

Energy Statement

85 Rochdale Road, Manchester

Job number: 13436

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2	05/12/2025	CT/MH	PK	Areas updated, minor amendments
3	23/03/2026	CT/MH	PK	Updated drawings

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1 Executive Summary

This report has been produced by Base Energy on behalf of McGoff Group and in support of the planning application for the development named as 85 Rochdale Road in Manchester. The development comprises of the erection of a 17-storey residential apartment building (Use Class C3 (a)), with associated access, amenity, landscaping, public realm, infrastructure and other associated works. Demolition of existing vacant building on site, comprising of ground floor retail and a first floor apartment falling under the requirements of The Greater Manchester Combined Local Authority and Manchester City Council.

It sets out the design approach with regards to energy, carbon dioxide emissions, and sustainability in order to ensure the development complies with:

- National Planning Policy
- The Greater Manchester Combined Local Authority, Places for everyone joint development plan, JP-S1 Sustainable Development and JP-S2 Carbon and Energy
- Manchester Core Strategy EN4 & EN6

The above policies require:

- A reduction in CO₂ over Part L 2021 targeting net zero carbon emissions
- A contribution to energy and carbon savings from renewable technology

The design of the development will incorporate energy efficient building fabric and services in addition to low carbon technology:

- Thermal specification meeting and exceeding Part L 2021 notional U-values
- A design which limits air permeability, targeting 3
- A design which limits thermal bridging
- Energy saving building services including low energy lighting, and mechanical ventilation with heat recovery
- Low carbon VRF (Air Source Heat Pumps), Hot Water Heat Pumps and Solar PV Panels

This results in a 71% reduction in CO₂ emissions over Part L 2021 for the domestic development and a 8% reduction in CO₂ emissions over Part L 2021 for the communal areas.

2 Proposed Development

The development site is located on land at 85 Rochdale Road in Manchester.

The development proposals are for erection of a 17-storey residential apartment building (Use Class C3 (a)), with associated access, amenity, landscaping, public realm, infrastructure and other associated works. Demolition of existing vacant building on site, comprising of ground floor retail and a first floor apartment.

The development is considered major, given its provision of 153 apartments.

Aspects of the site location, shape, and surroundings (in particular the adjacent buildings), along with any other requirements of planning, use type, and scale will naturally constrain the development proposals in terms of the layout, positioning, and orientation of the proposed development. Subsequently, these constraints will impact on the feasibility of certain renewable technologies (as discussed in Section 4 of this report).

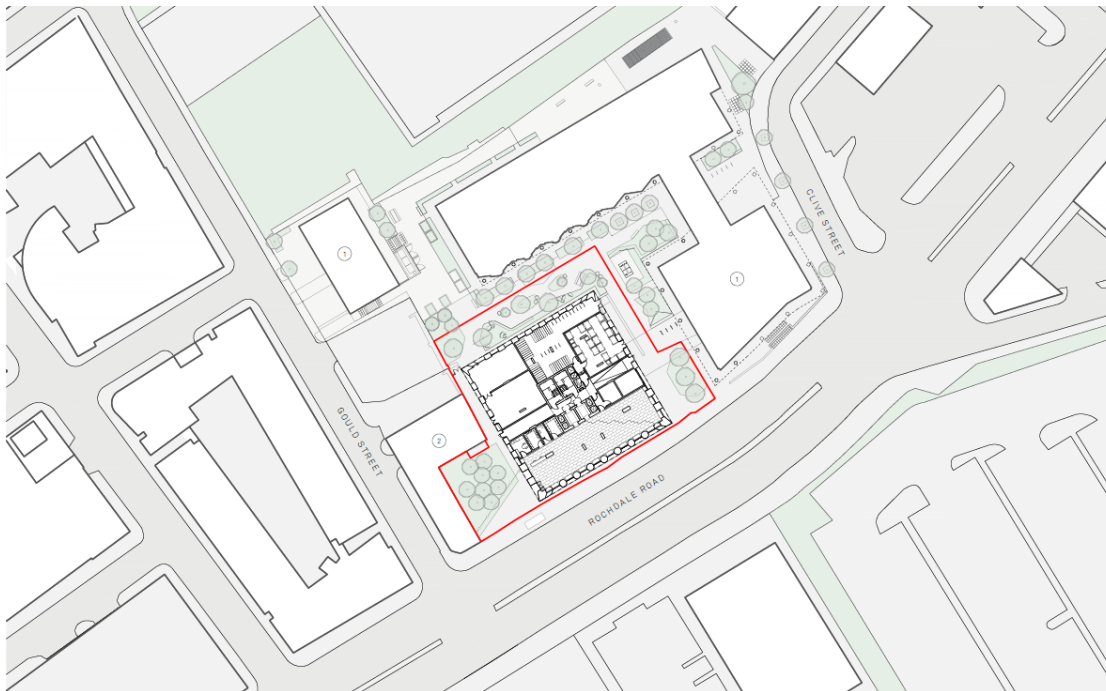


Figure 2.1: Site Location and proposals

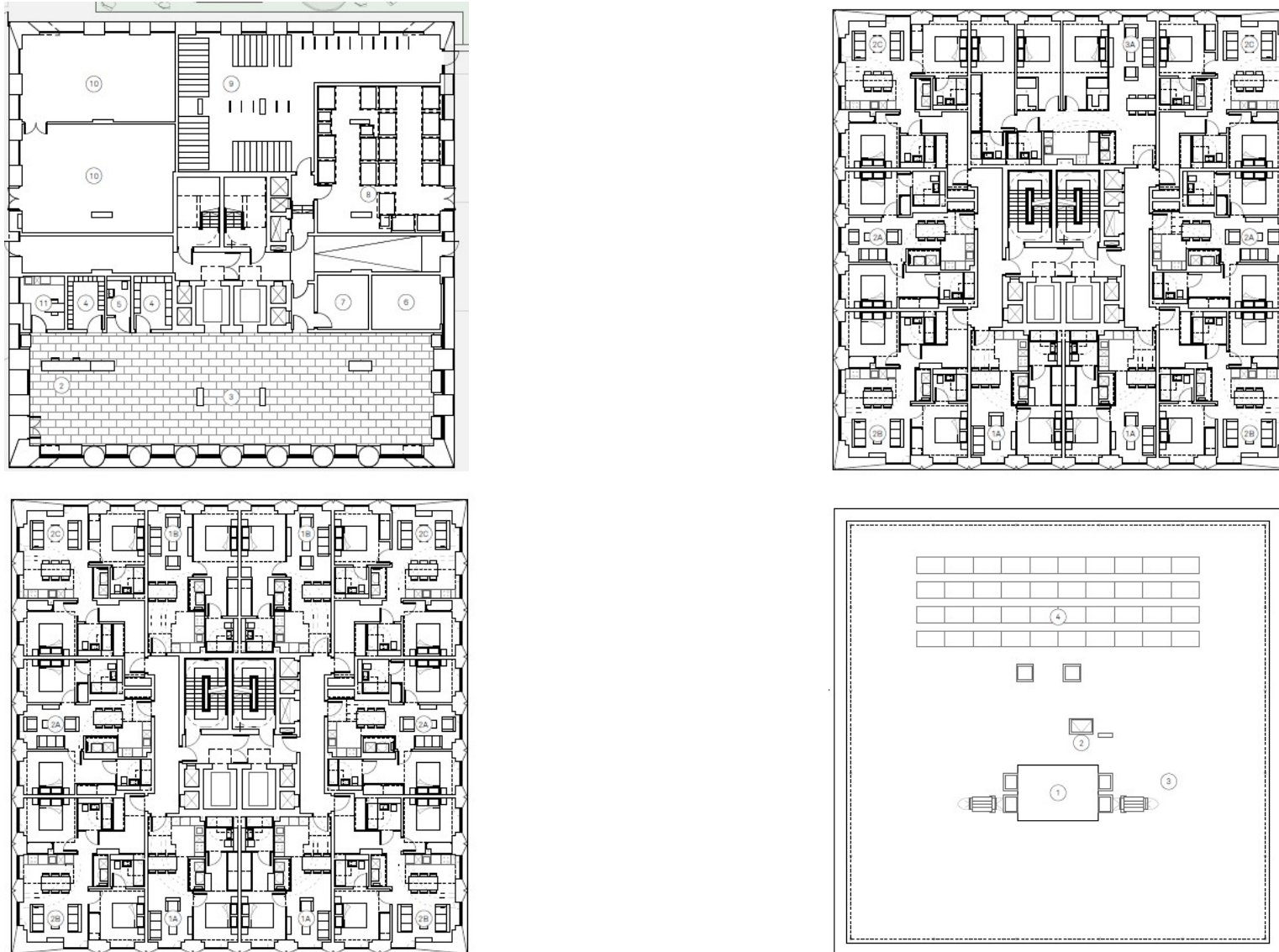


Figure 2.2: Proposals (Floor Plans)

3 Planning Policy

National Planning Policy Framework 2025

The NPPF was updated in February 2025 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Manchester City Council Core Strategy Development Plan Document:

- **Manchester Core Strategy EN4** - Reducing CO2 Emissions by Enabling Low and Zero Carbon Development
 - 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.
- **Manchester Core Strategy 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 1,000m² will be expected to produce an energy statement, as part of the Design and Access Statement to show how current PART L 1 2021 will be achieved. Such a statement will be expected to set out the projected regulated energy demand and associated CO2 emissions for all phases of the development.
 - The 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 Greater Manchester Combined Authority

The relevant Local Planning Policy requirements are as follows.

Places for Everyone joint development plan, JP-S1 Sustainable Development and JP-S2 Carbon and Energy

The development should target:

- Be Net Zero Carbon where feasible
 - From adoption to regulated operational carbon emissions
 - From 2028 to all emissions in construction
- As an interim measure, development should be consistent with 2022 Part L building regulations (this would be the current Part L 2021)
- From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions.

Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy.

Achieve the targets set for major development 10+ properties in the 'Energy and Carbon Proforma' Spreadsheet (Appendix 1) as set out below:

- Space heating demand <15 kWh/m²GIA/yr
- Energy Use Intensity <35 kWh/m²GIA/yr
- Solar PV is required where feasible to meet 40% of the ground floor area
- Fossil Fuel Free
- Reduce over heating risk
- Minimise embodied carbon

Based on the above the properties are aiming to go beyond Part L 2021 building regulations where feasible.

4 Methodology

The Standard Assessment Procedure (SAP) is the UK Government methodology for assessing and calculating the energy performance of dwellings.

The Simplified Building Energy Model (SBEM) is the UK Government methodology for assessing and calculating the energy performance of non-domestic buildings.

SAP and SBEM calculations take into account a range of factors that contribute to energy efficiency, including:

- Materials used for the construction and the thermal insulation of the building fabric (u-values¹ and thermal mass)
- Air permeability
- Efficiency, fuel source, and control of heating and cooling systems
- Ventilation system energy use and heat recovery
- Lighting energy
- Low carbon and energy saving or generating technologies

Approved Document Part L of current Building Regulations addresses the conservation of fuel and power. Part L is divided into two separate documents:

- Part L1 Newly constructed and extended or renovated existing dwellings
- Part L2 Newly constructed and extended or renovated existing non-domestic buildings

To comply with Part L, the calculations should demonstrate how the building will either meet or achieve a percentage reduction in the Building Emission Rate (BER) under the required Target Emission Rate (TER).

The calculation software has been used to calculate a baseline of energy demand and carbon dioxide emissions as appropriate from which any reductions or contributions have been measured.

¹ U-values (Thermal Transmittance) - the measure of the overall rate of heat transfer by all mechanisms under standard conditions, through a particular section of a construction. Lower u-values mean better thermal insulation

5 Baseline Energy & CO₂

Energy modelling software has been used to calculate a baseline for the development. This forms the basis from which compliance with planning policy has been measured.

Table 5.1: Average Residential Baseline CO₂

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Total Baseline Emissions (kg CO ₂ /year)
Baseline	11.88	111,553

The **Total Baseline CO₂ Emissions** for the development are shown to be 111,553 kg/year.

Table 5.2: Average Residential Baseline Energy Demand

	Energy Demand (kWh/m ² /year)	Total Baseline Energy Demand (kWh/year)
Baseline	65.34	613,543

The **Baseline Energy Demand** for the development is shown to be 613,543 kWh per year.

Table 5.3: Communal Areas Baseline CO₂

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Total Baseline Emissions (kg CO ₂ /year)
Baseline	2.20	4,445

The **Total Baseline CO₂ Emissions** for the communal areas are shown to be 4,445 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

Before considering low carbon energy generating technology the development has been designed to reduce energy demand through the first step of the energy hierarchy by considering 'fabric first'. A thermally efficient building envelope will follow the design standards as set out below.

Table 6.0: Building Fabric Standards (including u-values W/m²K)

	Part L 2021 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development
Walls	0.26	0.18	0.17
Ground Floor	0.18	0.13	0.12
Roof	0.16	0.11	0.11
Windows	1.6	1.2	1.30
Air permeability	8.00	5.00	3.00

- Insulation: The specified building envelope is designed to meet and exceed the notional Part L targets and will help to limit the energy demand of the dwelling for space heating
- Thermal bridging: The design will seek to limit heat loss through thermal bridging targeting a global 'y-value' of 0.05

Once heat retention has been addressed the next step is to ensure energy consuming building services are efficient.

Residential Building Services:

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- Space & Water Heating: Electric panel heaters
- Heating Controls: Programmer and appliance thermostat
- Ventilation: mechanical ventilation with heat recovery SFP 0.89 and 85% efficiency, rigid ductwork

Communal Areas Building Services:

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 125 lumens per watt
- Lighting Controls: PIR Occupancy sensors throughout
- Provision for metering with alarms for 'out of range' values for the communal areas lighting
- Space Heating: VRF system to ground floor reception and amenity areas. Electric panel heaters to corridors.
- Water Heating: Instantaneous electric water heaters
- Ventilation: MVHR ventilation to ground floor reception and amenity areas. Corridors to be naturally ventilated.

7 Building Form and Heat Loss Envelope

Building Form – GMCA Net Zero Design Guidance

The GMCA emphasizes that **building form** plays a critical role in achieving Net Zero Carbon outcomes. Key principles include:

- **Compactness:** More compact building shapes (e.g. cubes or rectangles) reduce the surface area exposed to external conditions, which minimizes heat loss and improves energy efficiency
- **Orientation:** Buildings should be oriented to maximize solar gain and natural daylight, especially in colder months. This reduces reliance on artificial heating and lighting
- **Window Placement and Size:** Thoughtful window design—balancing daylight access with heat retention—is essential. Oversized or poorly placed windows can increase heat loss
- **Early Design Decisions:** GMCA guidance stresses that decisions about building form should be made early in the design process. These choices are more cost-effective than retrofitting or relying solely on high-spec materials
- **Integration with Energy Hierarchy:** Building form supports the GMCA's energy hierarchy: first minimize energy demand, then maximize efficiency, followed by renewable and low-carbon energy use

These strategies align with GMCA's **Places for Everyone** policies JP-S2 and JP-S3, and the **Truly Affordable Net Zero (TANZ)** standard, which aims for all new buildings to be Net Zero Carbon in operation by 2028

All dwelling across the development have been assessed and the average form factor has been worked out at 0.53 which is less than the requirement of ≤ 2 . The form factors range from 0.26-1.59 across the whole development.

8 Low Carbon Technology Review & Recommendations

Having set out an energy efficient design, the next step is to incorporate low carbon technology for energy generation. A number of technologies exist and should be specified where they:

- Comply with planning policy
- Are feasible for the site
- Are cost efficient
- Are appropriate for proposed development form and function
- Protect against fuel poverty
- Promote fuel security
- Reduce reliance on fossil fuels
- Reduce carbon emissions
- Reduce resource depletion
- Reduce pollution

Site location and development form and function will influence the suitability of different technologies through:

- Orientation
- Space (inside and outside of the buildings)
- Surrounding topography, structures, and natural features
- Wind speed
- Overshading
- Geology and ground conditions
- Building form, function, and density

In determining the most feasible renewable technologies for the dwelling, the following have been reviewed:

- Wind turbines
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Biomass
- Combined Heat and Power
- Photovoltaic Panels
- Solar water heating

WIND TURBINES

Wind turbines are used to produce electricity. They can be either pole mounted (in a suitably exposed position) or building mounted; building mounted systems need a sufficient wind speed at the structural height and both a structural survey and planning permission.

- Wind speed can be too low on low rise buildings
- Taller systems need sufficient space
- Wind resources very variable and unpredictable
- May need planning permission

Wind turbines technology is **not recommended** for this development

GROUND SOURCE HEAT PUMP (GSHP)

GSHPs use naturally occurring underground low-level heat in areas with appropriate geological features. Heat is transferred from the ground by either extracting and discharging (re-charging) water from/to the ground directly (open loop) or circulating water through pipes buried within the ground, (closed loop). The water is passed through a heat pump to transfer the heat from this water into a higher temperature water circuit to provide heating. The loop can be fitted horizontally (laid in a shallow trench) or vertically (in a borehole).

- Feasibility analysis is costly
- Suitable ground conditions required
- More capital intensive than air source heat pumps
- Can be more efficient and lower running costs than ASHPs
- Well suited to highly insulated buildings

Ground source heat pump technology is **not recommended** for this development

AIR SOURCE HEAT PUMP (ASHP)

ASHP systems absorb heat from outside air at a low temperature into a fluid which is then passed through an electrically driven compressor where its temperature is increased. There are two main types of ASHP systems: Air to Water systems distribute heat through wet central heating; Air to air produce warm air which is circulated by fans. For an ASHP system to be installed, there needs to be ample outdoor space for the external condensing unit; these units can also be noisy and blow out colder air to the neighbouring environment.

- Requires space for external plant and internal hot water tank for wet systems supplying DHW
- Can generate noise though quieter systems have been developed
- Least efficient when most needed
- Longer life than fossil fuel boilers
- High capital costs vs gas systems but lower than GSHPs
- Well suited to highly insulated buildings

Air source heat pump technology **is recommended** for this development in the form of hot-water heat pumps for the residential units and VRF for the ground floor communal areas.

BIOMASS

Biomass systems burn wood pellets, chips, or logs to provide heat in a single room, or to power central heating and hot water boilers. There needs to be ample space available for both the boiler and the storage of fuel. There will also be regular deliveries of fuel and therefore adequate site access is required.

- Carbon emissions are cyclical unlike fossil fuel
- Requires fuel storage space and bulk delivery
- Carbon 'neutral' fuel in isolation but supply side emissions are still present so not neutral overall
- Harmful particulate emissions impact air quality and health

Biomass technology **is not recommended** for this development

COMBINED HEAT AND POWER (CHP)

CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating engine or turbine, which in turn drives an alternator to generate electrical power. The heat emitted by the engine and exhaust gases is recovered and used to heat the building or to provide hot water.

- Reduces consumption of and reliance on grid electricity
- Works best with high and consistent heat and hot water demand
- Recovers waste energy
- Can export to the grid
- Uses fossil fuel
- Emissions on site rather than upstream
- Efficiency is sensitive to sizing

CHP **is not recommended** for this development

DISTRICT HEATING

District Heating systems provide multiple buildings or dwellings with heat and hot water from a central boiler house, or 'energy centre'. The system can provide heating or cooling which is transferred from the energy centre through a network of highly insulated pipes carrying the heated water to each dwelling.

- Economies of scale
- Frees up space in habitable areas of development
- Variety of systems
- Can make use of waste heat from industry
- Can be fossil fuel based and dependent

There are no existing or proposed heat networks or energy centres within a suitable radius from the development and there are no existing networks local to the site.

District heating **is not recommended** for this development

SOLAR PHOTOVOLTAIC (PV)

Solar PV cells (which are mounted together in panels or tiles on the roof) convert sunlight into electricity. The cells are made from layers of semi-conducting material; when the light shines on the cell, an electric field is created across the layers. Although PV cells are most effective in bright sunlight, they can still generate electricity on a cloudy day. The power of a PV cell is measured in kilowatts peak (kWp). Each PV panel produces 250 Watts to 420 Watts depending on the manufacture.

- Passive technology, requires no energy input from grid
- Does not require sunny days to generate power
- Capital costs can be high although payback is effective
- Needs sufficient roof space and orientation
- Zero site or upstream emissions
- Can export to the grid

Solar PV technology **is recommended** to serve the communal/landlord areas of the building. As there is limited unshaded roof space available, Solar PV is not a feasible option for the residential development.

SOLAR HOT WATER

Solar hot water systems absorb energy from the sun and transfer this energy using heat exchangers to heat water which can then be stored. Systems should be roof mounted and oriented to face between a south-east and south-west direction.

- Mostly passive technology but requires pump energy
- Not suitable for combi boilers and developments without roof space
- Lower CO₂ reductions than other technologies

Solar hot water technology **is not recommended** for this development

Low and Zero Carbon Technology Summary

The low and zero carbon technology review indicates that solar PV and an ASHP would be potentially feasible. The following low carbon technologies are recommended:

- 10kWp Solar PV to provide a renewable source of electricity for the communal areas
- VRF (Air-Source-Heat-Pumps) to provide space heating and cooling to ground floor reception and amenity areas
- ASHP water cylinders for residential domestic hot water with a SCOP 3.4 per flat

9 Low Carbon Technology – Renewable Energy Generation - Be Green

The selected Low Carbon Technology has been incorporated into the calculations and the results are set out below.

Table 9.1: Average Residential Baseline vs Be Green CO₂

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Total Baseline Emissions (kg CO ₂ /year)	Reduction in CO ₂
Baseline	11.88	111,553	N/A
Be Lean & Green Design	3.40	32,946	71%

The **CO₂ Emissions reduction** as a result of energy efficient fabric and services is shown to be 78,607 kg/year.

Table 9.2: Residential Baseline vs Be Green Energy Demand

	Energy Demand (kWh/m ² /year)	Total Baseline Energy Demand (kWh/year)	Reduction in Energy Demand
Baseline	65.34	613,543	N/A
Be Green Design	36.01	338,134	46%

The **Energy Demand reduction** as a result of energy efficient fabric and services is shown to be 275,409 kWh per year

Table 9.3: Average Fabric Energy Efficiency

	Fabric Energy Efficiency (kWh/m ² /year)
Baseline	20.82
Be Lean	19.01

Table 9.4: Communal Areas Baseline vs Be Green CO₂

	CO ₂ Emission Rate (kg CO ₂ /m ² /year)	Total Baseline Emissions (kg CO ₂ /year)	Reduction in CO ₂
Baseline	2.20	4,445	N/A
Be Lean & Green Design	2.02	4,081	8%

The communal areas **CO₂ Emissions reduction** as a result of energy efficient fabric, services and LZC technology is shown to be 364 kg/year.

10 Conclusion

Proposals are for the development at 85 Rochdale Road in Manchester comprising the erection of a 17-storey residential apartment building (Use Class C3 (a)), with associated access, amenity, landscaping, public realm, infrastructure and other associated works. Demolition of existing vacant building on site, comprising of ground floor retail and a first floor apartment falling under the requirements of The Greater Manchester Combined Local Authority and Manchester City Council.

Under the local planning policy the proposed development is required to install low or zero carbon technologies were feasible.

Energy modelling software has been used to calculate a baseline against which compliance with the above can be measured.

The proposed development will be designed to limit energy demand through the inclusion of a thermally efficient building fabric and energy efficient services.

Low and zero carbon technology will be incorporated and is to comprise, VRF (Air Source Heat Pumps), Hot Water Heat Pumps (ASHP) and Solar PV.

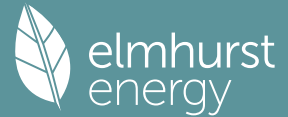
This results in a 71% CO₂ reduction over Part L 2021 for the residential development and a 8% CO₂ reduction over Part L 2021 for the communal areas of the development.

Energy Use Intensity calculations have been carried out which show the average space heating demand for the development is 12.3 kWh/m². The summary calculation can be seen in the appendices of this report.

This Energy Statement and the calculations on which it is based demonstrate that the proposed development complies with the local planning policy requirements.

11 **Appendix 1 Be Green DER/TER SAP Worksheets**

Full SAP Calculation Printout



Plot Reference	S13436 01.01				Issued on Date	16/03/2026	
Assessment Reference	Be Green			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	82 B	DER	4.71	TER	14.12		
Environmental	96 A	% DER < TER				66.64	
CO ₂ Emissions (t/year)	0.3	DFEE	29.12	TFEE	33.64		
Compliance Check	See BREL	% DFEE < TFEE				13.44	
% DPER < TPER	36.41	DPER	49.13	TPER	77.26		
Assessor Details	Mr. Peter Kinsella				Assessor ID	L770-0002	
Client	Davies Partnership, Davies Partnership						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	68.5800 (1b)	2.4000 (2b)	164.5920 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.5800		164.5920 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 164.5920 (5)

2. Ventilation rate

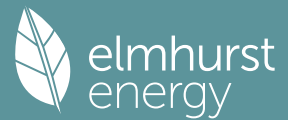
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												68.0000 (23c)
Effective ac	0.3226	0.3194	0.3162	0.3003	0.2971	0.2811	0.2811	0.2779	0.2875	0.2971	0.3034	0.3098 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
All other Windows			18.0000	1.2357	22.2433		(27)
Heat Loss Floor 1			68.5800	0.1200	8.2296	75.0000	5143.5000 (28a)
External Wall 1	39.3360	18.0000	21.3360	0.1700	3.6271	14.0000	298.7040 (29a)
Total net area of external elements Aum(A, m ²)			107.9160				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1001		(33)
Main dwelling							
Party Wall 1			45.0000	0.0000	0.0000	20.0000	900.0000 (32)
Corridor wall			5.6600	0.0000	0.0000	20.0000	113.2000 (32)
Party Ceilings 1			68.5800			30.0000	2057.4000 (32b)
Internal Wall 1			116.8300			9.0000	1051.4700 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9564.2740 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.4616 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							5.3958 (36)
Point Thermal bridges						(36a) =	0.0000

Full SAP Calculation Printout



Total fabric heat loss (33) + (36) + (36a) = 39.4959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	17.5201	17.3470	17.1738	16.3082	16.1351	15.2694	15.2694	15.0963	15.6157	16.1351	16.4813	16.8276 (38)
Heat transfer coeff	57.0160	56.8428	56.6697	55.8041	55.6309	54.7653	54.7653	54.5921	55.1115	55.6309	55.9772	56.3234 (39)
Average = Sum(39)m / 12 =												55.7608

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8314	0.8289	0.8263	0.8137	0.8112	0.7986	0.7986	0.7960	0.8036	0.8112	0.8162	Dec 0.8213 (40)
HLP (average)												0.8131
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2112 (42)

Hot water usage for mixer showers 84.2786 83.0121 81.1665 77.6353 75.0293 72.1232 70.4713 72.3030 74.3108 77.4311 81.0382 83.9557 (42a)

Hot water usage for baths 26.4815 26.0882 25.5343 24.5132 23.7485 22.9007 22.4427 22.9927 23.5915 24.4987 25.5409 26.3919 (42b)

Hot water usage for other uses 37.2745 35.9191 34.5636 33.2082 31.8528 30.4973 30.4973 31.8528 33.2082 34.5636 35.9191 37.2745 (42c)

Average daily hot water use (litres/day) 136.1405 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.0346	145.0194	141.2645	135.3567	130.6306	125.5212	123.4114	127.1484	131.1104	136.4934	142.4981	147.6222 (44)
Energy conte	234.4506	206.5056	217.1182	185.2965	175.8539	154.3429	149.2553	157.4363	161.6723	185.2203	203.0147	231.1407 (45)
Energy content (annual)										Total = Sum(45)m =		2261.3074
Distribution loss (46)m = 0.15 x (45)m	35.1676	30.9758	32.5677	27.7945	26.3781	23.1514	22.3883	23.6154	24.2508	27.7830	30.4522	34.6711 (46)
Water storage loss (or HIU loss):												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	261.4020	230.8488	244.0696	211.3785	202.8053	180.4249	176.2067	184.3877	187.7543	212.1717	229.0967	258.0921 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	261.4020	230.8488	244.0696	211.3785	202.8053	180.4249	176.2067	184.3877	187.7543	212.1717	229.0967	258.0921 (64)
12Total per year (kWh/year)												2578.6384 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	77.9548	68.6631	72.1918	61.6111	58.4714	51.3190	49.6274	52.3476	53.7560	61.5857	67.5024	76.8543 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.8308	108.3126	97.8308	101.0918	97.8308	101.0918	97.8308	97.8308	101.0918	97.8308	101.0918	97.8308 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.9604	195.9731	190.9012	180.1036	166.4736	153.6633	145.1053	143.0926	148.1645	158.9621	172.5921	185.4024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465 (71)
Water heating gains (Table 5)	104.7780	102.1773	97.0320	85.5709	78.5906	71.2764	66.7035	70.3596	74.6612	82.7765	93.7533	103.2988 (72)
Total internal gains	452.7366	462.6304	441.9314	422.9338	399.0624	382.1990	365.8070	367.4504	380.0849	395.7369	423.6047	442.6993 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Southwest	10.8000	36.7938	0.3500	0.0000	0.7700	107.0921 (79)						
Northwest	7.2000	11.2829	0.3500	0.0000	0.7700	21.8934 (81)						
Solar gains	128.9855	226.9822	329.8830	441.1176	523.6404	532.8526	508.3172	444.7642	368.0912	256.0718	155.8193	109.5278 (83)
Total gains	581.7222	689.6127	771.8144	864.0514	922.7028	915.0516	874.1242	812.2146	748.1762	651.8086	579.4239	552.2271 (84)

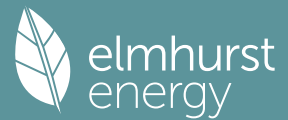
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	46.5965	46.7384	46.8812	47.6084	47.7566	48.5115	48.5115	48.6653	48.2067	47.7566	47.4612	47.1694
alpha	4.1064	4.1159	4.1254	4.1739	4.1838	4.2341	4.2341	4.2444	4.2138	4.1838	4.1641	4.1446

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util living area	0.9440	0.8995	0.8293	0.6968	0.5377	0.3789	0.2748	0.3077	0.4934	0.7562	0.9043	0.9523 (86)
MIT	19.9367	20.2213	20.5199	20.8060	20.9436	20.9900	20.9980	20.9968	20.9704	20.7726	20.3264	19.8875 (87)
Th 2	20.2262	20.2284	20.2306	20.2415	20.2437	20.2546	20.2546	20.2568	20.2502	20.2437	20.2393	20.2349 (88)
util rest of house												
MIT 2	0.9356	0.8859	0.8081	0.6657	0.4990	0.3361	0.2286	0.2586	0.4441	0.7216	0.8890	0.9450 (89)
Living area fraction	18.9947	19.3461	19.7071	20.0451	20.1931	20.2474	20.2536	20.2550	20.2273	20.0183	19.4897	18.9401 (90)
MIT	19.3013	19.6309	19.9716	20.2927	20.4373	20.4891	20.4958	20.4965	20.4692	FLA = Living area / (4) = 20.2638	19.7620	0.3255 (91)
Temperature adjustment												19.2484 (92)
adjusted MIT	19.3013	19.6309	19.9716	20.2927	20.4373	20.4891	20.4958	20.4965	20.4692	20.2638	19.7620	0.0000 (93)
8. Space heating requirement												
Utilisation	Jan 0.9236	Feb 0.8739	Mar 0.8005	Apr 0.6679	May 0.5091	Jun 0.3497	Jul 0.2436	Aug 0.2745	Sep 0.4587	Oct 0.7226	Nov 0.8781	Dec 0.9337 (94)
Useful gains	537.3021	602.6808	617.8185	577.0887	469.7328	319.9830	212.9452	222.9539	343.1839	470.9880	508.7755	515.5920 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	855.3114	837.3475	763.4343	635.7593	486.0664	322.5187	213.3570	223.6343	351.0143	537.6072	708.7828	847.5798 (97)
Space heating kWh	236.5989	157.6961	108.3382	42.2428	12.1522	0.0000	0.0000	0.0000	0.0000	49.5647	144.0053	246.9990 (98a)
Space heating requirement - total per year (kWh/year)												997.5971
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	236.5989	157.6961	108.3382	42.2428	12.1522	0.0000	0.0000	0.0000	0.0000	49.5647	144.0053	246.9990 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												997.5971
Space heating per m2										(98c) / (4) =		14.5465 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan 236.5989	Feb 157.6961	Mar 108.3382	Apr 42.2428	May 12.1522	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 49.5647	Nov 144.0053	Dec 246.9990 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	236.5989	157.6961	108.3382	42.2428	12.1522	0.0000	0.0000	0.0000	0.0000	49.5647	144.0053	246.9990 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	261.4020	230.8488	244.0696	211.3785	202.8053	180.4249	176.2067	184.3877	187.7543	212.1717	229.0967	258.0921 (64)
Efficiency of water heater (217)m	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288	338.0288 (216)
Fuel for water heating, kWh/month	77.3313	68.2926	72.2038	62.5327	59.9965	53.3756	52.1277	54.5479	55.5439	62.7673	67.7743	76.3521 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	21.2498	19.1934	21.2498	20.5643	21.2498	20.5643	21.2498	21.2498	20.5643	21.2498	20.5643	21.2498 (231)
Lighting	20.3273	16.3073	14.6829	10.7573	8.3093	6.7888	7.5800	9.8528	12.7978	16.7914	18.9658	20.8923 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												997.5971 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												338.0288
Water heating fuel used												762.8457 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2460)												
mechanical ventilation fans (SFP = 1.2460)												250.1996 (230a)
Total electricity for the above, kWh/year												250.1996 (231)
Electricity for lighting (calculated in Appendix L)												164.0530 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2174.6953 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	997.5971	0.1571	156.7640 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	762.8457	0.1412	107.7333 (264)
Space and water heating			264.4973 (265)
Pumps, fans and electric keep-hot	250.1996	0.1387	34.7058 (267)
Energy for lighting	164.0530	0.1443	23.6779 (268)
Total CO2, kg/year			322.8810 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	997.5971	1.5817	1577.9092 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	762.8457	1.5222	1161.2170 (278)
Space and water heating			2739.1261 (279)
Pumps, fans and electric keep-hot	250.1996	1.5128	378.5019 (281)
Energy for lighting	164.0530	1.5338	251.6299 (282)
Total Primary energy kWh/year			3369.2580 (286)
Dwelling Primary energy Rate (DPER)			49.1300 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	68.5800 (1b)	x 2.4000 (2b)	= 164.5920 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.5800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 164.5920 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1215 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3715 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3158 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	5.0000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3474	0.3395	0.3000	0.3000	0.2921	0.3158	0.3395	0.3553	0.3710 (22b)
Effective ac	0.5811	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688 (25)

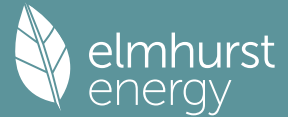
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opening Type			17.1500	1.1450	19.6374		(27)
Heat Loss Floor 1			68.5800	0.1300	8.9154		(28a)
External Wall 1	39.3360	17.1500	22.1860	0.1800	3.9935		(29a)
Total net area of external elements Aum(A, m2)			107.9160				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.5463		(33)
Main dwelling							

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581	110.5581 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.8308	108.3126	97.8308	101.0918	97.8308	101.0918	97.8308	97.8308	101.0918	97.8308	101.0918	97.8308 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.9604	195.9731	190.9012	180.1036	166.4736	153.6633	145.1053	143.0926	148.1645	158.9621	172.5921	185.4024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558	34.0558 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465	-88.4465 (71)
Water heating gains (Table 5)	138.6114	136.3279	131.9290	122.2875	116.3819	110.2090	106.4175	109.5498	113.2224	120.0718	129.3143	137.3786 (72)
Total internal gains	489.5700	499.7811	479.8284	462.6503	439.8537	421.1316	405.5210	406.6406	418.6461	436.0321	462.1657	479.7792 (73)

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Northwest	6.8600		11.2829		0.6300		0.7000		0.7700		23.6547 (81)	
Solar gains	139.3624	245.2429	356.4221	476.6055	565.7672	575.7205	549.2113	480.5455	397.7042	276.6728	168.3549	118.3393 (83)
Total gains	628.9324	745.0240	836.2505	939.2559	1005.6210	996.8521	954.7323	887.1861	816.3503	712.7049	630.5206	598.1185 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7731	34.8511	34.9279	35.2931	35.3623	35.6879	35.6879	35.7489	35.5618	35.3623	35.2226	35.0778
alpha	3.3182	3.3234	3.3285	3.3529	3.3575	3.3792	3.3792	3.3833	3.3708	3.3575	3.3482	3.3385
util living area	0.9491	0.9154	0.8622	0.7583	0.6163	0.4565	0.3370	0.3758	0.5744	0.8046	0.9184	0.9557 (86)
MIT	19.3518	19.6753	20.0716	20.5156	20.8073	20.9477	20.9857	20.9793	20.8861	20.4926	19.8561	19.2942 (87)
Th 2	19.9894	19.9914	19.9934	20.0028	20.0045	20.0127	20.0127	20.0142	20.0095	20.0045	20.0010	19.9973 (88)
util rest of house	0.9404	0.9018	0.8407	0.7234	0.5662	0.3927	0.2639	0.2990	0.5072	0.7672	0.9029	0.9480 (89)
MIT 2	18.0978	18.4997	18.9849	19.5137	19.8339	19.9767	20.0060	20.0038	19.9236	19.5041	18.7382	18.0312 (90)
Living area fraction	18.5059	18.8823	19.3385	19.8398	20.1507	20.2927	20.3248	20.3213	20.2369	fLA = Living area / (4) =	19.1020	18.4423 (91)
MIT	18.5059	18.8823	19.3385	19.8398	20.1507	20.2927	20.3248	20.3213	20.2369	19.8258	19.1020	18.4423 (92)
Temperature adjustment	18.5059	18.8823	19.3385	19.8398	20.1507	20.2927	20.3248	20.3213	20.2369	19.8258	19.1020	0.0000
adjusted MIT	18.5059	18.8823	19.3385	19.8398	20.1507	20.2927	20.3248	20.3213	20.2369	19.8258	19.1020	18.4423 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9240	0.8837	0.8247	0.7173	0.5739	0.4112	0.2873	0.3233	0.5233	0.7597	0.8859	0.9326 (94)
Useful gains	581.1434	658.3983	689.6255	673.6986	577.1385	409.9268	274.2617	286.8564	427.2154	541.4178	558.5898	557.7894 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1085.3640	1065.8899	976.5458	823.5081	634.8953	423.7876	277.2916	291.4177	458.4718	693.1311	905.2795	1078.6908 (97)
Space heating kWh	375.1402	273.8343	213.4687	107.8628	42.9711	0.0000	0.0000	0.0000	0.0000	112.8747	249.6166	387.5507 (98a)
Space heating requirement - total per year (kWh/year)												1763.3191
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	375.1402	273.8343	213.4687	107.8628	42.9711	0.0000	0.0000	0.0000	0.0000	112.8747	249.6166	387.5507 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1763.3191
Space heating per m2										(98c) / (4) =		25.7119 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	375.1402	273.8343	213.4687	107.8628	42.9711	0.0000	0.0000	0.0000	0.0000	112.8747	249.6166	387.5507 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	406.4357	296.6786	231.2771	116.8611	46.5559	0.0000	0.0000	0.0000	0.0000	122.2912	270.4405	419.8815 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	216.6219	191.5709	203.7403	179.9155	174.8765	158.1120	156.5435	162.5341	164.0436	182.2574	192.9403	214.3824 (64)
Efficiency of water heater (217)m	85.2792	84.8605	84.1645	82.9511	81.4279	79.8000	79.8000	79.8000	79.8000	83.0180	84.6384	79.8000 (216)
Fuel for water heating, kWh/month	254.0149	225.7481	242.0738	216.8933	214.7624	198.1354	196.1698	203.6768	205.5684	219.5397	227.9584	85.3708 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	20.3273	16.3073	14.6829	10.7573	8.3093	6.7888	7.5800	9.8528	12.7978	16.7914	18.9658	20.8923 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-5.0916	-8.0076	-12.8224	-16.1143	-18.9473	-18.2775	-18.0573	-16.2443	-13.3739	-9.8471	-5.8839	-4.3108 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-0.8152	-1.7996	-3.7433	-5.8798	-8.0383	-8.1755	-8.0793	-6.7170	-4.7658	-2.6533	-1.1127	-0.6385 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1910.4215 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2655.6601 (219)
Space cooling fuel												0.0000 (221)

Full SAP Calculation Printout



Electricity for pumps and fans:	86.0000 (231)
Total electricity for the above, kWh/year	
Electricity for lighting (calculated in Appendix L)	164.0530 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-199.3964 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4616.7382 (238)

----- 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1910.4215	0.2100	401.1885 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2655.6601	0.2100	557.6886 (264)
Space and water heating			958.8771 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	164.0530	0.1443	23.6779 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-146.9781	0.1324	-19.4574
PV Unit electricity exported	-52.4182	0.1246	-6.5321
Total			-25.9895 (269)
Total CO2, kg/year			968.4948 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.1200 (273)

----- 13a. Primary energy - Individual heating systems including micro-CHP -----

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1910.4215	1.1300	2158.7763 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2655.6601	1.1300	3000.8959 (278)
Space and water heating			5159.6722 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	164.0530	1.5338	251.6299 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-146.9781	1.4891	-218.8704
PV Unit electricity exported	-52.4182	0.4574	-23.9740
Total			-242.8444 (283)
Total Primary energy kWh/year			5298.5585 (286)
Target Primary Energy Rate (TPER)			77.2600 (287)

12 Appendix 2 Communal Areas BRUKL document

Project name

85 Rochdale Road Communal Areas**As designed****Date:** Mon Mar 16 13:04:13 2026**Administrative information****Building Details****Address:** 85 Rochdale Road Communal Areas,
Manchester,**Certifier details****Name:****Telephone number:****Address:** , ,**Certification tool****Calculation engine:** SBEM**Calculation engine version:** v6.1.e.2**Interface to calculation engine:** DesignBuilder SBEM**Interface to calculation engine version:** v7.3.1**BRUKL compliance module version:** v6.1.e.1**Foundation area [m²]:** 113.46**The CO₂ emission and primary energy rates of the building must not exceed the targets**

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	2.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	2.02
Target primary energy rate (TPER), kWh _{PE} /m ² annum	22.99
Building primary energy rate (BPER), kWh _{PE} /m ² annum	20.63
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.17	0.17	00 - Circulation_P_6
Floors	0.18	0.12	0.12	00 - Circulation_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.14	0.14	08 - Communal Circ_R_4
Windows** and roof windows	1.6	1.3	1.3	00 - Circulation_G_10
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	6	-	1.4	0.8
Standard value	2.5*	5	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

2- EPH

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
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

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.001
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
Standard value		95	80	0.3
00 - Cycle Store		125	-	-
00 - Refuse		125	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
00 - Substation		125	-	-
00 - Circulation		125	-	-
00 - Parcel & Post 2		125	-	-
00 - Acc WC		125	-	-
00 - Parcel & Post		125	-	-
00 - Building Manager		125	-	-
00 - Amenity		125	125	1.08
01 - Communal Circ		125	-	-
02 - Communal Circ		125	-	-
08 - Communal Circ		125	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 - Circulation	NO (-9%)	NO
00 - Parcel & Post 2	N/A	N/A
00 - Acc WC	N/A	N/A
00 - Parcel & Post	N/A	N/A
00 - Building Manager	NO (-36.7%)	NO
00 - Amenity	NO (-11%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	2020.5	2020.5
External area [m ²]	3735.6	3735.6
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	724.29	723.17
Average U-value [W/m ² K]	0.19	0.19
Alpha value* [%]	9.87	7.11

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

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels
 Residential Institutions: Hospitals and Care Homes
 Residential Institutions: Residential Schools

22 Residential Institutions: Universities and Colleges

Secure Residential Institutions

78 Residential Spaces

Non-residential Institutions: Community/Day Centre
 Non-residential Institutions: Libraries, Museums, and Galleries
 Non-residential Institutions: Education
 Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.13	4.25
Cooling	0.1	0.17
Auxiliary	0.64	1.1
Lighting	4.52	5.91
Hot water	5.31	5.13
Equipment*	16.94	16.94
TOTAL**	16.7	16.55

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	3.57	1.28
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>3.57</i>	<i>1.28</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	66.97	64.81
Primary energy [kWh _{PE} /m ²]	20.63	22.99
Total emissions [kg/m ²]	2.02	2.2

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] No Heating or Cooling										
	Actual	166	199.5	0	0	0	0	0	0	0
	Notional	149.7	191.7	0	0	0	0	----	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	68.7	7.7	4.6	0.6	3.4	4.16	3.83	4.5	6
	Notional	59.1	14.5	6.2	0.9	5.9	2.64	4.4	----	----
[ST] Other local room heater - unfanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	21.3	0.7	7.4	0	0	0.8	0	1	0
	Notional	20.9	2.2	4.3	0	0	1.34	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

13 Appendix 3 Energy Use Intensity Calculation

Average unit EUI Calculation:

	Lighting (kWh)	Pumps & Fans (kWh)	Space Heating (kWh)	Cooling (kWh)	DHW (kWh)	Unregulated (kWh)	Total
Jan 01-31	20.9	14.4	171.4	0	61.5	133.3	401.5
Feb 01-28	19	13	122	0	55.5	120.4	329.9
Mar 01-31	21	15.3	91.5	0	61.5	133.3	322.6
Apr 01-30	20.3	13.9	59	0	59.5	129	281.7
May 01-31	21	14.4	10.1	6.6	61.5	133.3	246.9
Jun 01-30	20.3	50.7	0.6	11.6	61.5	133.3	278
Jul 01-31	21	52.4	0	69.7	59.5	129	331.6
Aug 01-31	21	52.4	0	165.8	61.5	133.3	434
Sep 01-30	20.3	59.6	3.2	8.5	61.5	133.3	286.4
Oct 01-31	21	14.4	42.7	0	59.5	129	266.6
Nov 01-30	20.3	13.9	109.5	0	61.5	133.3	338.5
Dec 01-31	21	14.4	150.7	0	59.5	129	374.6
Summed total	247.1	328.8	760.7	262.2	724	1569.5	3892.3
EUI (kWh/m ²)							63.0
Space Heating Demand (kWh/m ²) (SAP)							12.3

ENERGY USAGE INTENSITY (EUI) IN CONTEXT

Table 1 below illustrates the Energy Use Intensity (EUI) for 85 Rochdale Road compared with a range of industry benchmarks, including the GMCA PfE TANZ standard.

As shown, while 85 Rochdale Road does not meet the GMCA (LETI) target, it falls within the current CIBSE Online Benchmark, aligns with the RIBA Climate Challenge benchmark, and sits comfortably within the current UKGBC target.

The development's EUI also falls within the UK average for Passivhaus residential dwellings, which currently stands at 73 kWh/m²·yr. Notably, Passivhaus case studies for mid-rise apartments included in the GMCA TANZ guidance exceed the GMCA 35 kWh/m²·yr target.

It is worth noting that the absence of a clear, standardised industry methodology for assessing unregulated energy use (e.g. white goods and small power) in high-rise apartment buildings leaves this aspect open to interpretation — and potential misuse. In this assessment, we have aligned with current CIBSE guidance to ensure transparency and consistency. In accordance with GMCA guidance, PHPP and SAP methodologies have not been used for modelling. Instead, a Dynamic Simulation Model (DSM) approach has been adopted, as is appropriate for a building of this scale and complexity.

Source/ Framework	2025 EUI Target (kWh/m ² ·yr)	2030 EUI Target (kWh/m ² ·yr)
GMCA – Places for Everyone TANZ 2025	35	35
LETI Climate Emergency Design Guide (large/med residential)	35	35
UKGBC – New Homes Policy Playbook (2021)	70	35
RIBA Climate Challenge v2 - Domestic	60	35
CIBSE Online Energy Benchmarking Tool (2021)	85	-
85 Rochdale Road Result	63.0	

Table 1 – 85 ROCHDALE ROAD EUI Comparison against industry benchmarks

Table 2 below presents an extract from the CIBSE Online Energy Benchmarking Tool. As shown, an EUI of 63.0 for 85 Rochdale Road places the development within the top 13% of 64,393 apartments included in the CIBSE benchmark dataset, where a score of 85 is considered 'good practice'.

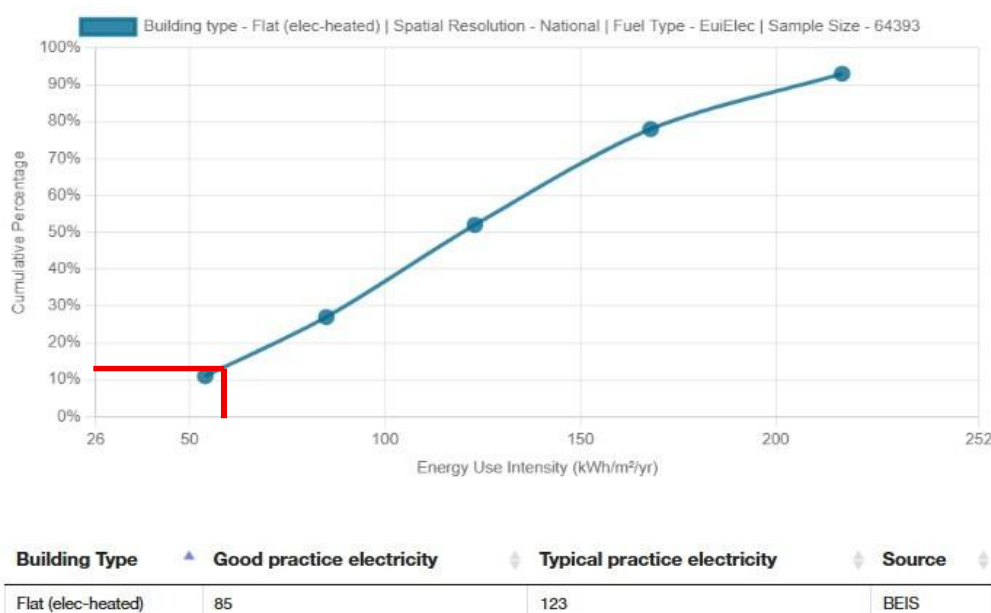


Table 2 – CIBSE Online Energy Benchmarking for Electric Apartments