

BACK TURNER STREET, MANCHESTER

Energy, Environmental Standards
Statement and Ventilation Statement
Ref: P712-ES-001 Rev E

NOVO

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AMENDMENT HISTORY



REVISION	DESCRIPTION	DATE	AUTHOR	CHECKED
A	Initial Issue	Sep 2018	P. Arnold	B. Duckworth
B	Amended due to design changes	Jan 2019	P. Arnold	B. Duckworth
C	Comments Incorporated	Jan 2019	P. Arnold	B. Duckworth
D	Amended due to design changes	Mar 2020	M. Loughlin	B. Duckworth
E	As Built Confirmation	Jan 2023	M. Loughlin	B. Duckworth

1	EXECUTIVE SUMMARY	4
2	INTRODUCTION.....	7
2.1	PURPOSE.....	7
2.2	BACKGROUND POLICY DOCUMENTS	7
2.3	SITE DESCRIPTION	8
2.4	PLANNING POLICY	10
2.5	BUILDING REGULATIONS.....	12
2.6	THE ENERGY HIERARCHY.....	14
3	DESIGN PARAMETERS	16
3.1	ARCHITECTURAL DRAWINGS BY JMA ARCHITECTS	16
3.2	CONSTRUCTION ELEMENTS.....	16
3.3	ENVIRONMENTAL CRITERIA.....	16
4	ENERGY STRATEGY	17
4.1	BUILDING ENVELOPE & FABRIC.....	17
4.2	HEATING DEMAND	17
4.3	HOT WATER DEMAND.....	18
4.4	VENTILATION.....	18
4.5	LIGHTING	18
4.6	CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS.....	18
4.7	DECENTRALISED ENERGY NETWORK	19
4.8	WIND TURBINES.....	20
4.9	PHOTOVOLTAIC CELLS (PV).....	21
4.10	VRF AIR SOURCE HEATING AND COOLING	21
4.11	BIOMASS BOILER.....	21
4.12	FUEL CELL	22
4.13	ENVIRONMENTAL STANDARDS.....	22
4.14	ENERGY EFFICIENCY.....	23
4.15	RENEWABLE ENERGY.....	23
4.16	ENERGY EFFICIENT DESIGN.....	24
4.17	ENERGY EFFICIENT DESIGN WITH GREEN TECHNOLOGY	24
4.18	WATER MANAGEMENT AND WEATHER RESILIENCE	25
4.19	WASTE MANAGEMENT.....	25
4.20	CONSTRUCTION MANAGEMENT	26
4.21	BIODIVERSITY.....	26
4.22	WATERWAYS.....	26
5	CONCLUSION	27
5.1	Results.....	27
6	APPENDICES	28

Appendix A – BRUKL

1 EXECUTIVE SUMMARY

The design of the proposed development of land at Back Turner Street, Manchester, located in an urban area of the city, has incorporated building fabric enhancement to increase the energy efficiency of the building.

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

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

The methodology for this report is to take a 'fabric first' approach as set out in Policy EN6 of Manchester City Councils Core Strategy, making improvements to the envelope first, reviewing the results due to these fabric improvements and then reviewing suitable technologies to enhance this design philosophy where feasible. The calculations have been calculated using current Building Regulations Part L2a 2013.

The proposed fabric specification is described in the table below:

Table 1 Building Fabric Specification

Proposed Building Fabric		
Element	L2A: 2013 Limiting U-values (W/m ² .k)	Proposed U-values (W/m ² .k)
Floors	0.25	0.15
External Walls	0.35	0.24
Curtain Walls	2.00	0.9 / 0.55
Roof	0.25	0.15
Windows	2.20	1.30
Doors	2.20	2.20
Air permeability (m ² /h.m ² @ 50 pa)		
All buildings	10.0	3.0

The fabric improvements alone would provide a 9.14% CO₂ reduction (BER/TER) against current Building Regulations for the entire aspect of the development. This equates to 15.14% reduction in CO₂ over Building Regulations 2010.

The report demonstrates that the development adheres fully with the requirements of Policy EN6 and associated paragraphs within the Manchester Core Strategy.

It has also been demonstrated that the ventilation strategy for the building will aid with the achievement of the CO₂ target and comply with Part F of Building Regulations.

The report also demonstrates that the Environmental Standards that Manchester employ for developers will be taken account of under the full construction package and significant mindfulness of these issued is carried throughout the full design process.

An electric air source heating system provides quiet, and non-direct polluting system which is considered to be the most complimentary to the site.

All Environmental Standards have been addressed accordingly, and a mindfulness to a sustainable and environmentally friendly design has been carried through to all aspects of the proposed development.

1.1 AS BUILT STATEMENT

Revision D of this report at planning had a Part L BRUKL that had a Building Emission Rate (BER) of 16.9 against a Target Emission Rate (TER) of 18.6 as can be seen below

Figure 1 Extract of Design Stage BRUKL

BRUKL Output Document  HM Government
 Compliance with England Building Regulations Part L 2013

Project name

P712 Back Turner Street
As designed

Date: Tue Feb 18 16:00:33 2020

Administrative information

Building Details
 Address: Back Turner Street, Manchester, Postcode

Owner Details
 Name: Name
 Telephone number: Phone
 Address: Street Address, City, Postcode

Certification tool
 Calculation engine: Apache
 Calculation engine version: 7.0.12
 Interface to calculation engine: IES Virtual Environment
 Interface to calculation engine version: 7.0.12
 BRUKL compliance check version: v5.6.a.1

Certifier details
 Name: Ben Duckworth
 Telephone number: 01132577300
 Address: Novo Integration, Oxford House, Oxford Road, Leeds, LS20 9AA

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	18.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	18.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	16.9
Are emissions from the building less than or equal to the target?	BER <= TER
Are as built details the same as used in the BER calculations?	Separate submission

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	0.24	0.24	TR000003:Surf[2]
Floor	0.25	0.15	0.15	TR000003:Surf[0]
Roof	0.25	0.18	0.18	0200000E:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	TR000003:Surf[1]
Personnel doors	2.2	2.2	2.2	TR00000D:Surf[5]
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/(m²K)]
 U_a Calc = Calculated area-weighted average U-values [W/(m²K)]
 U_i Calc = Calculated maximum individual element U-values [W/(m²K)]
 * 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

1 EXECUTIVE SUMMARY



The final as built BRUKL, taking into consideration all items such as final fabric, air conditioning plant, final air test.

As can be seen with the changes the BER has reduced to 11.7 against a TER of 16.4 This is now a reduction of 29% in emission rate, against a design stage of 10%.

This therefore meets MCC requirements and is a 19% improvement on the design stage.

Figure 2 Extract of As Built BRUKL – See Appendix B for full report.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

P712 Back Turner Street As-Built

As built

Date: Tue Jan 24 16:42:32 2023

Administrative information

Building Details

Address: Glassworks House, 32 Shudehill, Manchester, M4 1EZ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.17

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.17

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

Certifier details

Name: Ben Duckworth

Telephone number: 01132577300

Address: 7 Feast Field, Horsforth, West Yorkshire, Leeds, LS18 4TJ

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	16.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	16.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.7
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	0.24	0.24	TR000005:Surf[1]
Floor	0.25	0.15	0.15	TR000005:Surf[0]
Roof	0.25	0.18	0.18	01000029:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	00000004:Surf[6]
Personnel doors	2.2	2.2	2.2	00000004:Surf[5]
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/(m²K)]

U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]

U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* 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	2.97

Page 1 of 11

2 INTRODUCTION

2.1 PURPOSE

NOVO Integration Ltd has been appointed as energy consultants to produce an energy, environmental and ventilation statement for the development located on Back Turner Street, Manchester, located in close proximity to the Manchester Arndale Centre and the Northern Quarter of the city. Comprising of the re-use of the existing building and associated elements and the construction of the new 16 storey tower block and smaller 5 story block located either side of the existing building.

This is to support the scheme design process, demonstrate Building Regulations Part L compliance, included details with regards the ventilation strategy for the entirety of the development and to achieve the applicable planning policies set out in the Local Authority of Manchester City Council Adopted Core Strategy Development Plan Document.

This report will outline the following:

1. Assess the proposed development site's estimated CO₂ emissions, it will look into the feasibility of Low Zero Carbon technologies, examining the following aspects relative to LZC/renewable technologies:
 - Energy generated by Renewable/Low Zero Carbon Technologies (LZC)
 - Feasibility assessment for each Renewable/Low Zero Carbon Technologies (LZC)
 - Local Planning Requirements
2. The proposed building fabric and Low Zero Carbon (LZC) design strategy and analysis calculations, with respect to the Part L2A BRUKL analysis provides demonstration of how the design is compliant against the current 2013 Part L2A buildings regulations.
3. Assess the viability of compliance against Manchester's Core Strategy Environmental Standards as far as remit allows.
4. To provide relevant detail with regards the ventilation strategy for the development in order to confirm compliance viability with Part F of Building Regulations.
5. To provide a summary to the Environmental Standards and how the development will address these issues.

2.2 BACKGROUND POLICY DOCUMENTS

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

- The Kyoto Protocol at the United Nations
- Framework Convention on Climate Change as negotiated in December 1997 has come into effect on 16 February 2005 following the ratification of the agreement by Russia on 18 November 2004. The Burden Sharing Agreement of the EU mandates a 12.5% reduction in greenhouse gas emissions for the UK by 2008 - 12
- The Department of Transport and Industry White Paper, titled "Our Energy Future - Creating a Low Carbon Economy", spells out a target for 10% of electricity to be from renewable sources nationally by 2010 and twice this by 2020

- National Policy Objectives in regard to renewable energy Planning Policy Statement 22: Renewable energy guidance for local governing bodies concerning implementation of renewable energy technologies through appropriate planning
- The United Kingdom has made commitments that extend beyond this requirement. National Targets are for a reduction to 20% below 1990 CO₂ levels by 2010 and a 60% reduction by 2050
- Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, September 2004
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new buildings other than dwellings
- The Building Regulations 2013 – Approved Document F – Ventilation Means
- National Planning Policy Framework (July 2018)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. Particularly section 2 which states:

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

- a) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure.*
 - b) **A social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and*
 - c) **An environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting climate change, including moving to a low carbon economy.*
- Adopted Core Strategy Manchester Local Development Framework July 2012
 - Guide to Development in Manchester Supplementary Planning Document and Planning Guidance Adopted April 2007.

2.3 SITE DESCRIPTION

The development site is located within the centre of Manchester, on Back Turner Street, close to the Norther Quarter area of the city within close proximity to the Manchester Arndale Centre. The site currently stands as mainly a derelict building and the proposed development seeks to reclaim this land for commercial purposes.

The area surrounding the site is predominately urban commercial in its use, made up of mainly office buildings, shops, educational buildings and bars. There is also a significant amount of residential buildings, mainly apartments that surround the site in all aspects.

The new commercial development being proposed is in keeping of the with the surrounding uses. Please see the aerial view in figure (1).

Figure 3 Ariel View (indicative only)



The proposed development consists of 12 No open plan offices, with an additional 4 No open plan offices that are to be refurbished as part of the retention of the existing structure and will fall under Building Regulations Part L2A.

The ground floor areas consist of a reception area, café, changing room, refuse store, retail unit and plant room spaces.

The development is essentially split into three blocks, one tower block containing open plan offices utilising a curtain walling system and one new block connecting to a smaller existing building which also contains open plan offices and WC facilities.

The smaller block has a reduced amount of glazing when compared to the tower.

Figure 4 Site Location Plan



2.4 PLANNING POLICY

2.4.1 Local Policy

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

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

Policy EN 4:

Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development

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

- *All developments must follow the principle of the Energy*
- *Hierarchy, being designed to reduce the need for energy through design features that provide passive heating, natural lighting and cooling*
- *To reduce the need for energy through energy efficient features such as improved insulation and glazing*
- *To meet residual energy requirements through the use of low or zero carbon energy generating technologies*
- *Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies*
- *Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings*
- *Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes*

The policy relating to energy and sustainability that must be addressed for this particular development is Policy EN6: Target Framework for CO₂ reductions from low or zero carbon energy supplies.

Policy EN6

Target Framework for CO₂ reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

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

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

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

Policy EN 8:

Adaptation to Climate Change

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

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

Domestic CO₂ emission targets

Table 12.1

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

Non-domestic CO₂ emissions reduction targets

Table 12.2

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

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

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

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

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

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

2013 Part L2A Building Regulations is widely recognised within the industry as being 6% better than 2010. Meaning that it is already more onerous to achieve just a Building Regulations pass.

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

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

2.5 BUILDING REGULATIONS

2.5.1 Part L2A

Approved document L2A (2013)– Conservation of fuel and Power sets the standard for carbon emissions for new buildings other than dwellings. Buildings will need to comply with the criteria set out in the document, as follows:

In order to demonstrate compliance with the requirements for Approved Document L2A (2013) there are five separate criteria that must be met.

The following briefly outlines each of the five criteria:

(i) Criterion 1 - Achieving the Buildings Emission Rate (BER)

To demonstrate compliance with Criterion 1 the actual buildings emission rate is compared to the national buildings emission rate and has to be at least equal.

The actual buildings emission rate is calculated when the building is modelled using approved software and the proposed construction values are detailed, for example, u-values, efficiency of M&E plant, etc. following this exercise the software will generate a notional building, the notional building has the same layout as the actual building but the construction values and energy performance of the M&E equipment is pre-set, this allows the software to generate a target emission rate (TER) for the actual building, the TER is the anticipated emission rate from the notional building.

The BER is then compared to the TER and if it is equal to or lower than then the building is deemed to comply with Criterion 1.

This process needs to be completed and issued to Building Control at the “As-Designed” Stage to demonstrate to Building Control that the proposals for the building comply with the criteria.

(ii) Criterion 2 - Limits on Design Flexibility

Each element of the construction has pre-set performance limits within the document; these are generally split into 2 categories, an average value and an upper limit value which cannot be exceeded.

To demonstrate compliance with criterion 2 then criterion 1 must be achieved with no individual element exceeding the upper limit set for performance.

(iii) Criterion 3 - Limiting the Effects of Solar Gains in Summer

It is a requirement to demonstrate that solar gains have been limited during the summer period to either reduce the need for air conditioning; or to reduce the installed capacity of any air conditioning system that is installed.

To demonstrate compliance with criterion 3 an assessment of the solar gains must be undertaken, the actual building results are then compared to a pre-defined standard and if the performance of the actual building is no worse than that of the pre-defined building then it is deemed to comply with the criterion.

(iv) Criterion 4 – Building Performance Consistent with BER

The process for demonstrating compliance with criterion 4 is generally the same as criterion 1, the difference is that the actual building performance is compared to the notional building, for example, the air permeability results, building services commissioning figures, achieved construction u-values are used rather than the design assumptions.

It then must be demonstrated that the actual building performance is equal to or better than the TER.

Notice should be given that commissioning has been carried out according to a procedure approved by the Secretary of State.

(v) Criterion 5 – Provisions for Energy-Efficient Operation of the Building

The owner of the building should be provided with sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

This is generally achieved by production of a building logbook.

2.5.2 Part F Ventilation

Building Regulations Part F 2013 states that all newly constructed buildings other than dwellings are required to comply with the following criteria:-

- Criterion 1 – Extract ventilation to outside is required in all office sanitary accommodation, washrooms and food and beverage preparation areas. In addition, printers and photocopiers in substantial use (greater than 30 minutes per hour) should be located in a separate room (to avoid any pollutants entering the occupied space) and extract provision installed. The extract flow rates should be no less than those specified in the extracted (table 6.1a)

- Criterion 2 – The whole building ventilation rate for the supply of air to the offices shall be no less than specified in the extracted (table 6.1a)
- Criterion 3 – Purge ventilation provision is required in each office. The total ventilation should be efficient to reduce pollutants to an acceptable level before the space is occupied. The purged air should be taken directly to outside and should not be re-circulated to any other part of the building.

Figure 3: Ventilation Rates

Table 6.1a Extract ventilation rates	
Room	Extract rate
Rooms containing printers and photocopiers in substantial use (greater than 30 minutes per hour)	Air extract rate of 20 l/s per machine during use. Note that, if the operators are in the room continuously, use the greater of the extract and whole building ventilation rates
Office sanitary accommodation and washrooms	Intermittent air extract rate of: 15 l/s per shower/bath 6 l/s per WC/urinal
Food and beverage preparation areas (not commercial kitchens)	Intermittent air extract rate of: 15 l/s with microwave and beverages only 30 l/s adjacent to the hob with cooker(s) 60 l/s elsewhere with cooker(s) All to operate while food and beverage preparation is in progress
Specialist buildings/spaces (e.g. commercial kitchens, sports centres)	See Table 6.3

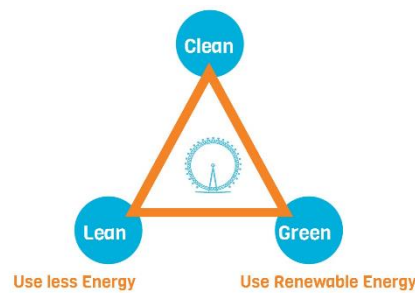
Table 6.1b Whole building ventilation rate for air supply to offices	
	Air supply rate
Total outdoor air supply rate for offices (no smoking and no significant pollutant sources)	10 l/s per person

It is proposed that the ventilation strategy for each office will satisfy these requirements. The exact specification will be determined at detailed design stage.

2.6 THE ENERGY HIERARCHY

The Carbon Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The following hierarchy should be used to assess applications:

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



The development Carbon strategy has adopted the following design ethos:

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

It is stated within the Manchester Core Strategies policies that the Energy Hierarchy is to be utilised with the energy strategy to form the basis of the methodology. In essence ensuring a 'Fabric First' approach is adopted.

This approach reduces heat losses and energy demand initially by ensuring the dwellings in question are thermally efficient and reduce heat losses.

3 DESIGN PARAMETERS

3.1 ARCHITECTURAL DRAWINGS BY JMA ARCHITECTS

Table 2 Architects Drawing Schedule

Drawing Number	Drawing Contents
05593_B1_02_2200_SK001	Proposed Ground Floor Plan
05593_B1_02_2201_SK001	Proposed First to Fourth Floor Plan
05593_B1_02_2205_SK001	Proposed Fifth Floor Plan
05593_B1_02_2206_SK010	Proposed Sixth to Sixteenth Floor Plan
05593_B1_04_2200	Proposed Elevations
05593_B1_04_2201	Proposed Elevations
05593_B1_04_2203	Proposed Elevations
05593_MP_00_0003	Proposed Site Plan

3.2 CONSTRUCTION ELEMENTS

Table 3 Baseline Building Fabric

Element	Part L2A: 2013 Limiting u-values (W/m ² .k)	Part L2A: 2013 Notional u-values (W/m ² .k)
Floors	0.25	0.22
External Walls	0.35	0.26
Roof	0.25	0.18
Windows	2.20	1.60
Doors	2.20	0.00
Air permeability (m ³ /h.m ² @ 50 pa)		
All buildings	10.0	3.0

3.3 ENVIRONMENTAL CRITERIA

As the Part L2A of the Building Regulations (2013) require, the environmental criteria of the occupied spaces have been set to the National Calculation Method Standards for the Energy Study.

4 ENERGY STRATEGY

4.1 BUILDING ENVELOPE & FABRIC

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

The table also details the enhanced air permeability that shall be targeted to assist the energy efficiency of the project.

Table 4 Proposed Building Fabric Specification

Proposed Building Fabric			
Element	L1A: 2013 Limiting U-values (W/m ² .k)	L1A: 2013 Notional U-values (W/m ² .k)	Proposed U-values (W/m ² .k)
Floors	0.25	0.22	0.15
External Walls	0.35	0.26	0.24
Roof	0.25	0.18	0.15
Windows	2.20	1.60	1.3
Doors	3.5	0.00	2.2
Air permeability (m ² /h.m ² @ 50 pa)			
All buildings	10.0	3.0	3.0

4.2 HEATING DEMAND

The heating energy demand will be reduced by providing good insulation of the building envelope in order to minimise heat losses.

An all-electric solution has been suggested in this instance, a VRF system utilising electric air source heat pumps to provide both heating and cooling is proposed for all office spaces.

This offers reduced heat loss through any centralised systems e.g. pipe / ductwork. This also reduces the amount of plant that will be required to service this aspect of the building.

This approach is a highly efficient heating and cooling system, reducing the CO₂ emissions and adding to the fabric first solution.

At the moment the carbon factor provided for an all electrical system is significantly greater than one that utilises gas. It has been announced by the BRE that the intention is to lower the carbon factor by over 50% of what in currently stands to bring this in line with gas.

This is due the lesser reliance on fossil fuels by the grid for electrical generation. This change enhances the merits of utilising an all-electric system, it is believed that this strategy is a more efficient and cost-effective way of providing heating and hot water for significant developments such as this. It is quite simply reducing the reliance on fossil fuels.

4.3 HOT WATER DEMAND

The hot water demand will be met through the use of high efficiency instantaneous hot water under basin units for the areas which require hot water provisions. As there are no standing losses with this type of system, they are highly efficient and reduce heat loss throughout the development.

Equally as there are no centralised plant for hot water, no internal pipework is required as such no additional losses from said pipework will be apparent.

4.4 VENTILATION

The ventilation strategy for each of the offices will adhere to all of the appropriate criteria with Part F of the Building Regulations. The strategy described in this report may be subject to change during the progression of detailed design, however the criteria will still be adhered to.

The open plan office spaces on floors 1 to 5 within the existing and extension section of the building will be naturally ventilated. Dynamic simulation modelling (DSM) has calculated the maximum ventilation flow rate through available openable windows which exceeds the ventilation requirement for these spaces and shall be agreed with Building Control at detailed design stage.

Each individual office template of the high tower will take advantage of a Centralised Mechanical Ventilation Heat Recovery (MVHR) system. This assists with reducing energy demand by recovering otherwise wasted heat. This assists in reducing the CO₂ emissions of the dwelling and assists with achieving the appropriate level of ventilation criteria described in Part F of the Building Regulations highlighted previously in this report.

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

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

Linking with the fabric improvements, a lower air permeability rate as described earlier allows for more heat to be recovered by the MVHR system making it more efficient.

4.5 LIGHTING

The proposed light fittings will be low energy efficient fittings, in this instance LED fittings only throughout with absence detection in offices and presence detection in circulation and WC's reduce electrical usage.

4.6 CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS

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

4.6.1 CHP

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

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

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

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

- Pollution discharged from the CHP unit may not be appropriate given the site locality and the number of people passing the site, given the proximity to the city centre and local building usage and the increase in pedestrian activity due to this development
- Noise pollution is a consideration given the function of the development
- Economic viability is heavily dependent on the constant demand for heat and power, as well as the price of electricity and gas
- As described previously, utilising an all electrical system lessens the demand on fossil fuels

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

4.7 DECENTRALISED ENERGY NETWORK

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed through the use of UK CHP Development Map, for Manchester City as for a District Heating network. The development is not in close proximity to an existing nor a potential District Heating transmission line.

At the moment there is no decentralized energy network available and in particular a district heating network in the proximity of the proposed development site that would allow the development to connect to such a network.

On this basis the proposals are to provide individual Direct Acting Electric Heaters throughout the WC area's and AC Air Source Heat Pump systems for the offices.

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

4.7.1 SOLAR WATER HEATING

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

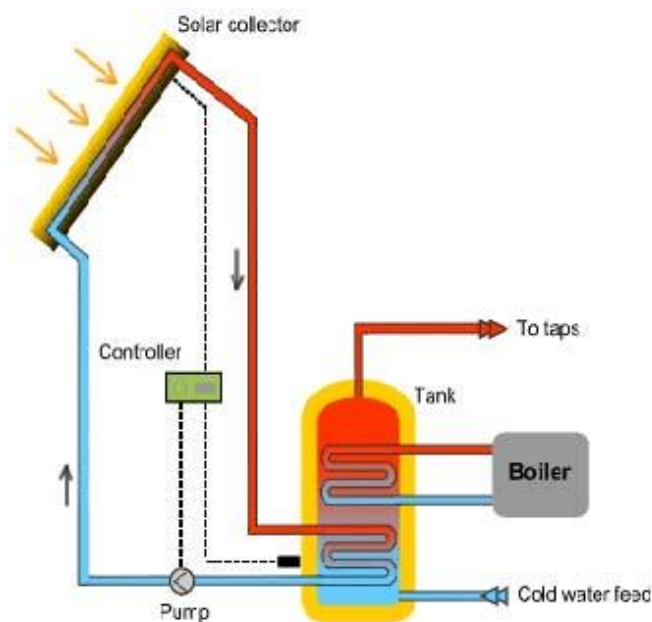


Figure 5 Solar Thermal Diagram

As the intention is to utilise the roof space for Photovoltaic panels which provided greater CO₂ reductions per £, as well as the increased servicing required to maintain a Solar Water Heating system.

This system alone would not generate a large enough CO₂ reduction in proportion to other comparable technologies.

This technology has been discounted due to the inflated cost of installation with regards additional pipe runs, maintenance requirements and the significant roof area that would be required.

4.8 WIND TURBINES

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

Figure 6 Wind Turbine



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

For the reasons detailed above wind turbines are not considered viable for the development in a city centre location.

4.9 PHOTOVOLTAIC CELLS (PV)

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

Figure 7 PV Examples



As the development is achieving Part L requirements utilising a fabric first approach with a highly efficient heating and cooling system in the form of VRF heat pump technology it is not deemed necessary to include this technology.

For these reasons this technology has not been included but could be added in the future on the roofs of the lower parts of the building.

4.10 VRF AIR SOURCE HEATING AND COOLING

The Air Source Heat Pumps can be linked with indoor units to heat and cool the space. These could be either ceiling mounted cassette units, wall mounted units or floor mounted units. This would have the benefit of also providing cooling to each room in summer months.

The outdoor units can be located anywhere and are not dependant on orientation. They need to be externally mounted and in a local compound to be safe.

This technology has been included in the form of VRF air conditioning units that will provide both heating and cooling for the office areas.

4.11 BIOMASS BOILER

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

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



Figure 8 Biomass Example

To avoid larger plant areas and flues to the city centre, logistics of deliveries etc and the domestic nature of the development it is not considered viable to transport wood pellets or similar to the building.

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

4.12 FUEL CELL

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

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

Fuel cells have various commercial and technical limitations. There is a high initial capital cost together with there being few established suppliers and a very limited specialist design, installation and maintenance capabilities. Certain fuel cell elements require regular replacement imposing a significant on-going cost implication. The fuel cells themselves are generally large, heavy and require fresh air ventilation.

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

4.13 ENVIRONMENTAL STANDARDS

Contained within a supplementary document to the Manchester Core Strategy named 'Guide to Development in Manchester Supplementary Planning Document and Planning Guidance Adopted April 2007' are the environmental standards that new developments are required to address.

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

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

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

Each individual section will highlight the points contained within the Guide to Development in Manchester document, that each development should adhere. Each element will then be summarised how the development will achieve this and any relevant third part reports referenced accordingly.

4.14 ENERGY EFFICIENCY

Section 4.5 Guide to Development in Manchester states that in summary, all new developments should endeavour to reduce their CO₂ emission by particular targets. These targets are superseded by the Manchester Core Strategy.

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

Section 4 Energy Strategy of this report details specifically how the proposed design of the development including the fabric, mechanical and electrical services will use passive, energy efficient and low carbon technologies throughout with emphasis on a fabric first approach to minimise the CO₂ emissions and meet the targets set in the Manchester Core Strategy Policy EN6.

The Energy Strategy describes how the development follows the Energy Hierarchy approach which the Manchester Core Strategy advocates the use of.

The results of the Energy Strategy describe compliance with both the Guide to Development in Manchester and the Manchester Core Strategy Policy, ultimately offering an overall reduction in CO₂ emissions of 9.14% over and above current 2013 Building Regulations Part L2A.

4.15 RENEWABLE ENERGY

Section 4.6 of the Guide to Development in Manchester document encourages the use of Low Zero Carbon technologies, specifically the use of renewable energy. This again follows the Hierarchical approach encouraged by the Manchester Core Strategy.

The section states that opportunities to reduce the energy demand via the use of onsite renewable technologies to improve energy security for occupants of the site and export of surplus energy back to the grid.

It also states that various opportunities and different technologies should be investigated to determine the most viable and appropriate technology for the site in question.

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

Following these in-depth reviews of varying renewable technologies, Air Source Heat Pump Air Conditioning systems will provide heating and cooling within the offices. This reduces the amount of reliance upon grid electricity of the entirety of the building and further reduces the CO₂ emissions overall.

4.16 ENERGY EFFICIENT DESIGN

This section outlines the design energy efficient measures taken to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline (Building Regulations compliance).

The energy efficient measures include:

- a) Inclusion of better U-values than the minimum U-values set in the Building Regulations.
- b) Designing for a buildings air permeability exceeding Building Regulations limiting target values.
- c) Utilising the highly efficient heating and hot water systems via LTHW boilers and point of use water heaters.
- d) Utilising low energy efficient lighting such as LED lighting.
- e) Mechanical and Natural ventilation as described in section 4.3.3

The Part L2A modelling software has generated the Target Emission Rates (TERs) for the whole development with a LTHW heating system:

Table 5 Target Emission Rate

TER	BER
kgCO ₂ /m ²	kgCO ₂ /m ²
19.5	19.4

From above can be seen that by utilising an LTHW boiler for the heating shall result in an energy improvement of 0.05% against Building Regulations, thus not meeting EN 06 of the Manchester Plan.

4.17 ENERGY EFFICIENT DESIGN WITH GREEN TECHNOLOGY

This section outlines the design energy efficient measures taken to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline (Building Regulations 2013 Part L2A compliance) by including as detailed in 4.2, but altering the LTHW gas fired boilers to electric air source heat pumps.

The energy efficient measures include:

- f) Inclusion of better U-values than the minimum U-values set in the ADL2A.
- g) Designing for a buildings air permeability exceeding ADL2A target values.
- h) Utilising the highly efficient heating and hot water systems.
- i) Utilising low energy efficient lighting such as LED lighting.
- j) Heating and cooling via air source heat pumps
- k) Hot water by electric point of use.
- l) Mechanical and Natural ventilation as described in section 4.3.3

Table 5 Target Emission Rate

TER	BER
kgCO ₂ /m ²	kgCO ₂ /m ²
18.6	16.9

The table above proves that by providing VRF air source heat pumps to heat the office spaces then the energy improvement is 9.14% against Part L2A (2013), which results in an improvement of 15.14% against Part L2A (2010) standards.

4.18 WATER MANAGEMENT AND WEATHER RESILIENCE

Section 4.9 of the Guide to Development in Manchester encourages thoughtful design to reduce the levels of pollution within the city's watercourses, as well as mitigating the effects of flooding should significant storms present themselves in the future.

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

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

The building will be designed to reduce mains/potable water and include water efficient devices and equipment. This will comprise of efficient water fixtures (low flow taps and dual flush WC's) to reduce potable water demand to <14 litres/person/day as per the requirement within Part G of Building Regulations.

4.19 WASTE MANAGEMENT

Section 4.10, 4.11 and 4.12 of the Guide to Development in Manchester describe how proposals should deal with the disposal or recycling of waste materials.

The proposed development will include the re-use of the existing building and associated elements and the construction of the new multi-storey commercial building.

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

The Waste Management plan will constantly be reviewed for opportunities to improve the procedures and will also review areas where reductions in waste, or an increase in recycling waste can be made.

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

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

4.20 CONSTRUCTION MANAGEMENT

Section 4.13 and 4.14 of the Guide to Development in Manchester encourages environmentally friendly construction methods and materials which in effect reduces energy consumption.

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

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

4.21 BIODIVERSITY

Section 4.15 of the Guide to Development in Manchester requires plans and designs to be put in places to protect any wildlife found to be occupying the site. This is also to limit the loss of any existing tree and valuable fauna on site. Developers are required to demonstrate compliance with Manchester's Biodiversity Strategy by demonstrating how they have taken account of the effect of the proposed development on the biodiversity of the site.

The fully qualified and independent Ecologist have been appointed by the applicant and has produced an Ecological Assessment report and subsequent Bat Survey Report to assess the current ecological value of the site, identify any wildlife, trees, flora and fauna that require protection and to advise on measure to mitigate any loss and to the biodiversity of the site.

The assessment is expected to state that although there is a number of protected sites and species within their search area that are expected to be identified, these will be deemed distant enough from the application site area to not be impacted by the proposed development.

As the site is currently a derelict building, the majority of the area was hard standing it is expected that no species of worthiness or note will be identified.

It is presumed that there is a low potential for use of roosting bats, however an additional Bat Survey report has been produced by the specialist and the results of which are available for review.

4.22 WATERWAYS

Section 4.16 of the Guide to Development in Manchester encourages reductions in pollution in city's waterways and see them as an important part of the recreational network.

Developers with proposals within close proximity to these waterways are required to demonstrate how public access and environmental management will be enhanced.

As this site is not within a significant proximity to the city's waterways to have an impact upon the ecological enhancement or public access, this section is deemed not relevant to this particular development.

However, it is anticipated that within the Flood Risk Assessment, discharge into these waterways would be dismissed for this site, reducing the risk of any pollution from this development being introduced into the waterways themselves.

5 CONCLUSION

The energy strategy for Back Turner Street, Manchester has adopted a hierarchical approach of using passive and low energy design technologies to reduce the baseline energy demand and hence CO₂ emissions followed by the application of low and zero carbon technologies as appropriate.

The analysis has shown that by incorporating passive and low energy design measures, there is a reduction in the development annual corrected CO₂ baseline emissions utilising the Part L2A thermal model assessment method. This is achieved by incorporation of the following elements:

- High performance glazing to reduce solar and transmission gains
- Improved thermal transmittance U-values
- Low Energy use, high efficiency Heat recovery air plant
- High efficiency VRF heat pump technology to officer areas
- Low building air leakage rate (3 m³/h/m² at a pressure differential of 50 Pa)
- Low energy LED lighting
- Automatic lighting control system with occupancy and daylight dimming controls in common parts
- Lighting designs carried out to ensure that the Luminaire Efficacy is 60 W/lm or greater.

5.1 Results

By utilising the be lean, be clean and be green energy strategy, the building has a reduction of CO₂ emissions when compared to the development as a whole over the notional scheme.

Table 7 BER / TER

	TER	BER
	kgCO₂/m²	kgCO₂/m²
Proposed Development	16.4	11.7

As can be seen from the table above, the proposed fabric, air permeability and services strategy achieves a 29% reduction in CO₂ emission over Part L2A 2013 Building Regulations. Therefore achieving the requirements stipulated in the Manchester core strategy policy EN6 as stated in section 2.4.1 of this report.

6 APPENDICES

Appendix A – As Built BRUKL

Appendix A

BRUKL

Project name

P712 Back Turner Street As-Built**As built****Date:** Tue Jan 24 16:42:32 2023**Administrative information****Building Details****Address:** Glassworks House, 32 Shudehill, Manchester, M4 1EZ**Certification tool****Calculation engine:** Apache**Calculation engine version:** 7.0.17**Interface to calculation engine:** IES Virtual Environment**Interface to calculation engine version:** 7.0.17**BRUKL compliance check version:** v5.6.b.0**Certifier details****Name:** Ben Duckworth**Telephone number:** 01132577300**Address:** 7 Feast Field, Horsforth, West Yorkshire, Leeds, LS18 4TJ**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	16.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	16.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.7
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	0.24	0.24	TR000005:Surf[1]
Floor	0.25	0.15	0.15	TR000005:Surf[0]
Roof	0.25	0.18	0.18	01000029:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	00000004:Surf[6]
Personnel doors	2.2	2.2	2.2	00000004:Surf[5]
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	2.97

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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

1- System 1 - Electric Panel Heaters Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- AS-BUILT System 9 - PURY 650 VRF Mech Vent - GF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	6.83	3.57	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- AS-BUILT System 2 - PURY 700 VRF Mech Vent - 1 to 4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	6.85	3.53	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

4- AS-BUILT System 10 - PURY 800 VRF Mech Vent - 05-06

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.21	2.99	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- AS-BUILT System 11 - PURY 600 VRF Mech Vent - 07-16

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	6.76	3.62	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- System 7 - DHW

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1		
00 Staff Welfare		-	-	0.3	-	-	-	-	-	-	-	N/A
00 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
00 Reception/Lounge		-	-	-	1.3	-	-	-	-	-	-	N/A
01 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
01 Open Plan Office 3		-	-	-	1.3	-	-	-	-	-	-	N/A
02 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
02 Open Plan Office 3		-	-	-	1.3	-	-	-	-	-	-	N/A
03 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
03 Open Plan Office 3		-	-	-	1.3	-	-	-	-	-	-	N/A
04 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
04 Open Plan Office 3		-	-	-	1.3	-	-	-	-	-	-	N/A
05 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
05 Open Plan Office 2		-	-	-	1.3	-	-	-	-	-	-	N/A
06 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
06 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
07 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
07 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
08 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
08 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
09 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
09 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
10 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
10 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
11 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
11 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
12 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
12 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
13 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
13 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A
14 Acc WC		-	-	0.3	-	-	-	-	-	-	-	N/A
14 Open Plan Office		-	-	-	1.3	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
15 Acc WC	-	-	0.3	-	-	-	-	-	-	-	N/A	
15 Open Plan Office	-	-	-	1.3	-	-	-	-	-	-	N/A	
16 Acc WC	-	-	0.3	-	-	-	-	-	-	-	N/A	
16 Open Plan Office	-	-	-	1.3	-	-	-	-	-	-	N/A	

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
01 WC 3		-	96	-	27
01 WC 4		-	96	-	27
01 WC 5		-	96	-	32
00 Stairs/Lobby 2		-	92	-	66
00 Staff Welfare		307	-	-	59
00 Circ 1		-	152	-	34
00 Fire Fighting Lobby		-	310	-	13
00 Acc WC		-	125	-	40
00 Escape Stairs		-	184	-	33
00 Escape circ		-	188	-	24
00 Escape Lobby		-	152	-	16
00 Reception/Lounge		-	158	15	443
01 Acc WC		-	128	-	26
01 Single WC		-	96	-	29
01 Landing		-	133	-	31
01 Stairs 1		-	94	-	41
01 single WC		-	96	-	30
01 Stairway 2		-	89	-	54
01 WC Lobby 2		-	265	-	18
01 Open Plan Office 1		129	-	-	769
01 Open Plan Office 2		128	-	-	765
01 Open Plan Office 3		129	-	-	800
02 WC 3		-	96	-	27
02 WC 4		-	96	-	27
02 WC 5		-	96	-	32
02 Acc WC		-	128	-	26
02 Single WC		-	96	-	29
02 Landing		-	133	-	31
02 Stairs 1		-	94	-	41
02 single WC		-	96	-	30
02 Stairway 2		-	89	-	54
02 WC Lobby 2		-	265	-	18
02 Open Plan Office 1		129	-	-	769
02 Open Plan Office 2		128	-	-	765
02 Open Plan Office 3		129	-	-	800

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
03 WC 3		-	96	-	27
03 WC 4		-	96	-	27
03 WC 5		-	96	-	32
03 Acc WC		-	128	-	26
03 Single WC		-	96	-	29
03 Landing		-	133	-	31
03 Stairs 1		-	94	-	41
03 single WC		-	96	-	30
03 Stairway 2		-	89	-	54
03 WC Lobby 2		-	265	-	18
03 Open Plan Office 1		129	-	-	769
03 Open Plan Office 2		128	-	-	765
03 Open Plan Office 3		129	-	-	800
04 WC 3		-	96	-	27
04 WC 4		-	96	-	27
04 WC 5		-	96	-	32
04 Acc WC		-	128	-	26
04 Single WC		-	96	-	29
04 Landing		-	133	-	31
04 Stairs 1		-	94	-	41
04 single WC		-	96	-	30
04 Stairway 2		-	89	-	54
04 WC Lobby 2		-	265	-	18
04 Open Plan Office 1		129	-	-	769
04 Open Plan Office 2		128	-	-	765
04 Open Plan Office 3		129	-	-	800
05 Acc WC		-	128	-	26
05 Single WC		-	96	-	29
05 Stairs 1		-	94	-	41
05 single WC		-	96	-	30
05 Landing		-	134	-	31
05 Open Plan Office 2		124	-	-	889
05 Open Plan Office 1		127	-	-	721
05 Stairway 2		-	89	-	53
05 WC Lobby		-	170	-	29
05 WC 4		-	96	-	26
05 WC 5		-	96	-	28
05 WC 6		-	96	-	27
06 Acc WC		-	128	-	26
06 Single WC		-	96	-	29
06 Stairs 1		-	94	-	41
06 single WC		-	96	-	30
06 Landing		-	133	-	31

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
06 Open Plan Office		133	-	-	894
07 Acc WC		-	128	-	26
07 Single WC		-	96	-	29
07 Stairs 1		-	94	-	41
07 single WC		-	96	-	30
07 Landing		-	133	-	31
07 Open Plan Office		133	-	-	894
08 Acc WC		-	128	-	26
08 Single WC		-	96	-	29
08 Stairs 1		-	94	-	41
08 single WC		-	96	-	30
08 Landing		-	133	-	31
08 Open Plan Office		133	-	-	894
09 Acc WC		-	128	-	26
09 Single WC		-	96	-	29
09 Stairs 1		-	94	-	41
09 single WC		-	96	-	30
09 Landing		-	133	-	31
09 Open Plan Office		133	-	-	894
10 Acc WC		-	128	-	26
10 Single WC		-	96	-	29
10 Stairs 1		-	94	-	41
10 single WC		-	96	-	30
10 Landing		-	133	-	31
10 Open Plan Office		133	-	-	894
11 Acc WC		-	128	-	26
11 Single WC		-	96	-	29
11 Stairs 1		-	94	-	41
11 single WC		-	96	-	30
11 Landing		-	133	-	31
11 Open Plan Office		133	-	-	894
12 Acc WC		-	128	-	26
12 Single WC		-	96	-	29
12 Stairs 1		-	94	-	41
12 single WC		-	96	-	30
12 Landing		-	133	-	31
12 Open Plan Office		133	-	-	894
13 Acc WC		-	128	-	26
13 Single WC		-	96	-	29
13 Stairs 1		-	94	-	41
13 single WC		-	96	-	30
13 Landing		-	133	-	31
13 Open Plan Office		133	-	-	894

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
14 Acc WC		-	128	-	26
14 Single WC		-	96	-	29
14 Stairs 1		-	94	-	41
14 single WC		-	96	-	30
14 Landing		-	133	-	31
14 Open Plan Office		133	-	-	894
15 Acc WC		-	128	-	26
15 Single WC		-	96	-	29
15 Stairs 1		-	94	-	41
15 single WC		-	96	-	30
15 Landing		-	133	-	31
15 Open Plan Office		133	-	-	894
16 Acc WC		-	145	-	26
16 Single WC		-	96	-	29
16 Stairs 1		-	99	-	41
16 single WC		-	96	-	30
16 Landing		-	145	-	31
16 Open Plan Office		134	-	-	894

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Staff Welfare	N/A	N/A
00 Reception/Lounge	YES (+53%)	NO
01 Open Plan Office 1	NO (-30.2%)	NO
01 Open Plan Office 2	NO (-22%)	NO
01 Open Plan Office 3	YES (+2.3%)	NO
02 Open Plan Office 1	NO (-28.7%)	NO
02 Open Plan Office 2	NO (-21.8%)	NO
02 Open Plan Office 3	YES (+2.3%)	NO
03 Open Plan Office 1	NO (-28.7%)	NO
03 Open Plan Office 2	NO (-21.8%)	NO
03 Open Plan Office 3	YES (+2.3%)	NO
04 Open Plan Office 1	NO (-28.7%)	NO
04 Open Plan Office 2	NO (-21.8%)	NO
04 Open Plan Office 3	YES (+2.3%)	NO
05 Open Plan Office 2	NO (-5.8%)	NO
05 Open Plan Office 1	NO (-28.2%)	NO
06 Open Plan Office	YES (+15.5%)	NO
07 Open Plan Office	YES (+15.5%)	NO
08 Open Plan Office	YES (+15.5%)	NO
09 Open Plan Office	YES (+15.5%)	NO
10 Open Plan Office	YES (+15.5%)	NO
11 Open Plan Office	YES (+15.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
12 Open Plan Office	YES (+15.5%)	NO
13 Open Plan Office	YES (+15.5%)	NO
14 Open Plan Office	YES (+15.5%)	NO
15 Open Plan Office	YES (+15.5%)	NO
16 Open Plan Office	YES (+15.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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

	Actual	Notional
Area [m ²]	5611.3	5611.3
External area [m ²]	5874.9	5874.9
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	3905.83	3916.87
Average U-value [W/m ² K]	0.66	0.67
Alpha value* [%]	10.32	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.33	11.34
Cooling	3.81	5.45
Auxiliary	2.97	1.34
Lighting	5.66	14.91
Hot water	2.34	2.58
Equipment*	35.85	35.85
TOTAL **	23.11	35.62

* 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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	165.96	140.76
Primary energy* [kWh/m ²]	69.16	89.92
Total emissions [kg/m ²]	11.7	16.4

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

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] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	131.6	0	45.7	0	0.2	0.8	0	1	0
Notional	154.6	0	49.8	0	0.4	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	78.9	88.7	3.4	3.6	1.7	6.38	6.79	6.85	9.56
Notional	70	82.4	7.6	6	0.7	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	99.4	185.4	4.3	7.7	4.6	6.36	6.69	6.83	9.42
Notional	91.6	95.6	9.9	7	1.9	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	70.9	108.8	4.1	4.7	3.6	4.85	6.5	5.21	9.15
Notional	63.7	92.6	6.9	6.8	1.5	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	56.1	126	2.5	5.2	5.1	6.3	6.69	6.76	9.42
Notional	37.7	94.4	4.1	6.9	2.1	2.56	3.79	----	----
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	TR000005:Surf[1]
Floor	0.2	0.15	TR000005:Surf[0]
Roof	0.15	0.18	01000029:Surf[0]
Windows, roof windows, and rooflights	1.5	1.3	00000004:Surf[6]
Personnel doors	1.5	2.2	00000004:Surf[5]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	2.97