



Transmission House Manchester

Energy Strategy Summary
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NOVO

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AMENDMENT HISTORY



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1 INTRODUCTION

1.1 PURPOSE

NOVO Integration Ltd has been appointed as energy consultants to produce an energy strategy completion summary report for the development known as Transmission House, Tib Street, Manchester.

This is to support the scheme completion process, demonstrate Building Regulations Part L compliance and to confirm compliance with the applicable planning policies set out in the Local Authority of Manchester City Council's Core Strategy.

This report will outline the following:

- 1) The overall confirmed specification of the development to reduce the CO₂ emissions of the development.
- 2) To confirm and summarise the results for the residential aspect of the development and to confirm that those results demonstrate a significant reduction in CO₂ emissions to comply with both Building Regulations Part L 2013 and the appropriate planning policies set out by the local authority.

This report will deal with specifically the site as a whole, to demonstrate compliance with appropriate planning policy.

1.2 BACKGROUND POLICY DOCUMENTS

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

- The Kyoto Protocol at the United Nations
- Framework Convention on Climate Change as negotiated in December 1997 has come into effect on 16 February 2005 following the ratification of the agreement by Russia on 18 November 2004. The Burden Sharing Agreement of the EU mandates a 12.5% reduction in greenhouse gas emissions for the UK by 2008 - 12.
- The Department of Transport and Industry White Paper, titled "Our Energy Future - Creating a Low Carbon Economy", spells out a target for 10% of electricity to be from renewable sources nationally by 2010 and twice this by 2020.
- National Policy Objectives in regard to renewable energy Planning Policy Statement 22: Renewable energy guidance for local governing bodies concerning implementation of renewable energy technologies through appropriate planning.
- The United Kingdom has made commitments that extend beyond this requirement. National Targets are for a reduction to 20% below 1990 CO₂ levels by 2010 and a 60% reduction by 2050.
- Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, September 2004.
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new buildings other than dwellings.
- National Planning Policy Framework (March 2012)
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.
- Adopted Core Strategy Leeds Local Development Framework Nov 2014.

1.3 SITE DESCRIPTION

The development site is located close to the centre of Manchester City situated within the Northern Quarter on Tib Street. This falls within the curtilage of the Manchester City Council Local Authority and as such the must adhere to the Policy adopted by Manchester City Council.

The area surrounding the site is predominately urban residential and commercial in its use, made up of mainly high rise residential developments and commercial elements.

The proposed development consists of 187 No, apartments, located within one, ten storey block.

The Ground Floor will consist of lobby areas along associated communal spaces and 4 commercial retail units.

1.4 PLANNING POLICY

1.4.1 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', this was adopted on 11th July 2012.

The main policy's relating to energy and sustainability that must be addressed for this particular development is Policy EN4 and EN6.

Policy EN4

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 development 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 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 use of building materials with low embodied carbon in new development and refurbishment schemes.*

Policy EN6

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

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

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

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

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating.
- 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.

Domestic CO₂ emissions reduction 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

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

Where the Council identifies and 'allowable solution' for example within an energy proposals plan, that would produce higher carbon reduction 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.

The above policy therefore dictates that the 15% reduction in CO₂ emissions is required over 2010 regulations. As the development has been produced to adhere to 2013 regulations, it is widely recognised that Building Regulations Part L1A 2013 are 6% more stringent than Part L1A and L2A 2010. As such the target reduction in CO₂ emissions for the development was accepted to be 9% overall the dwellings against Part L1A and L2A 2013.

1.5 BUILDING REGULATIONS

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

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

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

Approved document L2A – Conservation of fuel and power in new buildings other than dwellings, sets out the standard for carbon emissions for new, Non-Domestic Buildings and was revised 2013, (Part L 2013). All new build Non-Domestic buildings need to comply with the criteria set out within this document in much the same way as new build dwellings.

These criteria are described in brief below:

- 1) The actual Building CO₂ Emission Rate (BER) must be no greater (no worse) than the calculated Target CO₂ Emission Rate (TER).
- 2) The performance of the building fabric and fixed building services should be no more than the design limits set out in Table 3 of the approved Document L2A 2013.
- 3) The dwelling will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer to limit the inclusion of active cooling within the building to reduce energy demand in summer months.
- 4) That the performance of dwellings as-built comply with BER values achieved, including site testing or a representative sample of dwellings, demonstrating that the 'air permeability' rate achieved is as per that specified, or better. In much the same way as Part L1A.

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- 5) The necessary provisions for energy efficient operation of dwellings are put in place, including operation and maintenance instructions

All of these criteria must be met unless otherwise stated by the Building Control officer in order to achieve full compliance with Part L2A of the Building Regulations.

Any planning policy requirements are in addition to the Building Regulations requirements.

2 DESIGN PARAMETERS

2.1 METHODOLOGY

As this report deals with the residential aspect of this development only due to this being the predominant use of the development, the following calculation methodology was utilised for compliance.

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions for new dwellings. Results are derived in respect of floor area and consider energy use (kWh/m²/yr) and associated CO₂ emissions (kg.CO₂/m²/yr) from the following:

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

SAP is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purpose of this report, data has been produced by an accredited domestic energy assessor using FSAP 2012 version 1.0.4.25 software.

To enable a review of how the New Build elements have achieved an improvement, firstly the baseline CO₂ emission figures must be established. These figures are based on Part L1a 2013's 'Notional Dwelling', a specific set of specification criteria referenced in section 2.2 of this report.

A 'fabric first' approach has been undertaken throughout the design process, looking at improvements to the thermal envelope initially to understand the improvements that can be gained prior to any renewable/low carbon technologies to be included.

In addition the 4 commercial retail units that are being produced as Shell & Core units and therefore require compliant L2A SBEM calculations to be carried out to achieve as a minimum the same level of compliance as per the residential aspect of the development.

The SBEM will account for high thermal efficiency fabric and, with the units being Shell & Core, a realistic input for efficient services etc.

2.2 BASELINE CO₂ EMISSIONS

2.2.1 Domestic

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

For the purpose of this report the baseline energy use CO₂ emissions are calculated based on the 'Notional Dwelling' requirements for fixed building services only in this instance as specified in the Building Regulations L1A 2013 Figure 1.

The extract below is from Part L1A Notional Dwelling specification and it highlights all other aspects that have been included within this baseline specification.

Figure 1: Notional Dwelling Extract

Table 4 Summary of concurrent notional dwelling specification (<i>continued</i>)	
Element or system	Values
Heating system	Mains gas If combi boiler in actual dwelling, combi boiler; otherwise regular boiler Radiators Room sealed Fan flue SEDBUK 2009 89.5% efficient
Controls	Time and temperature zone control ⁵ Weather compensation Modulating boiler with interlock
Hot water storage system	Heated by boiler (regular or combi as above) If cylinder specified in actual dwelling, volume of cylinder in actual dwelling If combi boiler, no cylinder. Otherwise 150 litres Located in heated space Thermostat controlled Separate time control for space and water heating
Primary pipework	Fully insulated
Hot water cylinder loss factor (if specified)	Declared loss factor equal or better than $0.85 \times (0.2 + 0.051 V^{2/3})$ kWh/day
Secondary space heating	None
Low-energy lighting	100% low-energy lighting
Thermal mass parameter (TMP)	Medium (TMP = 250)

The individual CO₂ emissions and area weighted block compliance results for the development are presented in the table below. A full copy of the SAP calculations has also been included within the appendix of this report.

Please note that all residential units have been modelled using the SAP 2012 software.

The baseline CO₂ emission rate for the New-Build element, otherwise known as the Target Emission Rate (TER) is determined within the Part L1A by Part L1A's 'Notional Dwelling' requirements specific in the Building Regulations L1A 2013 and are described below in Table 4.

Table 1: Baseline Building Fabric New-Build

Element	Part L1A: 2013 Limiting U-Values (W/m ² .k)	Part L1A: 2013 Notional U-Values (W/m ² .k)
Floors	0.25	0.13
External Walls	0.30	0.18
Party Wall Between Dwelling	0.20	0.00
Roof	0.20	0.13
Windows	2.0	1.4
Doors	2.0	N/A
Y-Value (W/m ² .k)	0.15	~0.15
Air Permeability (m³/h.m² @ 50 pa)		
All Dwellings	10.0	5.0

The following table details the notional baseline CO₂ regulated emissions for the development.

Table 2: Baseline Carbon Emissions New-Build

Building Services	Baseline CO ₂ Emissions (kg CO ₂ /m ² /yr)	Baseline CO ₂ Emissions for overall development (kg CO ₂ / yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	23.40	267,572.68

2.2.2 Non- Domestic

For the 4 No, Non-Domestic commercial retail units on the ground floor, the baseline CO₂ emission rate is calculated in much the same way as the Domestic, utilising IES VE Software in accordance with the SBEM calculation methodology for Part L2A 2013.

For the purpose of this report the baseline energy use CO₂ emissions are calculated based on the 'Notional Building' requirements for fixed building services only in this instance as specified in the Building Regulations L2A 2013 Figure 2.

The extract below is from Part L2A Notional Building specification and it highlights all other aspects that have been included within this baseline specification.

Figure 2: Notional Building Extract

Table 5 Summary of concurrent notional building specification			
Element	Side lit or unlit (where HVAC specification is heating only)	Side lit or unlit (where HVAC specification includes cooling)	Top lit
Roof U-value (W/(m ² ·K))	0.18	0.18	0.18
Wall U-value (W/(m ² ·K))	0.26	0.26	0.26
Floor U-value (W/(m ² ·K))	0.22	0.22	0.22
Window U-value (W/(m ² ·K))	1.6 (10% FF)	1.6 (10% FF)	N/A
G-value (%)	40	40	N/A
Light transmittance (%)	71	71	N/A
Roof-light U-value (W/(m ² ·K))	N/A	N/A	1.8 (15% FF)
G-value (%)	N/A	N/A	55
Light transmittance (%)	N/A	N/A	60
Air permeability (m ³ /(m ² ·hour)) Gross internal area less than or equal to 250 m ²	5	5	7
Air permeability (m ³ /(m ² ·hour)) Gross internal area greater than 250 m ² and less than 3500 m ²	3	3	7
Air permeability (m ³ /(m ² ·hour)) Gross internal area greater than or equal to 3500 m ² and less than 10,000 m ²	3	3	5
Air permeability (m ³ /(m ² ·hour)) Gross internal area greater than or equal to 10,000 m ²	3	3	3
Lighting luminaire (lm/circuit watt)	60	60	60
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Maintenance factor	0.8	0.8	0.8
Constant illuminance control	No	No	No
Heating efficiency (heating and hot water) (%)	91	91	91
Central ventilation SFP (W/(l·s))	1.8	1.8	1.8
Terminal unit SFP (W/(l·s))	0.3	0.3	0.3
Cooling (air-conditioned) (SEER/SSEER)	N/A	4.5 / 3.6	4.5 / 3.6
Cooling (mixed mode) (SSEER) ¹	N/A	2.7	2.7
Heat recovery efficiency (%)	70	70	70
Variable speed control of fans and pumps, controlled via multiple sensors	Yes	Yes	Yes
Demand control (mechanical ventilation only). Variable speed control of fans via CO ₂ sensors	Yes	Yes	Yes
Note 1: Mixed mode assumed to be cooled by DX unit where SSEER includes indoor and outdoor units and fans, pumps and losses			

Table 3: Non-Domestic Baseline Building Fabric New-Build

Element	Part L2A: 2013 Limiting U-Values (W/m ² .k)	Part L1A: 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	2.2	1.60
Doors	2.2	N/A
Air Permeability (m³/h.m² @ 50 pa)		
Building	10.0	15.0 Not Tested

Table 4: Retail Unit 1 Baseline Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	34.80	11,647.56

Table 5: Retail Unit 2 Baseline Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	35.30	7,868.37

Table 6: Retail Unit 2 Baseline Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	34.80	22,682.64

Table 7: Retail Unit 2 Baseline Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	34.60	6,954.60

2.2.3 Overall Whole Building Baseline Emissions

In order to calculate the overall Building Baseline, the emission rates for each dwelling and the 4 commercial retail spaces need to be combined and included within a block compliance calculation.

The result of the block compliance for the Baseline provides a target for which the building must achieve a 9% betterment to achieve compliance with Manchester Core Strategy Planning requirements as detailed previously. The results are as follows.

Table 8: Block Compliance Baseline Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	24.65	316,690.05

3 STRATEGY & RESULTS

3.1 ENERGY EFFICIENT DESIGN

This section outlines the design energy efficient measures taken in order to minimise the new-build building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline (Building Regulations 2013 Part L1A compliance). Often referred to as the 'Fabric First' approach as per the Policy EN6 of Manchester Core Strategy

The energy efficient measures include:

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

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

Table 9: 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	0.13	0.13
External Walls	0.30	0.18	0.15
Party Walls Between Dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.15
Windows	2.00	1.40	1.26
Doors	2.00	1.0	N/A
Y – Value (W/M ² .K)	0.15	~0.05	0.08 ACD's
Air Permeability (M ² /H.M ² @ 50 Pa)			
All Dwellings	10.0	5.0	4.0

3.1.1 Air Permeability

All apartments have already been pressure tested on all levels of the development and average 4.00 m²/h.m² @50 Pa. Each individual air test has been included within each of the units and included within the As Built SAP calculations.

Air tests have not been carried out for the Non-Domestic commercial retail units and this has been incorporated within the Part L2A As Built 2013 SBEM calculations.

3.1.2 Heating Demand

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

An all-electric solution has been utilised in this instance, direct acting electric room heaters with programmer and room thermostats for control.

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 building.

The hot water demand is met through the use of electric hot water immersion tank within each apartment to feed hot water needs.

For the Non domestic retail units, an all electric heat pump system has also been included which is a highly efficient way of providing heating and cooling.

3.1.3 Ventilation

The dwellings take advantage of a decentralised Mechanical Ventilation Heat Recovery (MVHR) system. This assists with reducing energy demand and provides ventilation as the majority of the dwellings within the development are orientated in such a way that cross ventilation will not be possible in many cases.

The benefit of this is heat energy is recovered through a heat exchanger, reducing the heat loss of the development, and reducing the heating energy demand. It also reduces the number of individual extract fans that are normally incorporated within a dwelling, again reducing the energy demand of the development.

Heat recovery systems have also been included within the non-domestic retail units.

3.1.4 Lighting

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

3.2 CO₂ REDUCTIONS AFTER IMPROVEMENTS.

The following table demonstrates all of the results for the individual apartments that contribute to the overall block compliance.

Table 10: Fabric First Individual Results New-Build

Plot	DER	TER	CO ₂ Percentage Improvement %	DFEE	TFEE
P1031 Unit 101 1st	28.73	29.17	1.51	45.8	52.6
P1031 Unit 201 2nd	27.61	26.56	-3.95	43.1	44
P1031 Unit 301 3rd	29.91	26.56	-12.61	44.8	44
P1031 Unit 401 4th	30.4	27.13	-12.05	44.9	45.7
P1031 Unit 501 5th	28.47	27.13	-4.94	43.5	45.7

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Plot	DER	TER	CO ₂ Percentage Improvement %	DFEE	TFEE
P1031 Unit 601 6th	29.62	26.56	-11.52	44.5	44
P1031 Unit 701 7th	29.07	26.56	-9.45	44.1	44
P1031 Unit 801 8th	35.52	30.02	-18.32	56.6	55.3
P1031 Unit 102 1st	24.87	26.66	6.71	37.7	46.5
P1031 Unit 202 2nd	21.72	23.42	7.26	31.6	35.2
P1031 Unit 302 3rd	22.81	23.42	2.6	32.2	35.2
P1031 Unit 402 4th	23	23.42	1.79	32.4	35.2
P1031 Unit 502 5th	24.07	23.42	-2.78	33.1	35.2
P1031 Unit 602 6th	24.24	23.42	-3.5	33.2	35.2
P1031 Unit 702 7th	22.62	23.42	3.42	32.1	35.2
P1031 Unit 802 8th	28.03	26.06	-7.56	41.8	44
P1031 Unit 103 1st	25.64	26.66	3.83	38.1	46.5
P1031 Unit 203 2nd	22.89	23.42	2.26	32.3	35.2
P1031 Unit 303 3rd	23.79	23.42	-1.58	32.9	35.2
P1031 Unit 403 4th	23.52	23.42	-0.43	32.7	35.2
P1031 Unit 503 5th	23.27	23.42	0.64	32.6	35.2
P1031 Unit 603 6th	23.22	23.42	0.85	32.5	35.2
P1031 Unit 703 7th	22.76	23.42	2.82	32.2	35.2
P1031 Unit 803 8th	28	26.06	-7.44	41.8	44
P1031 Unit 104 1st	25.94	26.66	2.7	38.3	46.5
P1031 Unit 204 2nd	23.34	23.42	0.34	32.6	35.2
P1031 Unit 304 3rd	22.59	23.42	3.54	32.1	35.2
P1031 Unit 404 4th	23.13	23.42	1.24	32.5	35.2
P1031 Unit 504 5th	23.14	23.42	1.2	32.5	35.2
P1031 Unit 604 6th	23.01	23.42	1.75	32.4	35.2
P1031 Unit 704 7th	23.2	23.42	0.94	32.5	35.2
P1031 Unit 804 8th	27.95	26.06	-7.25	41.7	44
P1031 Unit 105 1st	26.18	26.66	1.8	38.5	46.5
P1031 Unit 205 2nd	22.89	23.42	2.26	32.3	35.2
P1031 Unit 305 3rd	22.45	23.42	4.14	32	35.2
P1031 Unit 405 4th	22.86	23.42	2.39	32.3	35.2
P1031 Unit 505 5th	22.95	23.42	2.01	32.3	35.2
P1031 Unit 605 6th	23.62	23.42	-0.85	32.8	35.2
P1031 Unit 705 7th	23.25	23.42	0.73	32.5	35.2
P1031 Unit 805 8th	27.86	26.06	-6.91	41.6	44
P1031 Unit 106 1st	30.78	25.55	-20.47	51.8	50.9
P1031 Unit 206 2nd	27.78	22.96	-20.99	46	42.4
P1031 Unit 306 3rd	28	22.96	-21.95	46.2	42.4
P1031 Unit 406 4th	27.76	22.9	-21.22	45.4	42.2
P1031 Unit 506 5th	27.72	22.9	-21.05	45.4	42.2
P1031 Unit 606 6th	28.64	22.96	-24.74	46.6	42.4
P1031 Unit 706 7th	27.95	22.96	-21.73	46.1	42.4
P1031 Unit 806 8th	35.92	25.8	-39.22	61.4	51.7
P1031 Unit 107 1st	25.43	22.33	-13.83	36.2	38.3
P1031 Unit 207 2nd	20.24	19.9	-1.71	29.2	29.5
P1031 Unit 307 3rd	21.36	19.9	-7.34	30.1	29.5

Plot	DER	TER	CO ₂ Percentage Improvement %	DFEE	TFEE
P1031 Unit 407 4th	21.23	19.9	-6.68	30	29.5
P1031 Unit 507 5th	20.06	19.9	-0.8	29.1	29.5
P1031 Unit 607 6th	19.62	19.9	1.41	28.8	29.5
P1031 Unit 707 6th	20.23	19.9	-1.66	29.2	29.5
P1031 Unit 807 8th	29.25	22.94	-27.51	46.9	39.6
P1031 Unit 108 1st	22.62	23.22	2.58	30.9	35.2
P1031 Unit 208 2nd	20.7	20.89	0.91	26.9	26.8
P1031 Unit 308 3rd	21.19	20.89	-1.44	27.2	26.8
P1031 Unit 408 4th	22.91	20.89	-9.67	28.6	26.8
P1031 Unit 508 5th	20.66	20.89	1.1	26.8	26.8
P1031 Unit 608 6th	19.52	20.89	6.56	26	26.8
P1031 Unit 708 7th	20.66	20.89	1.1	26.8	26.8
P1031 Unit 808 8th	25.08	23.23	-7.96	35.7	34.8
P1031 Unit 109 1st	22.74	23.22	2.07	31	35.2
P1031 Unit 209 2nd	20.79	20.89	0.48	26.9	26.8
P1031 Unit 309 3rd	21.42	20.89	-2.54	27.4	26.8
P1031 Unit 409 4th	21.14	20.89	-1.2	27.2	26.8
P1031 Unit 509 5th	20.62	20.89	1.29	26.8	26.8
P1031 Unit 609 6th	20.07	20.89	3.93	26.4	26.8
P1031 Unit 709 7th	20.12	20.89	3.69	26.7	26.8
P1031 Unit 809 8th	25.05	23.23	-7.83	35.7	34.8
P1031 Unit 110 1st	22.57	23.22	2.8	30.9	35.2
P1031 Unit 210 2nd	20.55	20.89	1.63	26.8	26.8
P1031 Unit 310 3rd	21.5	20.89	-2.92	27.5	26.8
P1031 Unit 410 4th	20.56	20.89	1.58	26.8	26.8
P1031 Unit 510 5th	20.69	20.89	0.96	26.8	26.8
P1031 Unit 610 6th	20.2	20.89	3.3	26.5	26.8
P1031 Unit 710 7th	20.71	20.89	0.86	26.9	26.8
P1031 Unit 810 8th	25.07	23.23	-7.92	35.7	34.8
P1031 Unit 111 1st	22.67	23.22	2.37	31	35.2
P1031 Unit 211 2nd	20.1	20.55	2.19	25.8	25.6
P1031 Unit 311 3rd	20.81	20.55	-1.27	26.4	25.6
P1031 Unit 411 4th	20.41	20.89	2.3	26.6	26.8
P1031 Unit 511 5th	24.3	22.18	-9.56	34.5	31.2
P1031 Unit 611 6th	19.46	20.55	5.3	25.4	25.6
P1031 Unit 711 7th	20.36	20.55	0.92	26	25.6
P1031 Unit 811 8th	24.92	23.23	-7.28	35.6	34.8
P1031 Unit 112 1st	21.96	23.1	4.94	32.1	38.8
P1031 Unit 212 2nd	22.35	21.26	-5.13	33.1	33
P1031 Unit 312 3rd	20.14	20.77	3.03	28.2	31
P1031 Unit 412 4th	19.48	20.8	6.35	28.1	31.1
P1031 Unit 512 5th	19.15	20.23	5.34	27	29.2
P1031 Unit 612 6th	19.51	20.77	6.07	27.7	31
P1031 Unit 712 7th	19.62	20.77	5.54	27.8	31
P1031 Unit 812 8th	27.82	23.5	-18.38	43.9	40.1
P1031 Unit 113 1st	26.01	27.04	3.81	38.5	44.2

3 STRATEGY & RESULTS



Plot	DER	TER	CO ₂ Percentage Improvement %	DFEE	TFEE
P1031 Unit 213 2nd	24.83	25.06	0.92	36.1	37.8
P1031 Unit 313 3rd	25.56	25.06	-2	36.7	37.8
P1031 Unit 413 4th	24.15	25.02	3.48	36.1	37.7
P1031 Unit 513 5th	24.35	25.02	2.68	36.2	37.7
P1031 Unit 613 6th	23.53	25.06	6.11	35.2	37.8
P1031 Unit 713 7th	24.32	25.06	2.95	35.7	37.8
P1031 Unit 813 8th	31.75	27.47	-15.58	49.8	45.8
P1031 Unit 114 1st	25.83	26.62	2.97	37.6	41.5
P1031 Unit 214 2nd	21.32	23.34	8.65	26.4	30.1
P1031 Unit 314 3rd	20.72	23.34	11.23	25.9	30.1
P1031 Unit 414 4th	19.88	23.34	14.82	25.3	30.1
P1031 Unit 514 5th	19.51	23.34	16.41	25	30.1
P1031 Unit 614 6th	19.87	23.34	14.87	25.2	30.1
P1031 Unit 714 7th	21.3	25.11	15.17	29.4	36.1
P1031 Unit 814 8th	30.69	28.36	-8.22	48.6	46.9
P1031 Unit 115 1st	30.14	27.25	-10.61	45.9	49.1
P1031 Unit 215 2nd	22.84	24.25	5.81	32.6	38.6
P1031 Unit 315 3rd	23.42	24.25	3.42	33	38.6
P1031 Unit 415 4th	22.95	24.25	5.36	32.6	38.6
P1031 Unit 515 5th	23.78	24.25	1.94	33.2	38.6
P1031 Unit 615 6th	29.48	27.33	-7.87	44.7	48.9
P1031 Unit 116 1st	29.99	27.25	-10.06	45.8	49.1
P1031 Unit 216 2nd	22.3	24.25	8.04	32.2	38.6
P1031 Unit 316 3rd	22.99	24.25	5.2	32.7	38.6
P1031 Unit 416 4th	23.16	24.25	4.49	32.8	38.6
P1031 Unit 516 5th	23.1	24.25	4.74	32.8	38.6
P1031 Unit 616 6th	29.58	27.33	-8.23	44.8	48.9
P1031 Unit 117 1st	28.66	26.49	-8.15	43.1	46.5
P1031 Unit 217 2nd	21.62	23.49	7.96	30.5	36.1
P1031 Unit 317 3rd	22.68	23.49	3.45	31.2	36.1
P1031 Unit 417 4th	23.5	23.49	-0.04	31.9	36.1
P1031 Unit 517 5th	22.37	23.49	4.77	31	36.1
P1031 Unit 617 6th	29.49	26.7	-10.45	44	46.8
P1031 Unit 118 1st	21.64	23.61	8.34	28.7	36
P1031 Unit 218 2nd	19.8	20.7	4.35	23	26
P1031 Unit 318 3rd	18.93	20.7	8.55	22.2	26
P1031 Unit 418 4th	19.96	20.7	3.57	23.2	26
P1031 Unit 518 5th	18.67	20.7	9.81	22	26
P1031 Unit 618 6th	19.02	20.7	8.12	22.3	26
P1031 Unit 718 7th	18.13	20.7	12.42	21.5	26
P1031 Unit 815 8th	18.28	19.6	6.73	21.7	25.2
P1031 Unit 119 1st	19.24	22.24	13.49	22.9	31.2
P1031 Unit 219 2nd	18.45	19.84	7.01	20.2	22.9
P1031 Unit 319 3rd	18.26	19.84	7.96	20	22.9
P1031 Unit 419 4th	19.92	19.84	-0.4	21.6	22.9

Plot	DER	TER	CO ₂ Percentage Improvement %	DFEE	TFEE
P1031 Unit 519 5th	18.78	19.84	5.34	20.5	22.9
P1031 Unit 619 6th	20.09	19.84	-1.26	21.8	22.9
P1031 Unit 719 7th	17.66	19.84	10.99	19.4	22.9
P1031 Unit 816 8th 816	18.04	19.84	9.07	19.8	22.9
P1031 Unit 120 1st	21.95	26.02	15.64	27.2	36.3
P1031 Unit 220 2nd	21.15	23.49	9.96	24.4	27.6
P1031 Unit 320 3rd	23.18	23.49	1.32	26.6	27.6
P1031 Unit 420 4th	26.36	23.49	-12.22	30.3	27.6
P1031 Unit 520 5th	22.23	23.49	5.36	25.6	27.6
P1031 Unit 620 6th	21.55	23.49	8.26	24.8	27.6
P1031 Unit 720 7th	19.85	23.49	15.5	23.2	27.6
P1031 Unit 817 8th 817	20.68	23.49	11.96	24	27.6
P1031 Unit 121 1st	24.85	27.48	9.57	33.8	43.7
P1031 Unit 221 2nd	23.42	24.84	5.72	30.5	34.9
P1031 Unit 321 3rd	23.59	24.84	5.03	30.6	34.9
P1031 Unit 421 4th	22.55	24.84	9.22	29.8	34.9
P1031 Unit 521 5th	22.03	24.84	11.31	29.4	34.9
P1031 Unit 621 6th	23.33	24.84	6.08	30.4	34.9
P1031 Unit 721 7th	22.5	24.84	9.42	29.8	34.9
P1031 Unit 818 8th 818	21.92	24.46	10.38	28.9	33.6
P1031 Unit 122 1st	26.33	26.76	1.61	39.1	47.1
P1031 Unit 222 2nd	22.5	23.46	4.09	31.5	36.1
P1031 Unit 322 3rd	22.93	23.46	2.26	31.8	36.1
P1031 Unit 422 4th	24.22	23.46	-3.24	32.8	36.1
P1031 Unit 522 5th	21.79	23.46	7.12	31.1	36.1
P1031 Unit 622 6th	21.57	23.46	8.06	30.9	36.1
P1031 Unit 722 7th	21.92	23.46	6.56	31.2	36.1
P1031 Unit 819 8th 819	22.5	23.46	4.09	31.5	36.1
P1031 Unit 123 1st	24.48	27.35	10.49	33.8	43.8
P1031 Unit 223 2nd	24.14	24.71	2.31	31.5	35
P1031 Unit 323 3rd	22	24.71	10.97	29.7	35
P1031 Unit 423 4th	22.72	24.71	8.05	30.2	35
P1031 Unit 523 5th	22.77	24.71	7.85	30.3	35
P1031 Unit 623 6th	21.37	24.71	13.52	29.2	35
P1031 Unit 723 7th	22.18	24.71	10.24	29.8	35
P1031 Unit 820 8th 820	22.42	24.71	9.27	30	35
P1031 Unit 901 9th	23.07	26.81	13.95	50.8	56.4
P1031 Unit 902 9th	21.67	24.8	12.62	47.6	51.5
P1031 Unit 903 9th	18.68	22.09	15.44	40.8	45.7
P1031 Unit 904 9th	21.67	25.12	13.73	43	47.4
P1031 Unit 905 9th	21.83	25.3	13.72	43.5	48

Plot	DER	TER	CO ₂ Percentage Improvement %	DFEE	TFEE
P1031 Unit 715 7th	29.08	27.33	-6.4	44.4	48.9
P1031 Unit 716 7th	29.37	27.33	-7.46	44.6	48.9
P1031 Unit 717 7th	27.39	26.7	-2.58	42.6	46.8
P1031 Unit 606 6th	28.64	22.96	-24.74	46.6	42.4

The following tables demonstrates the individual performance of each of the retail units.

Table 11: Retail Unit 1 Actual Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	13.90	4,652.33

Table 12: Retail Unit 2 Actual Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	9.60	2,139.84

Table 13: Retail Unit 2 Actual Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	19.10	12,449.38

Table 14: Retail Unit 2 Actual Carbon Emissions

Building Services	Baseline CO2 Emissions (kg CO2/m2/yr)	Baseline CO2 Emissions for overall development (kg CO2/ yr)
Total Regulated Emissions (Heating, Hot Water, Lighting, Fans & Pumps)	8.40	1,688.40

The following table demonstrates the reduction in CO₂ emissions based on an area weighted average calculation utilising a fabric first approach with renewable technology:

Table 5: Fabric First Results New-Build

Regulated Emissions	Baseline CO ₂ Emissions	Proposed Building CO ₂ Emissions	CO ₂ Emission Savings	% Reduction in CO ₂ Emissions
kg of CO ₂ /m ² /yr	24.65	22.41	2.24	9.08%
kg of CO ₂ /yr	316,632.45	287,859.36	28,773.09	

From the table above, it is demonstrated that the 9% reduction in CO₂ emissions against Part L 2013 Building Regulations have been met following significant fabric first improvements therefore meeting both policies set out with the adopted Manchester Core Strategy.

4 CONCLUSIONS

The completed development achieves a total reduction in CO₂ emissions of 9.08% over Building Regulations Part L 2013.

Policy EN6 of the Manchester Core Strategy requires a 15% over Building Regulations Part L1A 2010, however it is industry and auditor recognised that Building Regulations Part L 2013 is a 6% improvement over the 2010 version, therefore coupled with the 9% reduction this achieves the equivalent of 15.08% reduction over Building Regulations Part L 2010.

As this was achieved through significant fabric first improvements throughout the whole construction through the use of improved insulation in all fabric elements and enhanced mechanical and electrical services.

This conclusion is that the development complies with all appropriate planning policies and Building Regulations requirements.

5 APPENDICES

Appendix A – SAP Calculations

Appendix B – BRUKL documents

Appendix A

SAP Calculation

Appendix B

BRUKL Documents