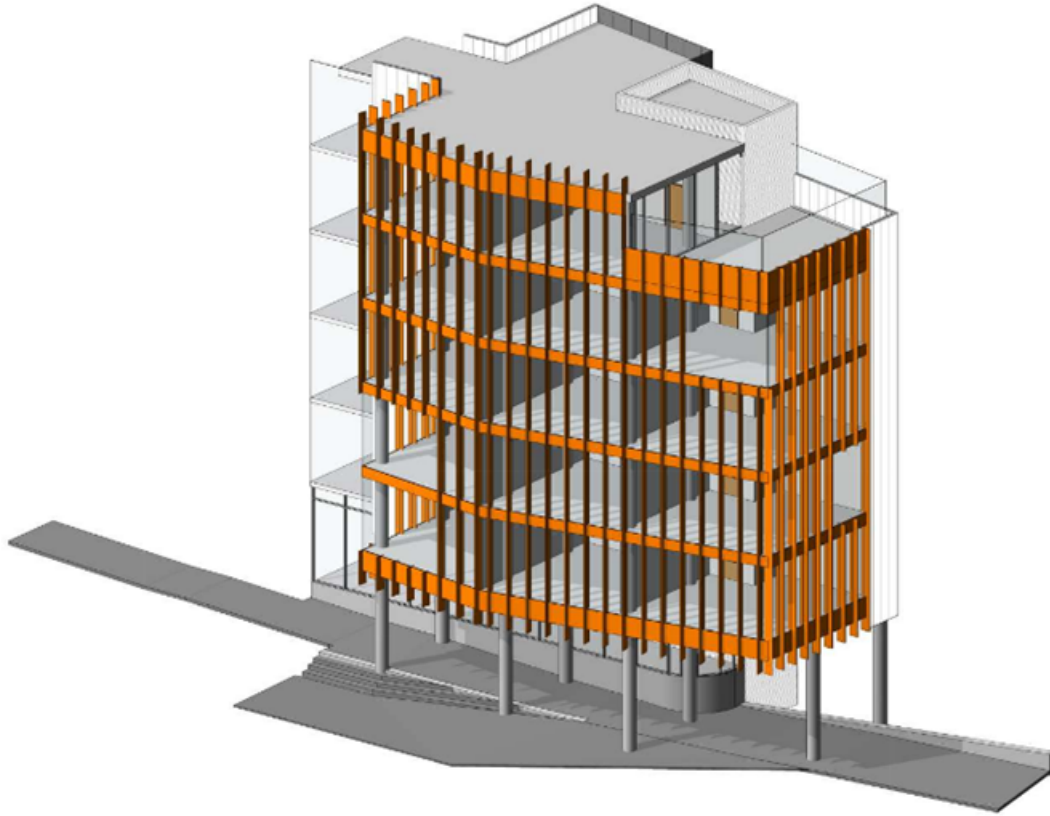




Rochdale 6th Form College Building Extension

Energy Statement for Planning Application

27 October 2022

RSFC-RSB-XX-RP-ES-XXXX

Revision A

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Executive Summary

This Energy & Sustainability Statement has been developed in support of the planning application for the proposed six-storey education building extension with basement located in Rochdale. The statement will evaluate the technical and economic feasibility of using both passive and low and zero carbon technologies and will assess the practical levels of CO₂ and energy reduction possible for this development to comply with the following Rochdale Borough Council planning requirements:

- Rochdale Adopted Core Strategy (2016)

The following low and zero carbon technologies have been evaluated:

- | | |
|--|-------------------------------|
| • Biomass | • Geothermal |
| • Wind | • Combined Heat & Power (CHP) |
| • Biogas | • Solar Hot Water |
| • Air Source Heat Pumps & Exhaust Air Heat Pumps | • Solar Photovoltaic |

The approach for the Rochdale Sixth Form College extension is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

- 1) Enhanced building fabric and air tightness to meet Building Regulations ADL2 (2021)
- 2) Heating and cooling will be provided to occupied areas by an air-to-air heat pump system
- 3) Hot water will be provided by local electric point of use heaters
- 4) Ventilation will be provided by mechanical ventilation with heat recovery (MVHR)
- 5) Lighting will be provided to all areas by high-efficacy LED-type fittings
- 6) Rooftop 100m² photovoltaic (PV) panel array (located on the existing roof)

An assessment of CO₂ emissions is made based on the Simplified Building Energy Model (SBEM) methodology to comply with Approved Document Part L2 (2021) and in line with the requirements of Rochdale Borough Council planning policy. The development will be provided with energy savings through the use of passive improvement measures, such as improved energy efficient system, prior to the application of renewable technologies. This passive approach to compliance will complement the integrated approach to the sustainable energy and carbon objectives of the national and local policies.

The principles of a 'Be Lean, Be Clean, Be Green' design philosophy have been applied, which results in a 2% carbon emissions improvement and a 3% primary energy improvement over the Building Regulations Part L2 (2021) baseline, as indicated in Table 1.

A full design specification that confirms inputs used within the energy model calculations is provided within the appendices of this report.

Table 1 – Summary of proposed building energy modelling results against Part L2 2021

	Total CO₂ Emissions (kgCO₂/yr)	Total Primary Energy (kWh/yr)
Target Building Performance	10,046	104,696
Proposed Building Performance	9,847	107,574
Total Reduction	199	2,878
Percentage Improvement (above ADL2 2021)	2.0%	2.7%

A full design specification that confirms inputs used within the Part L2 (2021) calculations is provided within the appendices of this report.

1. Introduction

The proposed development consists of a six-storey education building extension and basement located in Rochdale. The development is required to achieve compliance under Building Regulations Approved Document Part L2 (2021).

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

- Rochdale Adopted Core Strategy (2016)
- National Planning Policy Framework (2021)

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the energy hierarchy.

An assessment of CO₂ emissions is made based on the calculation methodology dictated by the Simplified Building Energy Model (SBEM) methodology to comply with Approved Document Part L2 (2021) and in line with the requirements of Rochdale Borough Council planning policy.

1.1. Location

The area for the proposed development in Rochdale is shown in Figure 1. Rochdale town centre is roughly one kilometre to the southeast of the site.

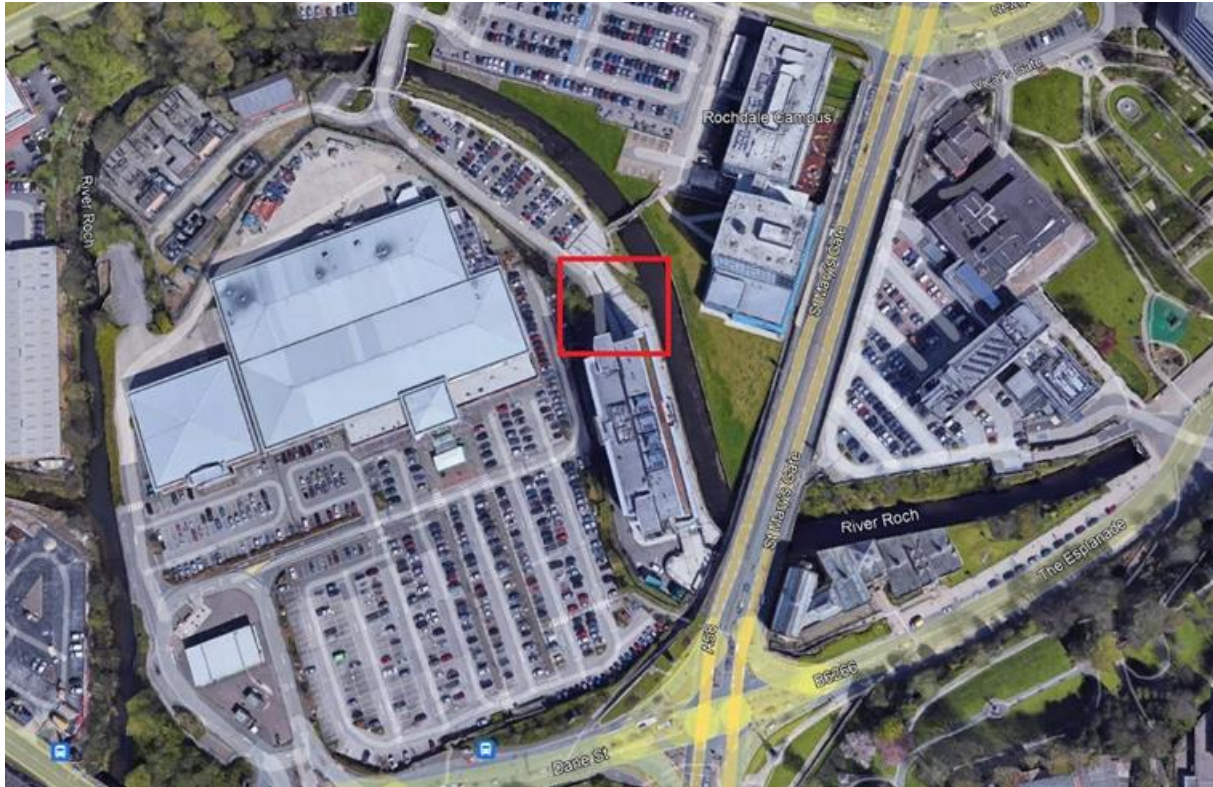


Figure 1 - Location and surrounding area of proposed Rochdale Sixth Form College extension

The site is accessed from College Road to the north of the site. The existing school building is located to the west of St Mary's Gate/Manchester Road, with an Asda superstore located to the west.

The site is a densely populated urban area with existing development on all sides. The proposed development site is currently used as a car park.

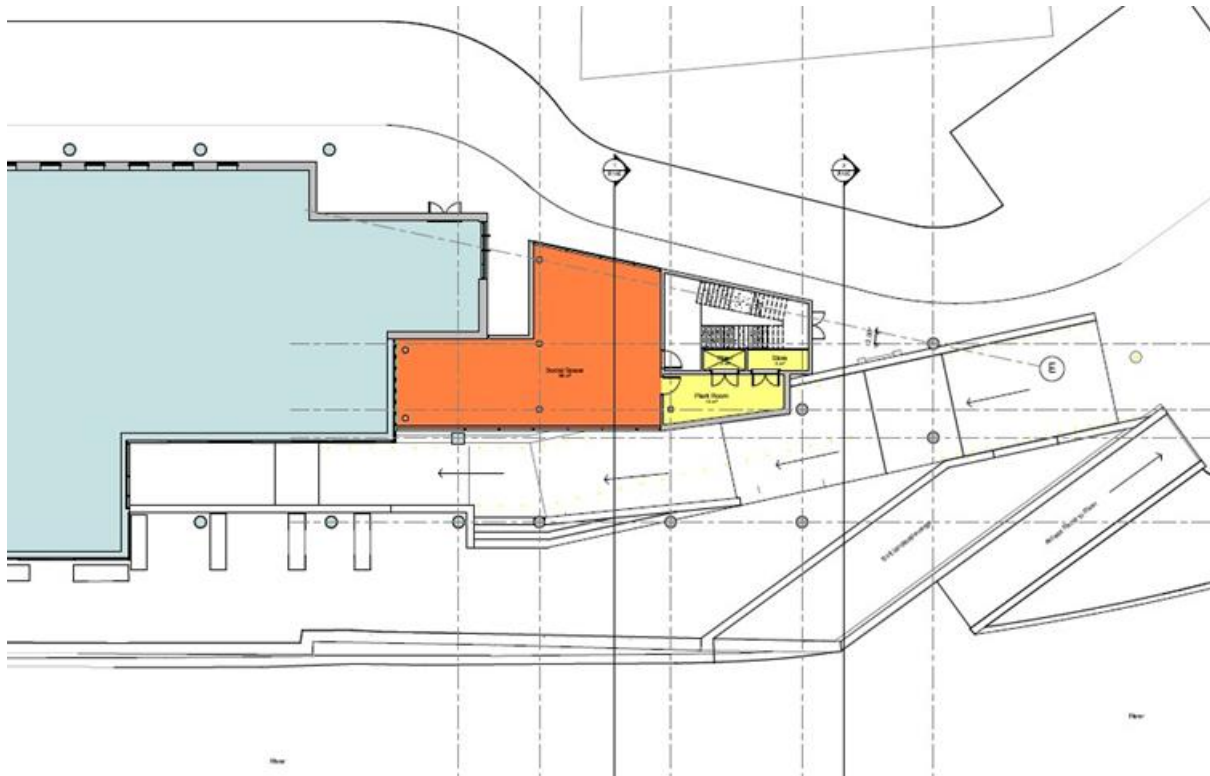
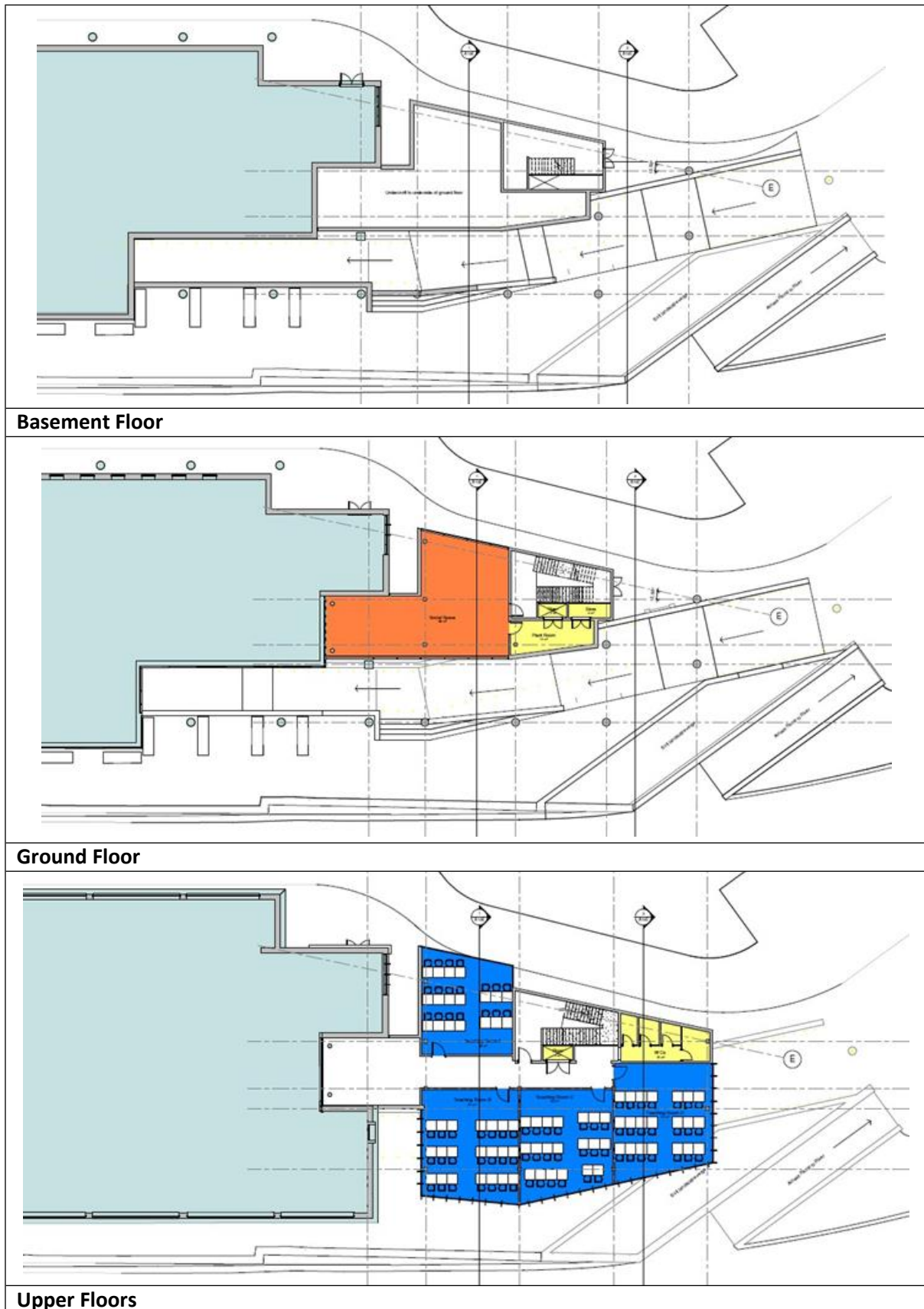


Figure 2 – Site plan for the proposed Rochdale Sixth Form College extension

The proposed development consists of a new college building extension that will be located on the northern facade of the existing college building, as shown in Figure 2 above.

1.2. Floor Plans



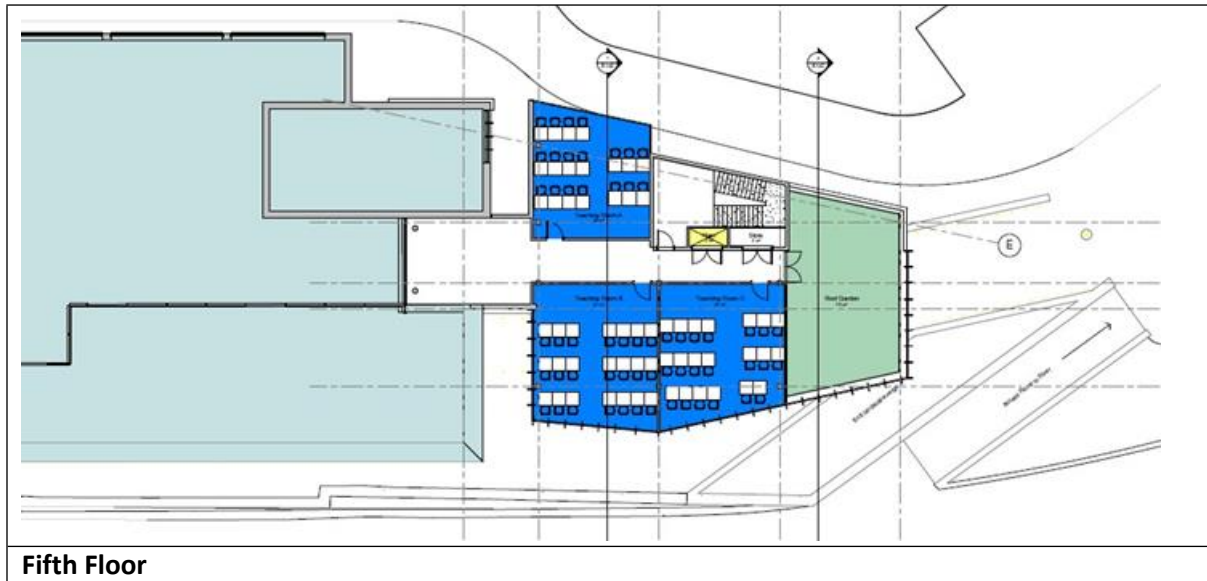


Figure 3 – Floor plans for the proposed Rochdale Sixth Form College extension

The proposed development will extend the existing college building at a height of six storeys, with a basement level. The proposed extension will include teaching spaces on all upper floors, a communal space to the ground floor and circulation, storage and plant space throughout the building, as shown in Figure 3.

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the proposed Rochdale Sixth Form College extension, at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in July 2021 and sets out the government's planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

Table 2 – Key National Planning Policy Requirements and Design Responses

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in Rochdale Borough Council's Adopted Core Strategy (2016), using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes in Rochdale and an assessment on the potential for future schemes in relation to this development is provided in Section 4 of this report. This sustainability and renewable energy statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The Adopted Core Strategy for Rochdale Borough Council (2016) provides a set of guidelines for new development within Rochdale. All relevant energy policy within these documents is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

Rochdale Borough Council Adopted Core Strategy (2016)		
Section	Policy Requirements	Design Response
G1 - Tackling and adapting to climate change	We will address climate change and ensure growth does not increase CO₂ emissions by: - Locating growth in areas which are likely to minimise the need for travel and which are well served by public transport, services and infrastructure; - Expecting all development and regeneration schemes to be well connected to surrounding areas and facilities by sustainable means of transport (Policy T2); - Encouraging and promoting renewable energy developments, including standalone and community developments, that do not, by virtue of their scale, siting, construction or operation, cause harm to the local area, its character and environmental assets and adjoining uses, which cannot be satisfactorily mitigated (Policy G3); - Promoting the efficient re-use of buildings, especially those of heritage value, and the recycling of construction waste; - Ensuring that development does not cause unacceptable harm to the borough's peatlands and woodlands, and encouraging their restoration and responsible management; - Promoting sustainable waste management through the operation of policies in the Core Strategy and Greater Manchester Joint Waste Plan; - Making the best use of open space to contribute to climate change mitigation and adaptation; and - Securing planning obligations for energy infrastructure and climate change adaptation measures. New developments will be expected to: a. Be zero carbon in line with national targets and definitions;	The new development will implement a range of sustainable design and construction approaches to the proposed development, to ensure the principles of the Adopted Core Strategy (2016) are met. These measures have been detailed within Section 6 of this report. A reduction in energy bills through low carbon technologies will also be pursued through the design, providing a carbon emissions reduction on the notional building baseline within Part L 2021. A review of the impact of these technologies

	b. Adhere to the 'energy hierarchy' as outlined in policy G2, being designed in such a way that ensures that buildings require the minimum amount of energy to function over their lifetime; c. Reduce CO2 emissions through the use of renewable and low carbon decentralised energy technologies and networks. This will be through both on-site provision in new developments and through connection to local networks; d. Address the impacts of climate change by incorporating comprehensive adaptation measures, including: i. suitable measures, such as urban greening, for tackling the 'urban heat island' effect; ii. where possible, the opening up of covered and culverted sections of waterways and provision of new water features, to help cooling and provide biodiversity, landscape and flood prevention benefits; iii. the incorporation of appropriate water conservation and management measures, such as Sustainable Drainage Systems (SuDS), including ensuring that the rate of run-off on 'greenfield' sites is not increased and on 'brownfield' sites is significantly reduced, and avoiding the use of impermeable surfaces; iv. the retention of existing trees wherever possible and the taking of all appropriate opportunities to plant trees and other suitable vegetation on site; and v. the incorporation of 'green roofs' wherever possible, such as with flat roofs.	is provided in Section 5 of the report. Air source heat pumps are included within the servicing strategy, which have minimal impact on the landscape character and visual appearance of the local area. A photovoltaic array is also provided on the existing roof present building to further reduce carbon emissions.
G2 - Energy and new development	All new development will be expected to adhere to the following energy hierarchy to the extent that policy G2 reflects national policy, targets and requirements for that type of development: 1. Demand Reduction – Achieve the maximum possible reduction in demand for energy through building design (i.e. the use of passive systems). At the design stage of new developments, every effort should be made to ensure that buildings use as little energy as possible throughout their lifetimes, using siting, orientation, layout, construction and landscaping to optimise use of natural passive systems such as solar gain and natural lighting, shading, ventilation and cooling to minimise heating, cooling and lighting demands. Green	Any carbon emissions or energy reductions are made through energy efficiency measures before the application of low and zero carbon technologies in line with the defined 'Be Lean, Be Clean, Be

	roofs and green walls should be incorporated into developments wherever feasible. 2. Energy efficiency and low / zero carbon technologies and networks – Design to maximize energy efficiency, and use on-site or linked low or zero carbon technologies or direct connection to a low or zero carbon heat source (not necessarily on-site). 3. ‘Allowable solutions’ – use wider energy efficiency / CO2 reduction measures, which could include developer contributions, to compensate for ‘residual emissions’ not addressed by 1 or 2 above.	Green’ energy hierarchy. Carbon emissions reductions are provided from on-site systems, rather than ‘allowable solutions’.
G3 Renewable and low carbon energy developments	- The Council will promote renewable, low and zero carbon energy generating developments, including wind power, biomass, Combined Heat and Power (CHP), hydro and heat pumps in order to help meet CO2 reduction targets and contribute towards energy security for Greater Manchester and the North West. Any proposal and associated infrastructure must avoid harm to the health and safety of the public, including through nuisance or adverse impact on highway safety by conflict with or undue distraction to road users. Any harm to the following must be minimised and appropriately mitigated: - The visual character and quality of the landscape or townscape and the physical record of the historic and cultural evolution of the landscape; - The setting of heritage assets including Scheduled Ancient Monuments, Conservation Areas and Listed Buildings; - Local residents and their amenity; - Biodiversity including protected species, statutory and locally designated sites and important habitats, and geodiversity; - The value of the borough’s peatlands as an ecological and hydrological resource and as a carbon sink; - The value of the surrounding area for relaxation and recreation; - Water quality; - Land which is used for water catchment purposes and which is critical to the delivery of water supply; and - Highway safety. Any proposal must demonstrate the best use of location, topography, siting, design and colour to minimise it’s visual and other impacts, including any cumulative impacts. Any ancillary structures and access roads should employ sensitive design and the use of local materials to	As noted above, the proposed development will incorporate the use of low and zero carbon technologies to provide carbon emissions reductions in line with national targets. A review of the most applicable systems for the proposed development is provided within Section 5 of this report. A number of technologies have been discounted following a feasibility review. The proposed integrated low and zero carbon technologies of air source heat pumps (ASHP) and a

	respect the character and appearance of the setting. The visual impact of infrastructure associated with renewable energy developments should be satisfactorily addressed, including by routing power lines underground wherever possible. All proposals should seek to minimise the length of cable connection in order to reduce the visual impact of such structures when sited above ground. It must be demonstrated that the proposal will not result in electro-magnetic interference with local television reception and specialist radio communication networks. All the above issues, where relevant, will have to be addressed in a detailed statement of environmental effects submitted with the application. Planning permission will be subject to a condition that if a wind turbine generator, or other redundant plant or infrastructure, is not producing electricity for six months or more, it shall be removed and the site fully restored to a use and condition appropriate to its surroundings in accordance with this plan. In the case of wind power developments, in addition to the above criteria the following will also apply. Planning permission will only be granted if: - The development site is in an area identified as suitable for wind energy development in a Local or Neighbourhood Plan; and - Following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.	photovoltaic (PV) array provide significant levels of carbon emissions and energy reductions. Following the review in Section 5 below, these technologies are deemed to be sympathetic to the local environment and provide easy integration into the proposed building design given its scale and form.
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3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO₂ emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline. Building Regulations Part L2 2021 applies to the development and provides carbon emissions from regulated energy.

The building can then be benchmarked/ thermally modelled using the energy hierarchy:

1. Be Lean <i>A reduction in energy use as a result of passive design and energy efficiency</i>
Thermal performance of envelope (U values) Glazing design Airtight construction Efficient mechanical ventilation and heat recovery Variable speed fans and pumps Efficient lighting
2. Be Clean <i>A focus on supplying energy to the development through efficient means</i>
Connect to low carbon heat networks Develop site wide heat network from single energy centre On site CHP Provide energy efficient individual heating
3. Be Green <i>The installation of renewable technologies to meet energy demand where possible</i>
Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, district heating, etc.) and finally the use of renewable energy technologies, where

practical. This hierarchy complements the integrated approach to the sustainable energy objectives of Rochdale Borough Council.

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance and operation.

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

4. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the development in line with the energy hierarchy.

4.1. Decentralised Heating Networks

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

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

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

A number of heat network opportunities are at various stages of development across the country. Benefits of district heating networks can include:

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

There are currently no existing district heating networks within proximity to the site, as indicated in Figure 4. The nearest district heating network is located in Oldham at Oldham Sports Centre.

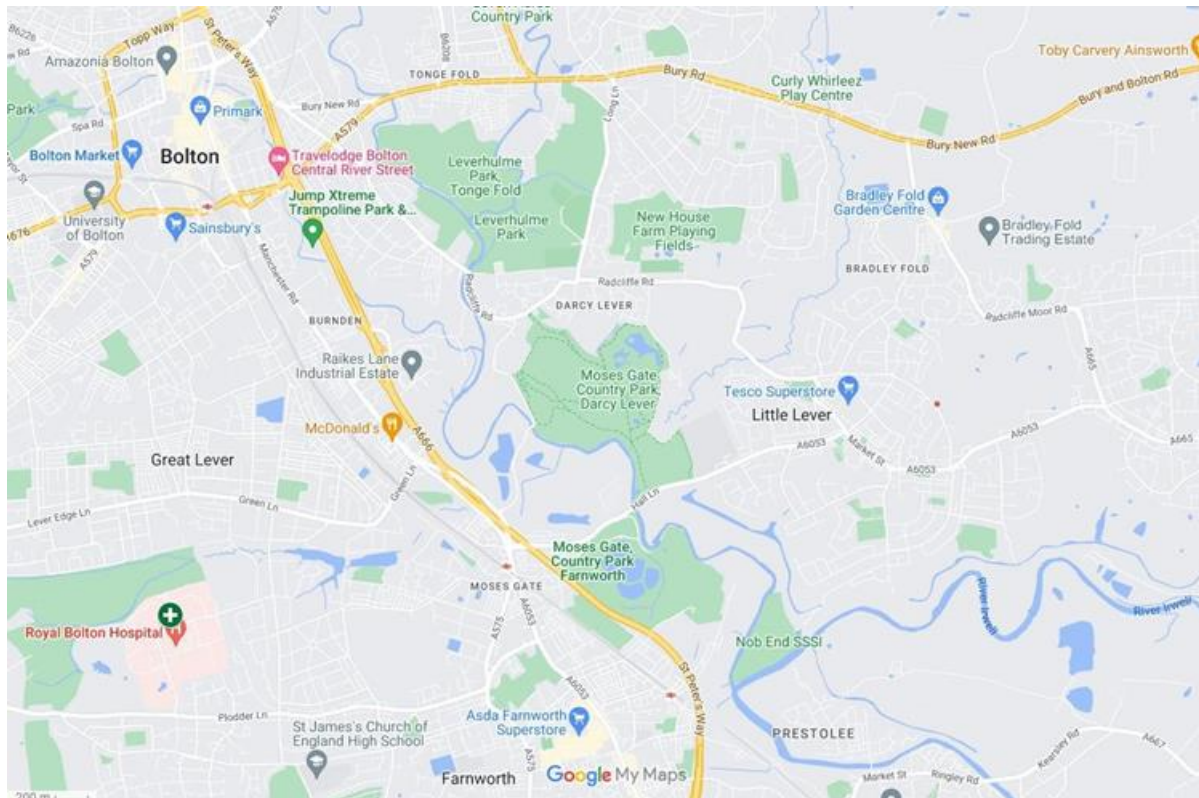


Figure 4 - Location of site in relation to current heat networks (Source: ADE District Heating Installation Map)

4.2. New Heating Networks – Options

Consideration has been given to adopting a centralised or decentralised energy strategy. A decentralised energy option would typically be an energy centre distributing heat, hot water and electricity to the development from a single source either as a DHN or CHN. This typically would include boilers and a CHP type unit sized to provide the whole development. Sometimes multiple energy centres are used to split the loads, provide resilience and to serve different buildings.

The proposed heating and hot water demand from the development is not sufficient to justify a DHN or CHN. There is also insufficient space to locate a CHN plantroom - Communal Boiler or CHP units and associated HW store, pump sets etc within the development.

5. Renewable Energy Technologies

Rosiben have reviewed options for the use of on-site renewable energy/ low or zero carbon technologies in line with Rochdale Borough Council policy aspirations.

This renewable energy statement/strategy reviews the technical and economic feasibility of the following technologies –

- Solar Photovoltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

5.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as kilowatt peak (kWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof

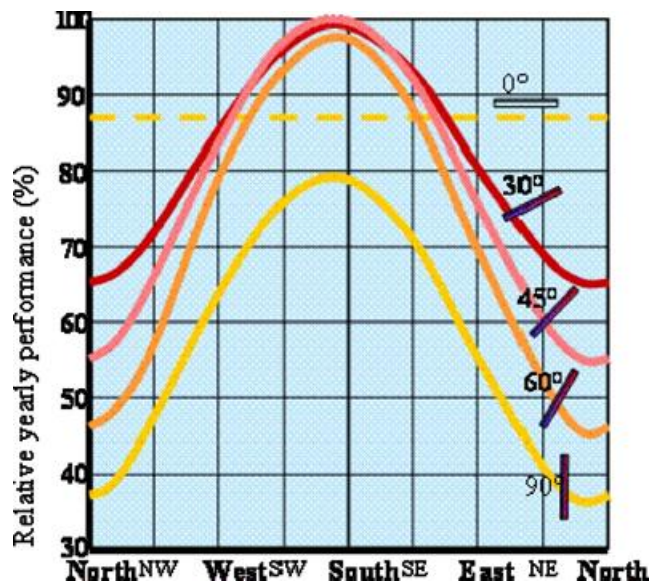


Figure 5 - Performance of photovoltaic panel orientation

tiles to panels and transparent cells that you can use on conservatories and glass to provide shading, as well as generating electricity. The roof construction should be strong enough to take their weight, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however, panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar

collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph to the right:

The cost to install PV is typically £1,000 - £1,500 per kWp for 'on-roof' panel systems.

The proposed extension roof could support the addition of photovoltaic panels, and these are considered an appropriate solution to reduce carbon emissions to comply with the policy requirements of Rochdale Borough Council's Core Strategy (2016). A photovoltaic panel array is applied the rooftop within the preliminary Part L calculations in Section 6.



Figure 6 - Photovoltaic array on a pitched roof

5.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

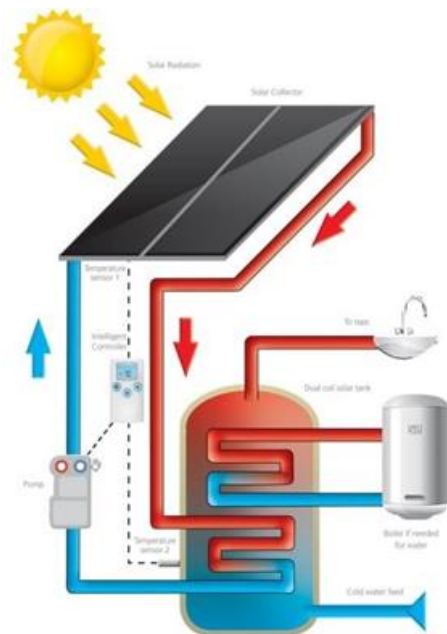


Figure 7 - The principles of a solar thermal system

The cost of installing the system is dependent on the

distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage, the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m² which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels are applied best in conjunction with individual heating systems for dwellings. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve significant carbon savings. Carbon savings of approximately 4-5% are achievable with this technology. The proposed development is unlikely to require sufficient hot water storage to deem solar thermal a feasible technology for this site.

5.3. Ground Source Heat Pump (GSHP)

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be

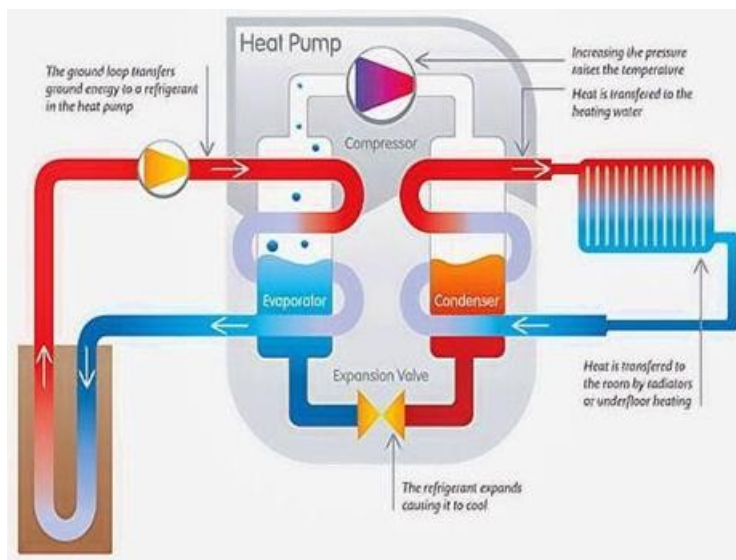


Figure 8 - Principles of a GSHP system

installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4

although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Due to the scale of the proposed development and the small area of the site, GSHPs are not considered an appropriate design solution.

5.4. Air Source Heat Pump/Exhaust Air Heat Pump

Air source heat pumps (ASHP) and exhaust air heat pumps (EAHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

Exhaust air heat pumps such as the NIBE F370 work in a similar manner to ASHP units but

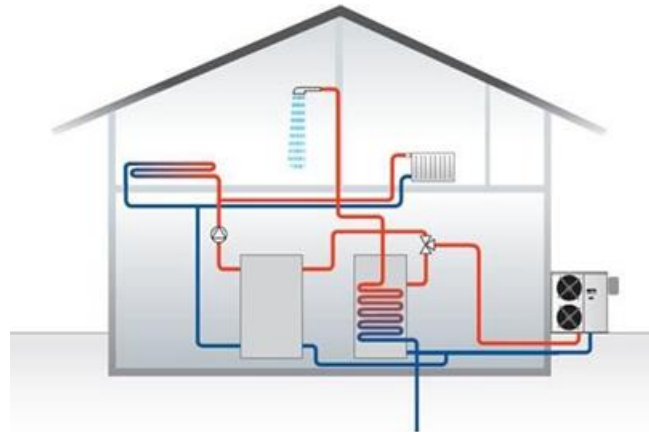


Figure 9 - Principles of an ASHP system

have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwellings where mains gas is unavailable or unsuitable for a development. A higher capital cost of the equipment, installation and the enhanced structural requirements can be offset by reduced operational energy costs.

ASHPs are considered an appropriate technology for this scheme, due to the likelihood of requiring both cooling and heating within classroom areas. This would provide a cooling solution not reliant on openable windows, which would be preferable given the adjacency to the A58. A VRF type system has been assumed within the energy calculations in Section 6.

5.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of dwellings/non-domestic properties
- Mast mounted – Which are free standing

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- The ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence



Figure 10 - Mounted wind turbine

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 4.1 m/s at a height of 10 metres, which is less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development.

5.6. Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than



Figure 11 - Biomass boiler and hopper

mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason, biomass is discounted.

6. Energy Assessment of Proposed Scheme

The proposed Rochdale Sixth Form College extension has adopted the principles of the 'Be Lean, Be Clean, Be Green' approach. The thermal performance of the modelled elements in the proposed development is indicated in Table 4.

Table 4 - Fabric efficiency in the preliminary Rochdale Sixth Form College extension Part L2 model

	U-value (W/m ² K)	G Value	Light Transmittance
Roof	0.10	n/a	n/a
Ground Floor	0.10	n/a	n/a
External Wall	0.10	n/a	n/a
External Glazing	1.40	0.35	0.70
Door	1.60	n/a	n/a

The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, airtight envelope, passive improvements and the use of highly efficient building services to condition spaces.

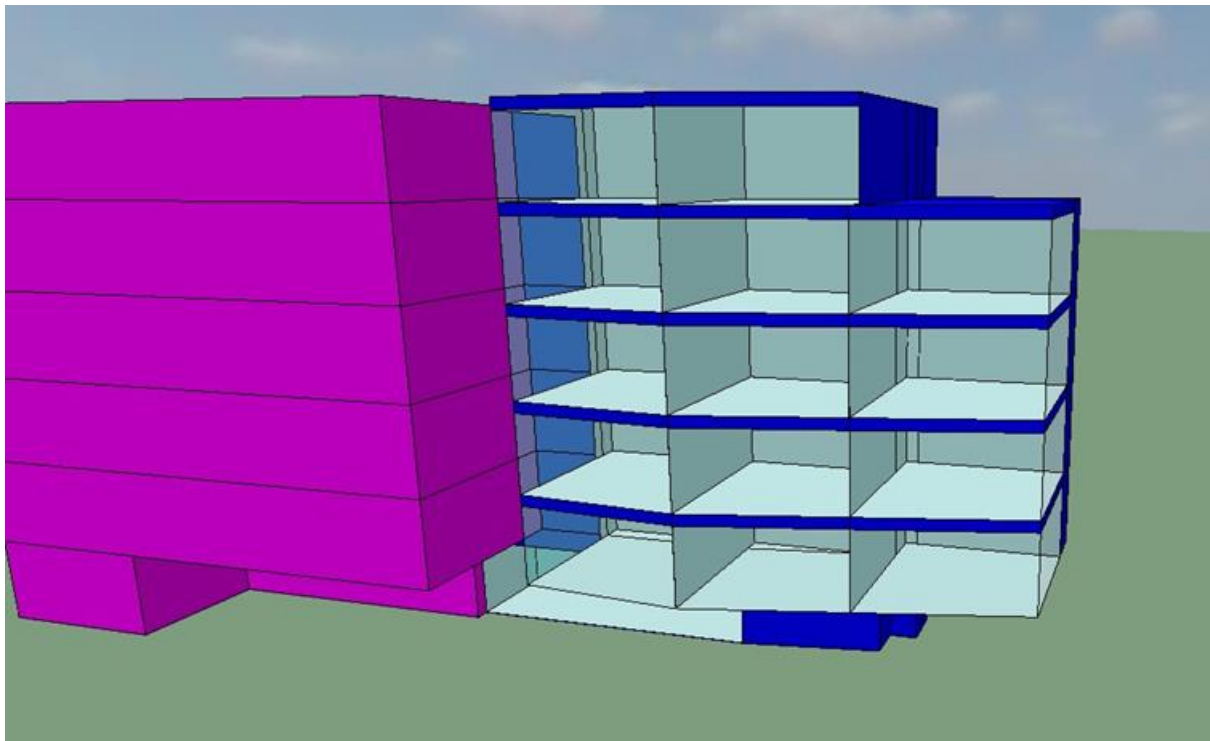


Figure 12 – Proposed Rochdale Sixth Form College extension visualisation within IES-VE 2022

A preliminary model design has been developed within IES-VE 2022 to understand the likely performance of the development against Approved Document Part L2 2021. A full overview of inputs within the model is provided within the appendices of this report.

The results in Table 5 indicate that a 2% emissions improvement and a 3% primary energy improvement can be achieved through the adoption of passive design techniques, energy efficient systems and photovoltaic panel array. The proposed specification provides a 199 kg reduction in annual carbon emissions above Part L2 2021 compliance.

Table 5 - Results of preliminary model Part L2 2021 calculations

Emissions	Actual	Notional	Improvement (%)
Total emissions (kg/m ²)	BER: 5.44	TER: 5.55	2.0%
Annual emissions (kg)	9,847	10,046	
Primary energy (kWh/m ²)	BPER: 57.84	TPER: 59.43	2.7%
Annual primary energy (kWh)	104,696	107,574	

7. Conclusion

The approach for the proposed Rochdale Sixth Form College extension is to embed sustainability into the heart of the development through the 'Be Lean, Be Clean, Be Green' design hierarchy.

The proposed design is predicted to reduce the total carbon emissions by 199 Kg/CO₂/yr from the baseline Part L 2021 emissions of 10,046 kg/CO₂/yr, equating to a 2% reduction from the baseline regulated emissions. Primary energy is also predicted to be reduced by 2,878 kWh from the baseline rate of 107,574 kWh, equating to a 3% improvement. Proposed design measures will include:

- 1) Enhanced building fabric and air tightness to meet Building Regulations ADL2 (2021)
- 2) Heating and cooling will be provided to classroom areas by an air source heat pump (ASHP)
- 3) Hot water will be provided by local electric point of use heaters
- 4) Ventilation will be provided by mechanical ventilation with heat recovery (MVHR)
- 5) Lighting will be provided to all areas by high-efficacy LED-type fittings
- 6) Rooftop 100m² photovoltaic (PV) panel array (located on the existing roof)

7.1. Low/ Zero Carbon Technologies Review

- Photovoltaic panels have been specified for this development with a 100m² rooftop array providing significant carbon emissions savings, (located on the existing roof).
- Solar Thermal Hot Water is not considered a viable option as an accurate estimate of hot water demand is not known - however it is not expected to be a major energy contributor.
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries, etc. It would require a centralised larger plant space for storing fuel, which is not suitable.
- Micro-wind turbines do not work on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind power electricity generation and there would be issues with turbulence, wind shading and noise.
- GSHPs are not viable for site because of spatial and financial costs. There is no room to accommodate a GSHP vertical bore and associated communal plant room. Ground conditions are also unknown, and as this is a small site, these systems could be very costly.
- ASHP units have been specified in occupied areas of the proposed development as they are likely to have a large heating and cooling demand.

7.2. Summary Headlines

- A fabric-first approach to meeting local energy policy has been undertaken for the proposed Rochdale Sixth Form College extension, defined within the 'Be Lean, Be Clean, Be Green' energy hierarchy. The proposed design also provides compliance with Building Regulations ADL2 2021.
- The use of a high-efficiency air source heat pump system and a photovoltaic array reduces carbon emissions by 2% on the Part L 2021 baseline.
- Site constraints and viability for District Heating Network (DHN) and Communal Heating Network (CHN) have been reviewed. Existing DHN is not sufficiently close to connect into. In addition to this, the scheme's heating and hot water (HW) demand is too small to justify connection to DHN or CHN.

An overall 2% improvement in CO₂ emissions and 3% improvement in primary energy above the Building Regulations Part L 2021 baseline is proposed to support our application and to meet policy requirements.

Table 6 - Summary of preliminary energy modelling results using Part L 2021

	Total CO₂ Emissions (kgCO₂/yr)	Total Primary Energy (kWh/yr)
Target Building Performance	10,046	104,696
Proposed Building Performance	9,847	107,574
Total Reduction	199	2,878
Percentage Improvement (above ADL2 2021)	2.0%	2.7%

8. Appendices

8.1. Specification for Energy Assessments (ADL2 2021)

Item	Brief Description	Notes	Confirm
	The following information is required for the design submission (as per requirements of ADL2 2021).	Please note submission is now in two stages. A) Design B) As installed	
1. Building Details			
1.1	Building Regulations Part L2 2021 applies.		
1.2	Full building address is:		
1.3	Building owner is:		
1.4	Electric Power Factor Correction = <0.90		
2. Floor Construction Details			
2.1	Ground floor is insulated to achieve the U-value stated opposite.	U-Value = 0.10 W/m ² K As per email from SB received 13-10-2022.	
3. Wall Construction Details			
3.1	External walls are insulated and achieve the U-value stated opposite.	U-Value = 0.10 W/m ² K As per email from SB received 13-10-2022.	
4. Roof Construction Details			
4.1	Roof areas are insulated to achieve the U-value indicated opposite.	U-Value = 0.10 W/m ² K As per email from SB received 13-10-2021.	
5. Openings			
5.1	All double-glazed windows and glazed doors are to achieve the U-value and G-value indicated opposite.	U-Value = 1.4 W/m ² K G-Value = 0.35 As per email from SB received 13-10-2021.	
6. Ventilation			
6.1	A design stage air permeability rate of 5m ³ /hr.m ² at 50pa has been applied.		
6.2	Mechanical ventilation with heat recovery is provided to teaching areas and WCs.	Supply SFP = 1.1 W/l/s HR = 75%	
6.3	All other areas of the building are naturally ventilated.		
7. Space Heating and Cooling			
7.1	Heating and cooling to teaching, circulation and social space areas to be provided by an air-to-air heat pump.	SCOP = 4.0 SEER = 5.0	
7.2	Heating is provided to WC areas by an air-to-water heat pump	SCOP = 4.0	
7.3	All heating systems provided with central time control and local temperature controls.		
7.4	Heating systems are metered but are not provided with automatic monitoring and targeting with alarms to warn out-of-range values.		
8. Water Heating			
8.1	Water heating is provided by local electric water heater systems.	Total Storage Assumed = 60L Standing Loss = 0.01 kWh/l/day	
8.2	Secondary circulation has not been provided on hot water systems.		
9. Lighting and Lighting Controls			
9.1	Luminaire efficacies have been applied as per the figure opposite. LED lighting is assumed throughout.	Efficacy = 100 lm/W LOR = 1	
9.2	Presence detection is provided to all WC and circulation areas.	Parasitic Power = 0.1W/m	
9.3	Light fitting energy use is metered but not provided with automatic monitoring and targeting with alarms to warn out-of-range values.		
10. Renewables			
10.1	A 100m ² rooftop PV panel array is assumed within the calculations.	Module Efficiency = 20% Orientation = 180° Azimuth = 20° Inverter Efficiency = 97%	
11. Other			

11.1	All fans are in accordance with the minimum requirements of Table 6.9 of ADL Volume 2: Buildings other than dwellings, 2021 in terms of Specific Fan Power.		
11.2	A Building Log Book will be provided following the guidance in CIBSE TM31, Building Log Book Toolkit.		
11.3	Building Regulations Part L2 2021 apply. Please confirm that all fixed building services are in accordance with the minimum standards set out in Section 6 of ADL2 2021.		

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8.3. Preliminary Design BRUKL Report

Project name

Z52269 Rochdale Sixth Form College

As designed

Date: Fri Oct 21 11:00:58 2022

Administrative information

Building Details

Address: College Road, Rochdale, OL12 6HY

Certifier details

Name: Anthony Turner

Telephone number:

Address: Energy Counsel, Viridor House, 3 Bolholt Terrace,
BURY, BL8 1PP

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.17

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.17

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

Foundation area [m²]: 300.25The 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	5.55
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	5.44
Target primary energy rate (TPER), kWh/m ² annum	59.43
Building primary energy rate (BPER), kWh/m ² annum	57.84
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	0.1	0.1	BS000002:Surf[1]
Floors	0.18	0.1	0.1	BS000002:Surf[0]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.1	0.1	3F000001:Surf[0]
Windows** and roof windows	1.6	1.4	1.4	GF000001:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors [^]	1.6	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No Vehicle access doors in building
High usage entrance doors	3	-	-	No High usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{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	5

Building services

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

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

1- ASHP (A2A) w/MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	5	0	-	0.75
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- ASHP (A2A)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	5	0	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- ASHP (A2W) + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	0.2	-	0.75
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- DHW - Local Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.01
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			
GF Social Space	-	-	-	1.1	-	-	-	-	-		-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard	
1F Teaching Room A	-	-	-	1.1	-	-	-	-	-	-	N/A	
1F WCs	-	-	-	1.1	-	-	-	-	-	-	N/A	
1F Teaching Room D	-	-	-	1.1	-	-	-	-	-	-	N/A	
1F Teaching Room C	-	-	-	1.1	-	-	-	-	-	-	N/A	
1F Teaching Room B	-	-	-	1.1	-	-	-	-	-	-	N/A	
2F Teaching Room A	-	-	-	1.1	-	-	-	-	-	-	N/A	
2F WCs	-	-	-	1.1	-	-	-	-	-	-	N/A	
2F Teaching Room D	-	-	-	1.1	-	-	-	-	-	-	N/A	
2F Teaching Room C	-	-	-	1.1	-	-	-	-	-	-	N/A	
2F Teaching Room B	-	-	-	1.1	-	-	-	-	-	-	N/A	
3F Teaching Room A	-	-	-	1.1	-	-	-	-	-	-	N/A	
3F WCs	-	-	-	1.1	-	-	-	-	-	-	N/A	
3F Teaching Room D	-	-	-	1.1	-	-	-	-	-	-	N/A	
3F Teaching Room C	-	-	-	1.1	-	-	-	-	-	-	N/A	
3F Teaching Room B	-	-	-	1.1	-	-	-	-	-	-	N/A	
4F Teaching Room A	-	-	-	1.1	-	-	-	-	-	-	N/A	
4F WCs	-	-	-	1.1	-	-	-	-	-	-	N/A	
4F Teaching Room D	-	-	-	1.1	-	-	-	-	-	-	N/A	
4F Teaching Room C	-	-	-	1.1	-	-	-	-	-	-	N/A	
4F Teaching Room B	-	-	-	1.1	-	-	-	-	-	-	N/A	
5F Teaching Room A	-	-	-	1.1	-	-	-	-	-	-	N/A	
5F Teaching Room B	-	-	-	1.1	-	-	-	-	-	-	N/A	
5F Teaching Room C	-	-	-	1.1	-	-	-	-	-	-	N/A	

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
GF Social Space		100	-	-
GF Store		100	-	-
GF Circulation		100	-	-
1F Teaching Room A		100	-	-
1F Circulation		100	-	-
1F WCs		100	-	-
1F Teaching Room D		100	-	-
1F Teaching Room C		100	-	-
1F Teaching Room B		100	-	-
1F Circulation		100	-	-
2F Teaching Room A		100	-	-
2F Circulation		100	-	-
2F WCs		100	-	-
2F Teaching Room D		100	-	-
2F Teaching Room C		100	-	-
2F Teaching Room B		100	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
2F Circulation		100	-	-
3F Teaching Room A		100	-	-
3F Circulation		100	-	-
3F WCs		100	-	-
3F Teaching Room D		100	-	-
3F Teaching Room C		100	-	-
3F Teaching Room B		100	-	-
3F Circulation		100	-	-
4F Teaching Room A		100	-	-
4F Circulation		100	-	-
4F WCs		100	-	-
4F Teaching Room D		100	-	-
4F Teaching Room C		100	-	-
4F Teaching Room B		100	-	-
4F Circulation		100	-	-
5F Teaching Room A		100	-	-
5F Teaching Room B		100	-	-
5F Circulation		100	-	-
5F Store		100	-	-
5F Circulation		100	-	-
5F Teaching Room C		100	-	-

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?
GF Social Space	YES (+10.7%)	NO
GF Circulation	NO (-85.3%)	NO
1F Teaching Room A	NO (-57.4%)	NO
1F Circulation	N/A	N/A
1F Teaching Room D	YES (+63.7%)	NO
1F Teaching Room C	YES (+100.7%)	NO
1F Teaching Room B	YES (+34.5%)	NO
1F Circulation	N/A	N/A
2F Teaching Room A	NO (-57.3%)	NO
2F Circulation	N/A	N/A
2F Teaching Room D	YES (+63.7%)	NO
2F Teaching Room C	YES (+100.7%)	NO
2F Teaching Room B	YES (+34.6%)	NO
2F Circulation	N/A	N/A
3F Teaching Room A	NO (-57.3%)	NO
3F Circulation	N/A	N/A
3F Teaching Room D	YES (+63.7%)	NO
3F Teaching Room C	YES (+100.7%)	NO
3F Teaching Room B	YES (+35.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3F Circulation	N/A	N/A
4F Teaching Room A	NO (-57.3%)	NO
4F Circulation	N/A	N/A
4F Teaching Room D	YES (+63.7%)	NO
4F Teaching Room C	YES (+100.7%)	NO
4F Teaching Room B	YES (+41.1%)	NO
4F Circulation	N/A	N/A
5F Teaching Room A	NO (-57.2%)	NO
5F Teaching Room B	YES (+74.4%)	NO
5F Circulation	N/A	N/A
5F Circulation	N/A	N/A
5F Teaching Room C	YES (+4.1%)	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?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1810.1	1810.1
External area [m ²]	2562.8	2562.8
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	1195.46	0
Average U-value [W/m ² K]	0.47	0
Alpha value* [%]	27.09	10

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	9.98	11.1
Cooling	2.84	1.73
Auxiliary	5.68	1.84
Lighting	11.79	9.17
Hot water	17.03	16.06
Equipment*	15.79	15.79
TOTAL **	47.31	39.9

* 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	9.63	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>9.63</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	170.1	139.96
Primary energy [kWh/m ²]	57.84	59.43
Total emissions [kg/m ²]	5.44	5.55

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	117	48.3	8.7	3.8	8.1	3.73	3.55	4	5
Notional	40.9	35.5	4.1	2.1	2.4	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	183.9	15.7	13.7	1.2	0	3.73	3.55	4	5
Notional	231.5	24	23.1	1.4	0	2.78	4.63	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	69	0	5.4	0	7.4	3.57	0	4	0
Notional	139	0	13.9	0	5.6	2.78	0	----	----
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	----	----

Key to terms

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