



Olive Primary School, Manchester- Energy Statement

Prepared for Conlon Construction Ltd

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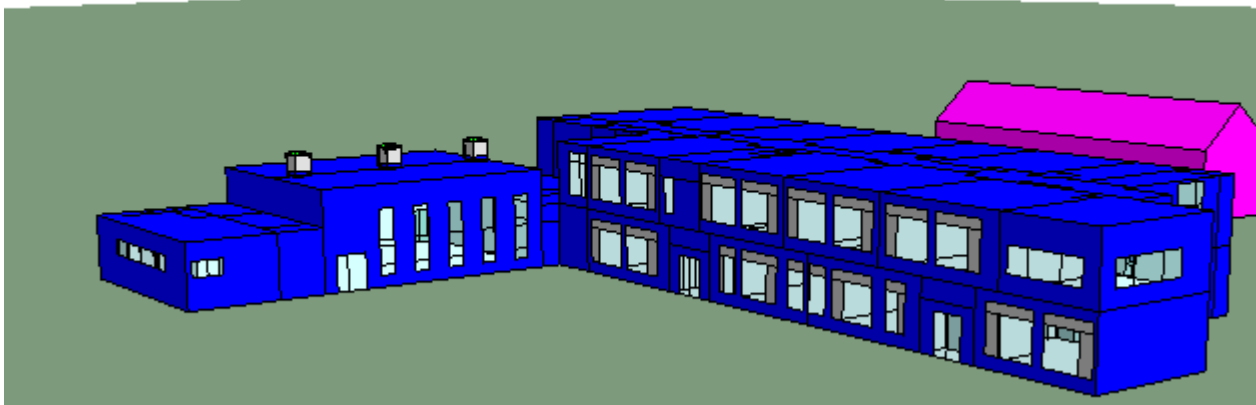


Figure 1: Thermal Model Image of Proposed Building

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1. Introduction

The following document outlines the planning energy strategy required for the proposed development at:

Olive School, Heywood St., Cheetham Hill, Manchester

1.1 Site Description

Olive Primary School, Manchester is to be based Heywood Street, Cheetham Hill. The development is proposed on a piece of land that is currently in use as Bignor Street Park.

The two form-entry, two-storey school, car park, and multi-use games area would be built on the northern half of the three-acre site. The southern section, currently home to a cricket pitch, would be home to a sports pitch and two cricket batting nets that will be available for public use.

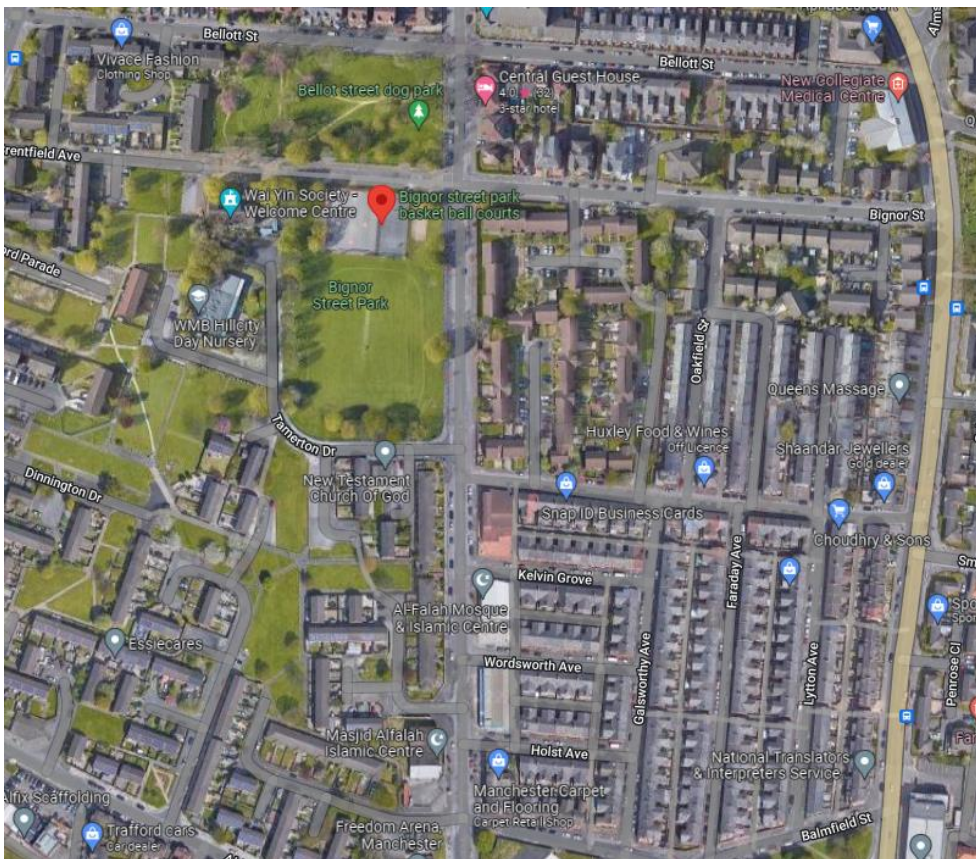


Figure 1: Site Location

1.2 Development description

The new 2 Form Entry school will be designed for a Published Admission Number (PAN) of 60 primary school pupils, reception year to Y6, with an overall capacity of 420.

The proposed new school building will provide a modern teaching space, in line with the Department of Education requirements and the standards of the current Building Bulletins. The organisation of the teaching accommodation will be rationalised, allowing consolidation into one hybrid building over ground and first floor. This will provide staff and pupils with flexibility to have the accommodations arranged in most suitable way over two storeys, whilst providing minimal travel distances and maximised teaching time.

The new Building will be located in the northeast corner of the site and close to Peacock Hall Road.

- Table A outlines building fabric criteria which can be utilised to achieve compliance.
- Table B outlines system performance criteria which can be utilised to achieve compliance.
- Appendix A provides the rationale for the allocation of on-site Low and Zero Carbon technologies and renewables.

During the design period the proposals will be examined in detail and will be the subject of more refined analysis. This detailed analysis will be based on the actual details intended for construction to confirm and / or modify the following information.

2 Terms of Reference

This Energy Statement seeks to demonstrate that the design intent for the scheme as well as the commitment to aligning with the Councils aspirations and wishes to deliver sustainable developments. The energy strategy for the scheme has been developed using the following regulations and planning policies.

2.1 Building Regulations

The Building Regulations Approved Document Part L (Conservation of Fuel and Power) 2021 outline the requirements for reductions in carbon emissions and primary energy usage required for new developments.

The scheme has been initially reviewed against the requirements of Building Regulations Part L Vol 2 'Building other than dwellings' utilising Dynamic Simulation Modelling (DSM).

2.2 National Planning Policy (2021)

Paragraph 152 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.

Paragraph 153 Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

Paragraph 154 New development should be planned for in ways that:

- a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- b) can help to reduce greenhouse gas emissions, such as through its location, orientation, and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

Paragraph 155 To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts).
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- c) identify opportunities for development to draw its energy supply from decentralised, renewable, or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

Paragraph 156 Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

Paragraph 157 In determining planning applications, local planning authorities should expect new development to:

- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- b) take account of landform, layout, building orientation, massing, and landscaping to minimise energy consumption.

2.3 Manchester City Council Core Strategy

The Manchester City Council, Manchester Core Strategy 2012 to 2027 document and planning policies have been utilised for the assessment as follows. The following policies are extracted from the Manchester Core Strategy Document:

2.3.1 Policy EN 4 - Reducing CO2 Emissions by Enabling Low and Zero Carbon Development

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

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

2.3.2 Policy EN 6 - Target Framework for CO2 reductions from low or zero carbon energy supplies

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

projected regulated energy demand and associated CO₂ emissions for all phases of the development.

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

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

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

Domestic CO₂ emissions reduction targets (Table 12.1)

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

Non-domestic CO₂ emissions reduction targets (Table 12.2)

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO ₂ /m ²))	+10% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

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

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

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

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

2.3.3 Policy DM 1 - Development Management

All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:-

- Appropriate siting, layout, scale, form, massing, materials, and detail.
- Impact on the surrounding areas in terms of the design, scale, and appearance of the
- proposed development. Development should have regard to the character of the surrounding area.
- Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions, such as noise.
- Accessibility: buildings and neighbourhoods fully accessible to disabled people, access to new development by sustainable transport modes.
- Community safety and crime prevention.
- Design for health.
- Adequacy of internal accommodation and external amenity space.
- Refuse storage and collection.
- Vehicular access and car parking.
- Effects relating to biodiversity, landscape, archaeological or built heritage.
- Green Infrastructure including open space, both public and private.
- The use of alternatives to peat-based products in landscaping/gardens within development schemes.
- Flood risk and drainage.
- Existing or proposed hazardous installations.
- Subject to scheme viability, developers will be required to demonstrate that new development incorporates sustainable construction techniques as follows (In terms of energy targets this policy should be read alongside policy EN6 and the higher target will apply):-
 - a) For new residential development (note that the requirement to meet Code for Sustainable homes targets has been removed from planning policy)
 - b) For new commercial developments to demonstrate best practice which will include the application of the BREEAM (Building Research Establishment Environmental Assessment Method) standards. By 2019 provisions similar to the Code for Sustainable Homes will also apply to all new non-domestic buildings.

2.4 Greater Manchester Spatial Framework Revised Draft 2019

Greater Manchester Spatial Framework Revised Draft 2019 supports the council's strategies which include underpinning the ambition to become a carbon neutral city 2038.

Objective 7 of the document ensures Greater Manchester is a more resilient and carbon neutral city region which will:

- Promote carbon neutrality of new development by 2028
- Promote sustainable patterns of development that minimise the need to travel and contribute to cleaner air
- Locate and design development to reduce car dependency
- Facilitate provision of infrastructure for cleaner vehicles
- Improve energy efficiency and the generation of renewable and low carbon energy.

Policy GM-S2 is a policy that supports objective 7 and has the aim of delivering a carbon neutral Greater Manchester no later than 2038. Part of this policy is to take a positive approach to renewable and low carbon energy schemes. Keeping fossil fuels in the ground. It also provides an energy an energy hierarchy as follows:

- i. Minimise energy demand;
- ii. Maximise energy efficiency;
- iii. Utilise renewable energy;
- iv. Utilise low carbon energy; and
- v. Utilise other energy sources.

Incorporate adequate electric vehicle charging points to meet likely long-term demand;

Where practicable, connect to a renewable/low carbon heat and energy network;

Achieve a minimum 20% reduction in carbon emissions (based on the dwelling emission or building emissions rates) through the use of on site or nearby renewable and / or low carbon technologies; and

Include a carbon assessment to demonstrate how the design and layout of the development sought to maximize reductions in whole life CO2 equivalent carbon emissions.

Policy GM-S4 considers increasing resilience so that development of Greater Manchester will be managed so as to increase considerably the capacity of its citizens, communities, businesses, and infrastructure to survive, adapt and grow in the face of physical, social, economic, and environmental challenges.

One of the measures includes designing indoor and outdoor environments to provide a reduction and respite from more extreme temperatures and winds associated with climate change and greater urbanisation.

Policy GM-S6 tackles air pollution and improving air quality focusing particularly on locations where people live, where children learn and play, and where air quality targets are not being met.

One of the measures includes restricting and carefully regulating developments that would generate significant point source pollution such as some types of industrial activity and energy generation.

2.5 Manchester City Councils Climate Emergency Declaration 10th July 2019

The declaration looks to deliver the zero-carbon target by 2038 and determine if an earlier target can be possible. To become carbon neutral at the earliest possible date.

2.6 Manchester City Council Climate Change Framework

Manchester Climate Change Framework for 2020-2025, builds on the Draft Manchester Zero Carbon Framework 2020-38, which was published in February 2019 and Manchester City Council's declaration of a climate emergency in July 2019. This gives a target for the 2020-25 period to reduce direct CO₂ emissions by at least 50% to stay within carbon budget targets. This is to support Objective 1 of the document which includes staying within our 15 million tonne carbon budget for 2018-2100,

The Framework recognises that the UK gas supply will take a long time for decarbonisation with biogas and / or hydrogen and that to stop using gas will promote decarbonisation because of the opportunity available for reducing carbon emissions associated with grid electricity. Therefore, moving buildings to electric heating, air source heat pumps and zero carbon district heating provide a more immediate carbon reduction benefit.

The Framework wants to ensure new developments in the city don't eat into our limited carbon budgets and add to the already significant retrofit challenge. This means that we need them to be built and operated to zero carbon standards as soon as possible.

2.7 Places for Everyone (August 2021)

The overarching requirements to achieve carbon commitments are:

- Be carbon neutral by 2038
- Hold cumulative carbon dioxide emissions to within our carbon budget
- Initiate a programme of mitigation to reduce emissions including by:
 - Significantly upscaling solar photovoltaic energy;
 - Reducing heat demand in homes;
 - Moving away from carbon intensive gas as the primary source of heat;
 - Reducing heating and cooling demand for public and commercial buildings;
 - Increasing biofuel use;
 - Enable sustainable choices for travel and decarbonise transport;
 - Significantly upscaling building retrofit; and
 - Increase the delivery of nature-based solutions and biodiversity net gain.

Within Policy JP-S2 has the following requirements:

Incorporate adequate electric vehicle charging points to future proof for the likely long-term demand, taking account of the potential maximum energy demand for the site

Where practicable, prioritise connection to a renewable energy/heating/cooling network in the first instance or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date.

For non-residential developments, achieve at least BREEAM excellent standard for the 'Ene 01 – reduction of energy use and carbon emissions' category rising to 'BREEAM Outstanding' equivalent for ENE01 from 2028

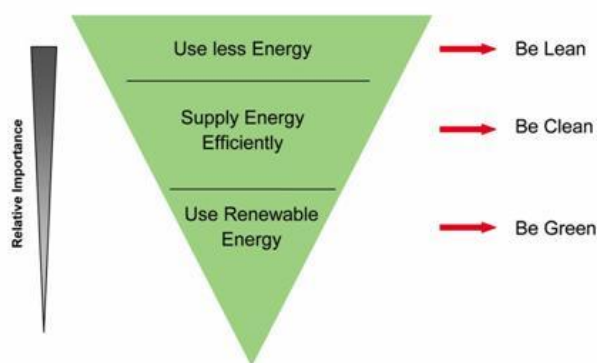
Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation. Whole life cycle emissions should be considered where possible.

3 Confirmation of Scope and Route to Compliance

3.1 Energy Hierarchy

This development follows the principles to make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- **Be lean:** use less energy
- **Be clean:** supply energy efficiently
- **Be green:** use renewable energy



3.2 Fabric Performance

The intention is to adopt an enhanced building fabric based on values which are equal or better than the minimum required for compliance with Building Regulations AD Part L 2021 as outlined in Table 'A' below. This will minimise the building energy demand and contribute towards Building Regulations compliance. Also, the performance against the LETI design guide suggested fabric U-values for a school have been shown for reference.

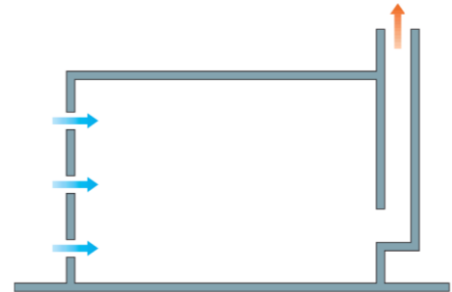
Description	Part L minimum 2021	LETI Suggested Measures	Proposed for Seven Stars	Improvement Relative to Part L
External Wall U-Value	0.26 W/m ² .K area-weighted average	0.12 - 0.15 W/m ² .K	0.15 W/m².K	42% Improvement
Ground Floor U-Value	0.18 W/m ² .K area-weighted average	0.10 - 0.12 W/m ² .K	0.10 W/m².K	44% Improvement
Roof U-Value	0.16 W/m ² .K area-weighted average	0.10 - 0.12 W/m ² .K	0.12 W/m².K	25% Improvement
Window U-Value	1.6 W/m ² .K area-weighted average	1.0 – 1.2 W/m ² .K	1.2 W/m².K	25% Improvement
Glass G-value	N/A	0.4 – 0.3	0.32 (BS EN 410)	
Door /Glazed door U-Value	1.6 W/m ² .K area-weighted average	1.2 W/m ² .K	1.2 W/m².K	25% Improvement
Building Air Permeability	8 m ³ /(h.m ²) @ 50 Pa	<1 m ³ /(h.m ²) @ 50 Pa	3 m³/(h.m²) @ 50 Pa	62% Improvement

Table A – Proposed fabric performance

3.3 Passive design Measures

The building incorporates passive design measure to limit the amount of energy used by building services systems. These include the following:

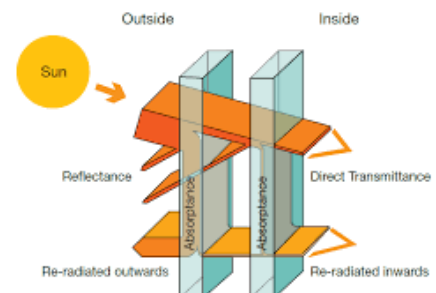
Passive stack ventilation will be included in classrooms to provide crossflow ventilation in conjunction with openings on the façade. The stack ventilation increases the driving force for natural ventilation over that of single sided ventilation. This will enable natural ventilation to meet the needs of occupants for a greater proportion of the year which will save on energy required for mechanical ventilation. The increased ventilation will also assist in maintaining comfortable temperatures within summer negating the need for comfort cooling now and in the future.



Exposed thermal mass along with night-time cooling will also be provided within classroom areas. The exposed concrete soffit will absorb heat energy during the day and then this heat will be purged from the building in summer at night when it is cooler. This will assist in maintaining comfortable temperatures within summer negating the need for comfort cooling now and in the future.



Highly selective glazing is proposed that will limit the amount of solar gain while maximising the amount of natural day light. This is achieved using coatings on the glass to reduce the amount of infrared that passes into the room while maximising the visible light portion of the electromagnetic spectrum.



3.3.1 Building Services Performance

Furthermore, efficient systems will be adopted as outlined in Table B below to minimise the building energy consumption and contribute further towards a passive and sustainable building which is compliant with Building Regulations.

Description	Building Services Systems		
	Classrooms	Office Areas (perimeter)	Office Area (landlocked)
Space Heating & Cooling	System Type: Heater Battery - Heating SCOP: 3.00 - Variable speed pumps sensor across pump	System Type: LST Rads - Heating SCOP: 3.00 - Variable speed pumps sensor across pump	System Type: Heater Battery - Heating SCOP: 3.00 - Variable speed pumps sensor across pump
Ventilation	System: Hybrid - Hybrid SFP: 0.164 W/l/s - Heat Recovery Efficiency: 42% - Demand Control Ventilation with gas	Mech Vent + Heat Recovery - SFP 1.5 W/l/s - Heat Recovery Efficiency: 80%	Natural Ventilation

	sensor and speed control of fan.		
Lighting	130 Luminaire Lumens per circuit Watt - Daylight Dimming - Absence Detection	130 Luminaire Lumens per circuit Watt - Daylight Dimming - Absence Detection	130 Luminaire Lumens per circuit Watt - Absence Detection

Table B – Proposed efficient building services system

Description	Building Services Systems		
	Circulation	Toilets / Hygiene Room, Cleaner St	Hall
Space Heating & Cooling	System Type: LST Rads - Heating SCOP: 3.00 - Variable speed pumps sensor across pump	System Type: LST Rads - Heating SCOP: 3.00 - Variable speed pumps sensor across pump	System Type: Radiant Panels - Heating SCOP: 3.00 - Variable speed pumps sensor across pump
Ventilation	Supply vent (Via MVHR) - SFP 1.5 W//s - Heat Recovery Efficiency: 80%	Extract Vent (Via MVHR) - SFP 1.5 W//s - Heat Recovery Efficiency: 80%	Natural Ventilation (Windcatcher Zero)
Lighting	110 Luminaire Lumens per circuit Watt - Presence Detection - Daylight Switching (Stairs)	110 Luminaire Lumens per circuit Watt - Presence Detection	130 Luminaire Lumens per circuit Watt - Daylight Dimming - Absence Detection
Domestic Hot Water	Air Source Heat Pump - SCOP: 2.2 - Hot water Storage 4No 500 litre vessels 550 metres of secondary flow & return pipework - Secondary pump with timeclock control or scheduled from BMS		
Management & Control Features	Automatic Monitoring & Targeting with alarms with out-of-range values		

Table C – Proposed efficient building services system. (Continued)

3.3.2 Renewable Energy Systems

Renewable and low carbon energy systems have been considered inline with Building Regulations regulation 25A. Details of the assessment can be seen in section 7 (Appendix A). From this assessment photovoltaic panels and air source heat pumps were deemed the best renewable or low carbon systems that were appropriate to the building and aligned with the Councils aspirations.

Provision for a new photovoltaic system is proposed on the majority of the roof area. The current proposal is for approximately 430m² of panel area facing east/west at an inclination of 10°, which will provide approximately 90 kWp. The modelling of the PV estimates an annual output of 70.5 MWh of electricity.

Air source heat pumps are also proposed for both space heating and domestic hot water production. Space heating will be provided by a Low Temperature Hot Water (LTHW) pipework distribution system serving radiators, heater batteries and radiant panels.

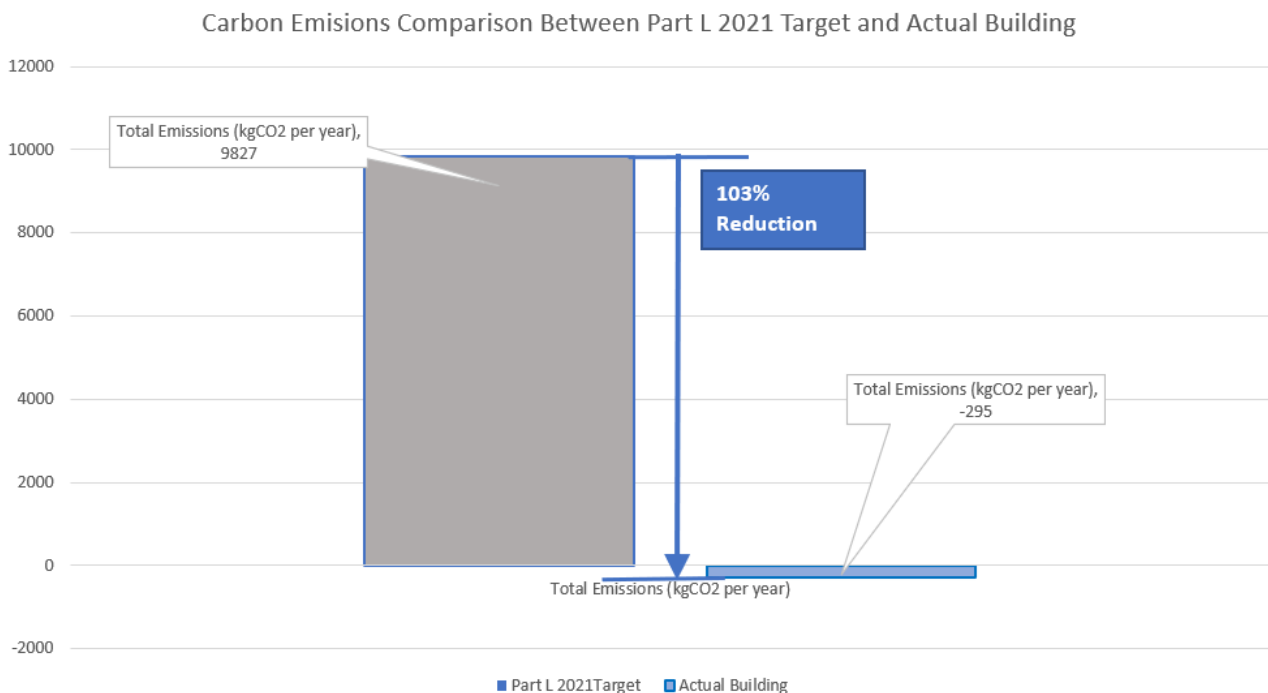
4 Building Regulation Part L Thermal Modelling

4.1 Introduction

IES accredited software, version 2022.1.2.0 was used to create a model of the building. IES automatically generates the Notional Building from which the Notional Building CO₂ emission rate and primary energy rate are calculated. The Target emission rate (TER) and Target Primary Energy Rate (TPER) is subsequently calculated and compared with the Actual Building emission rate (BER) and Actual Primary Energy Rate .

The thermal model used the fabric performance of Table A along with the Building Services equipment and efficiencies as shown in Table B and Table C . The relevant excerpts from BRUKL document are shown in Section 8 (Appendix B)

4.2 Results



The Part L thermal dynamic simulations shows that the proposed building and building services can achieve a 103% improvement on Part L 2021 target which exceeds the planning Policy EN 6 requirement. This is a reduction of 10.1 Metric tonnes of carbon dioxide emissions per year

The proposal is to provide a fabric first solution by minimising heat loss through the thermal elements. The thermal elements are within the suggested performance range of the LETI guide except for the building air leakage.

All building services systems utilise electric and will not use fossil fuels for regulated energy and therefore will take advantage of the decarbonisation of grid electricity and meet the 'nearly zero carbon emissions' standard within Part L 2021.

During the design stage, the proposals will be subject to more refined modelling based on the final building form, construction details and building services systems to optimise the design.

5 BREEAM

Manchester City Council Policy JP-S2 requires the building to achieve BREEAM Ene01 'Excellent' rating, which is a benchmark for the EPR_{NC} of 0.4. This raises to 'Outstanding' EPR_{NC} of 0.6 by 2028.

The initial Part L calculation shows and that the building currently achieves an EPR_{NC} of 0.98, which far exceeds the Councils requirements for BREEAM Ene01 'Excellent' rating and the 'Outstanding' requirement for 2028.

The results from the BREEAM calculator are shown in section 9

6 Conclusion

This development follows the principles to make the fullest contribution to minimising carbon dioxide emissions in accordance with the energy hierarchy as follows:

Be Lean

Passive design measure including excellent building fabric performance, stack ventilation, Hybrid ventilation and utilising exposed thermal mass has been used to minimise the regulated energy demand and negate the need for cooling. These measures will have the longest impact on carbon savings, most of them for the life of the building.

Be Clean

There are no heat networks found on the Association for Decentralized Energy websites interactive map and following an online review there are no proposed heat network for the area and there is unlikely to be one due to the low energy density of the area.

Due to changes in grid carbon factors, gas CHP is not appropriate as it increases carbon emissions over that of using direct electricity.

Therefore, no emissions reductions have been included for the 'clean' measures for this building

Be Green

The building services exclude the use of combustion equipment for providing space heating and hot water and therefore there will impose no additional local pollution sources associated with the regulated building services. This aligns with GM-S6 which tackles air pollution and improving air quality

All building services systems utilise electric and will not use fossil fuels for regulated energy and therefore will take advantage of the decarbonisation of grid electricity and meet the 'nearly zero carbon emissions' standard within Part L 2021.

Provision for a new photovoltaic system is proposed on the majority of the roof area. The current proposal is for approximately 430m² of panel area facing east/west at an inclination of 10°, which will provide approximately 90 kWp. The modelling of the PV estimates an annual output of 70.5 MWh of electricity.

Part L 2021 target in line with planning policy EN 6

The building is predicted to achieve a 103% carbon emission reduction against Part L 2021 in line with planning policy EN 6 and exceeds Policy GM-S2 for 20% reduction against the BER. This has been achieved through passive design, excellent building fabric performance and renewable technology.

Climate Change Resilience

The building will be designed to avoid the risk of overheating to meet thermal comfort requirements of DfE against the future 2080 weather year (Low emission scenario) and will be adaptable to also achieve internal thermal comfort conditions against the future 2080 weather year (high emission scenario). These scenarios represent a 2°C and 4°C global warming scenarios respectively.

This meets Policy GM-S4 of providing indoor environments to provide a reduction and respite from more extreme temperatures

7 APPENDIX A: Regulation 25A Assessment

7.1 Introduction

7.1.1 Purpose of Study

This report considers the technical, environmental, and economic feasibility of using high-efficient alternative systems in the construction.

The Building Regulations are technology neutral and do not require that high-efficiency alternative systems or other low and zero carbon systems are installed. However, where a technology is feasible but not included in the design, then consideration of making the building easily adaptable by facilitating the integration of any feasible technology will be included if appropriate.

This assessment has been carried out at RIBA Stage 2 (Concept Design).

7.1.2 Limitation

This report considers high efficient systems at a high level and considers its feasibility on physical limitations of the site and known issues associated with each technology. It is recognised that the development of any energy strategy is an iterative process that takes into account development needs, end user's requirements, site restrictions and changes to legislation and incentive programmes. Any considered system will need further detailed analysis prior to specification and installation.

7.2 High Efficient Alternative Systems

7.2.1 Wind – Micro scale

Technology Description

Wind turbines harness energy from wind and convert it into electricity. Wind passing over the blades causes them to rotate, and the blade rotor axle passes through an electricity generator. The electrical output is passed through a control system and then an inverter which is connected to the buildings mains electrical system. The inverter ensures that the alternating current electricity produced by the turbine is synchronous and in phase with the mains electrical supply.



Not Economically Feasible - Wind speed results would suggest that a wind turbine would not be economically viable.

7.2.2 Wind – Large and Medium scale

Technology Description

Medium (30m – 80m overall height to blade tip) and large turbine (80m+) can be used for a large building or groups of buildings. A ‘private wire’ system can deliver electricity to each building with any surplus being exported to the grid. Other factors to consider include risk of collision with low flying aircraft and interference with radar as well as visual impacts, shadow flicker and noise.



Not Technical Feasible - residential location would not be appropriate for Large turbine

7.2.3 Solar Photovoltaic Panels

Technology Description

Photovoltaic (PV) systems convert energy from the sun into electricity through semiconductor cells. When sunlight reaches the semiconductor material, direct current is generated. In most systems, this is then converted into alternating current by means of an inverter, which is fed into the dwelling's mains electrical system.



Feasible - It is currently proposed to include PV's within the design

7.2.4 Solar Thermal

Technology Description

Solar thermal systems harness energy from the sun to heat water. Various systems are available, but generally a solar thermal collector, installed at roof level, absorbs the sun's energy, and transfers it into a liquid (normally a water/antifreeze solution). This liquid is circulated through a heat exchange coil where its heat is transferred. Generally solar thermal systems are used to heat domestic hot water or swimming pool water.

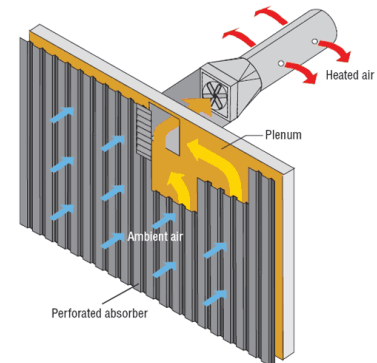


Less Desirable - Savings in energy and carbon are greatly reduced when paired with ASHP generated domestic hot water

7.2.5 Solar Air Heating

Technology Description

Solar air heating systems collect solar energy to heat air. The air can be used to pre-heat ventilation air, heat air inside a building or to heat water. A basic system comprises a solar collector and a hot air distribution system. Solar air systems can also incorporate thermal storage using either the thermal mass of the building or dedicated thermal stores, such as a rock store. The solar collectors can be purpose-built panels or a glazed cavity over an existing façade.



Not technically Feasible - No centralised supply mechanical ventilation to take advantage of solar air system

7.2.6 Aero-Thermal / Air Source Heat Pump

Technology Description

Air source heat pumps extract heat from the outside air or warm exhaust air. The heat can then be used for heating and domestic hot water. The heat pump efficiency is related to the difference between the source temperature and supply temperature, therefore in winter, when heat is most needed the efficiency and output reduces. Noise from the external unit also has to be considered.



Feasible - It is currently proposed to include air source heat pumps for space heating and domestic hot water generation

7.2.7 Ground Source Heat pumps

Technology Description

Ground source heat pumps extract heat from the ground by either horizontal coils or vertical bore holes. The heat can then be used for heating and domestic hot water. A ground source heat pump system absorbs heat from the ground and releases it at a higher temperature for use within a building. The ground has a more stable temperature than ambient air which often results in higher overall efficiencies than an air source heat pump.



Not Economically Feasible - Much higher cost solution than airtsource for approximately 25% improvement in efficiency

7.2.8 Hydrothermal / Surface Water Source Heat Pumps

Technology Description

Surface water (rivers, lakes, sea canal) can be used in an open –loop or via submerged heat exchanger to extract heat to be used for heating and domestic hot water. The choice of system will depend on environmental consideration, quality of the water and risk of biofouling of the pipework and heat exchanger (for open-source systems)



Not Technically Feasible - No suitable surface water bodies which can be used for heat extraction

7.2.9 Hydropower

Technology Description

The energy from flowing water is used to generate electricity using a turbine. Depending on the water flow and head of the water course, different types of turbines are used. An abstraction licence is required for all turbines, as the part of the water course between extraction and insertion can be affected by the reduced flow (this is known as the depleted or deprived reach). This can impact on ecology, amenity, and navigation needs.



Not Technically Feasible - No suitable water course within the boundaries of the development.

7.2.10 Biomass

Technology Description

Biomass is any plant-derived organic material that renews itself over a short period. Biomass energy systems are based on either the direct or indirect combustion of fuels derived from those plant sources. The amount of carbon released from burning the biomass is equal to the carbon absorbed when growing. The only carbon associated with biomass is related to processing and transportation.



Not Technically Feasible: Biomass heating does not align with the Council's Air Quality objectives

7.2.11 Biogas

Technology Description

Biogas can be obtained from the breakdown of various organic materials, by natural digestion. The gas generated can be used for burning or may be used in internal combustion engines as part of CHP systems. Farm, food, and market waste products are particularly good as source materials. Generally, plant is of an industrial nature and is more ideal co-located with light industrial or agricultural buildings.



Not Technically Feasible - Inappropriate location for industrial type plant

7.2.12 Cogeneration (Also Known as Combined Heat and Power [CHP])

Technology Description

Combined heat and power is the generation of thermal and electrical energy in a single process where both energy streams can be utilised within buildings. Although the production of electricity by CHP is less efficient than that achieved from national power stations, the use of the heat that would otherwise be rejected leads to net saving in primary energy.



Not Technically feasible - Due to changes in grid carbon factors, gas CHP is not appropriate as it increases carbon emissions over that of using direct electricity.

7.2.13 Onsite Community Heating or Block Heating

A community heating scheme provides heat from a central source to more than one building or dwelling via a network of heating mains. Heat can be supplied from conventional boilers or from renewable energy sources or waste heat from power generation (Combined Heat and Power). Community heating is most appropriate where heating demand is required over a small area. This is known as the heat usage density and is measured in kWh/m² per annum.



Not Applicable - The building will utilise space heating and hot water from a centralised plant rooms

7.2.14 Offsite District Heating

Large scale or city centre district heating schemes have greater efficiency where there is a greater energy density and diversity of load served. Where buildings are in the locality of such systems consideration should be given to using the thermal energy provided.



Not Technically Feasible - No offsite district heating system available

8 APPENDIX B: BRUKL Document Excerpts

BRUKL Output Document

 HM Government
Compliance with England Building Regulations Part L 2021

Project name

Olive School

As designed

Date: Tue Dec 13 16:46:42 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 1014.4

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	4.66
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	-0.14
Target primary energy rate (TPER), kWh/m ² .annum	49.02
Building primary energy rate (BPER), kWh/m ² .annum	-5.88
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 _o -Limit	U _o -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.15	0.15	00000000:Surf[7]
Floors	0.18	0.1	0.15	01000012:Surf[0]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.12	0.12	0000002E:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	00000003:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.93	1.2	0000000A:Surf[1]
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_o-Limit = Limiting area-weighted average U-values [W/(m²K)]
U_o-Calc = Calculated area-weighted average U-values [W/(m²K)]
U_i-Calc = Calculated maximum individual element 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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	2108.7	2108.7
External area [m ²]	4006.4	3991.4
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	957.32	1259.89
Average U-value [W/m ² K]	0.24	0.32
Alpha value* [%]	24.63	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
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
100	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	8.63	14.2
Cooling	0	0
Auxiliary	4.65	5.15
Lighting	6.09	6.76
Hot water	9.33	6.49
Equipment*	19.52	19.52
TOTAL**	28.7	32.6

* 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	33.46	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	33.46	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	87.2	142.03
Primary energy [kWh/m ²]	-5.88	49.02
Total emissions [kg/m ²]	-0.14	4.66

9 APPENDIX C: BREEAM ENE01 Calculator results

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Energy performance - Building score

Heating and cooling demand energy performance ratio (EPRdem)	0.327
Primary consumption energy performance ratio (EPRpc)	0.327
CO ₂ -eq energy performance ratio (EPRco2-eq)	0.327
Overall building energy performance ratio (EPRnc)	0.98
Total BREEAM credits achieved	9.0

Calculate score

Clear