit
Seasonal Efficiency	SCOP	4.5	4.5	2.5
Cooling				
Fuel		Electricity		
Generator		Heat pump (electric): Air source	N/A	Heat pump (electric)
Emitter		Fan coil unit	N/A	Fan coil unit
Seasonal Efficiency	SEER	4.5	N/A	4
Pumping type		Variable speed, multiple pressure sensors	N/A	Variable speed, multiple pressure sensors

Table 6-3 DHW system standards

DHW	Unit	Instantaneous local heater	Central heating
Serving		All other spaces, including WCs and office kitchens	Showers
Fuel		Electric	
Generator		Instantaneous Local Heater	Heat pump (electric): air source
Delivery Efficiency	%	100	N/A
Seasonal Efficiency	SCOP	N/A	2
Total Cylinder Volume (calorifiers)	Litres	N/A	N/A
Cylinder Loss	kWh/l/day	N/A	N/A

Table 6-4 ventilation system standards

Ventilation	Units	Variable Air Volume (VAV)	Mechanical Ventilation with Heat Recovery
Serving		All office floor areas	WCs, showers, ancillary areas
Extract air volume	Air change per hour	6 (Toilets/Shower) 3 (Storage)	N.A.
AHU total SFP	W/l/s	1.3 (floor-by-floor AHUs) 1.5 (rooftop AHUs)	N/A
Terminal unit SFP	W/l/s	0.25	N/A
AHU leakage classification	-	Class L2	N/A
Duct leakage classification	-	Class A	N/A
Heat recovery efficiency	%	75	75
Ventilation volume control	N.A.	VAV boxes respond to CO2 level within occupied zone.	Motor speed responds to room CO2 level

Electrical services

The following tables summarise electrical system standards assumed for the compliance calculations.

Table 6-5 lighting standards

Zone	NCM Lighting lux level	Lighting efficacy (lm/W)	Lighting control	Lighting control parasitic power (W/m2)
Kitchen, kitchenettes	500	130	Absence detection / Daylight dimming	0.1
Open plan office areas, meeting rooms, training areas, IT	400	130	Absence detection / Daylight dimming	0.1
Workshops	300	130	Absence detection / Daylight dimming	0.1
Reception, entrance lobbies, WCs, plant rooms, showers	200	130	Absence detection / Daylight dimming	0.1
Cafés, WC lobbies	150	130	Absence detection / Daylight dimming	0.1
Changing rooms, first aid room, circulation	100	130	Absence detection / Daylight dimming	0.1
Stores	50	130	Absence detection / Daylight dimming	0.1
1W connected load per occupancy sensor/ daylight dimming control gear as parasitic power				

Table 6-6 metering, emission factor, and power factor correction

Sub-meter	Provision	Comments
Sub-metering	Automatic monitoring and targeting software with alarms for out-of-range values to include a complete installation that measures, records, transmits, analyses, reports, and communicates meaningful energy management information from all building energy meters and sub-meters to enable the building operator to manage the energy the building uses.	Building Energy Monitoring and Targeting Software must be installed
Heating	Meter electric supply to primary plant	
HVAC	Meter all MCC Panels	
Cooling	Meter electrical supply to primary plant	
Lighting	Metering on a distribution board by distribution board basis	
Small Power	Metering on a distribution board by distribution board basis	
Power Factor Correction	Above 0.95	Power factor monitoring equipment must be installed. Should the stated power factor not be achieved power factor equipment must be installed.

Table 6-7 PV data

LZC Technology	Units	Requirement
2 Angel Square PV collector area	m ²	200
3 Angel Square PV collector area	m ²	610
Shading factor		1
		Installed at a 10-degree pitch facing 180 degrees clockwise from north
		Inverter efficiency 96%
		Module nominal efficiency 20%

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