



Part of the **Contollo** Group

Energy and Climate Change Adaptation Statement
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Hopwood Hall College
PA1771

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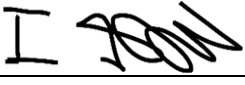
Willmott Dixon

Consulting Engineers

TACE
Portland House
Oak Green
Earl Road
Cheadle Hulme
Cheshire
SK8 6QL

www.tace.co.uk

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<i>Prepared by:</i>	Iain Jackson	I 	07/03/25
<i>Checked:</i>	Nick Thomas	N Thomas 	07/03/25
<i>TACE Approved:</i>	James Massey		07/03/25

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1.0 Executive Summary

This report identifies the elements of the design which address the sustainable design credentials as required by the Rochdale Council Core Strategy Development Plan and the National Planning Policy Framework (NPPF).

The report sets out how the Hopwood Hall College scheme design reduces primary energy demands, provides resilience through decentralising systems and uses low carbon technologies as the main heating source, in the absence of a local district heating network.

To reduce CO2 emissions as far as reasonably practical, significant importance has been placed on collaboration with the design team to consider the building orientation, thermal properties and air permeability to minimise the energy required to operate the college and by then employing very efficient plant and equipment to maintain the internal environmental criteria.

The main source of heating is utilising air source heat pumps to efficiently generate low temperature hot water to provide space heating.

As per the DfE generic design brief, Net Zero Carbon in Operation is a project goal, however given the site restrictions in terms of available space and the significant heat gains within specialist teaching rooms this will not be achieved on this project.

However, the design has been developed to minimise CO2 emissions as far as reasonably practical and significant levels of PV have been provided on the project in the form of a large PV array at roof level of the new building and a covered walkway to the existing building.

2.0 Introduction

An energy assessment which is structured according to an energy hierarchy has been undertaken and will continue to be developed in order to reduce carbon emissions of the building as far as possible. This Energy Assessment demonstrates how the building has considered these steps by demand reduction in the first instance, clean energy sources, then by a series of renewable energies including a large PV array and air source heat pumps (ASHP).

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However, the design has been developed to minimise CO₂ emissions as far as reasonably practical and significant levels of PV have been provided on the project in the form of a large PV array at roof level of the new building and a covered walkway to the existing building.

The DfE benchmark of <67kWh/m²/year will be achieved as a consequence of the design proposals. Based on the estimate energy load from the TM54, we calculated there is potential to be reduce this down to meet a target of at least 57.2kWh/m²/year.

The results show that by following the energy hierarchy the scheme will be able to significantly reduce the energy use of the building and deliver significant reductions in energy use and CO₂ emissions before renewables need to be considered.

To reduce CO₂ emissions, the college must generate a substantial amount of electricity onsite. Various options have been explored to maximise PV coverage on the building while ensuring safe access. It has been estimated at this stage that the roof area of the building can accommodate circa 480 panels. An additional 122 panels can be accommodated on an external covered walkway between the new and existing buildings.

The DfE Output Specification Technical Annex 2J: Sustainability notes that if a college site meets all the requirements of the Output Specification but cannot achieve Net Zero Carbon in Operation using on-site renewables due to site-specific items or project constraints, a clear roadmap towards 2050 should be detailed. The design team believes that this will be achieved through the decarbonization of the grid and improvements in the efficiency of on-site equipment throughout the development's lifecycle. This is further supported by the UK's commitment to decarbonize its electricity system by 2035.

Key points include:

- The new building will be completely free of gas-combustion technology.
- Renewable energy will be provided via photovoltaic (PV) panels.
- The college will be designed to reduce CO₂ emissions as far as reasonably practical.
- The energy use intensity will be in the order of 57.2 kWh/m².

To ensure the project meets sustainability goals, it is crucial to conduct a thorough evaluation and adhere to established methodologies.

3.0 Low Carbon Design Principles

3.1 Executive Summary

The following have been considered in the design of the development:

- Exploration of building orientation on performance.
- Enhanced building fabric.
- Reduced air permeability.
- Maximise daylighting.
- High efficiency systems
- Energy efficient lighting.
- Use of heat recovery systems.
- Reducing the volume of water used in sanitaryware.
- Low carbon transportation measures.
- Electric vehicle charging (EVC's).
- Cycle storage.

The table below summarises the LZC design principles viability. Each LZC principle has been considered in the subsequent pages to determine the suitability to allow an informed decision as to whether they would be beneficial to the development.

Low Carbon Design Principles	Viable?
Passive Measures: • Building Orientation • Building Fabric • Air Permeability • Daylighting	YES
High Efficiency Systems: • Energy Efficient Lighting • Reduced Water Consumption • Heat Recovery • ASHP for domestic hot water	YES
Low Carbon Transportation Measures: • Electric Vehicle Charging • Cycle Storage	YES

3.2 Passive Measures

The following passive measures have been deemed viable for the scheme and should be incorporated where possible.

3.2.1 Building Orientation

Building and room orientation can significantly impact a building's energy consumption, influencing the efficiency and comfort of the indoor environment. Properly orienting a building to take advantage of natural elements can lead to substantial energy savings. This approach enhances natural lighting, further decreasing the reliance on electric lighting and improving overall energy efficiency.

3.2.2 Building Fabric

The design has taken a fabric first approach. The performance of the thermal elements will be optimised to minimise heat loss during the winter and heat gains in the summer. This will lead to reduced heating and cooling loads, reducing the carbon dioxide emissions from the buildings energy sources to maintain the required indoor temperatures. The following table sets out the proposed building fabric standards which are currently in line with DfE requirements. These will be improved on by the design team where it is found to be technically, functionally, and economically feasible to do so.

Building Element	Building Regulations Limiting Value (W/m ² . K)	Proposed Construction Value (W/m ² . K)
Roof	0.16	0.12
External Wall	0.26	0.15
Floor	0.25	0.12
Windows & Doors*	1.6	1.1

3.2.3 Glazing

The glazing performance, properties and ratios, will be optimised to balance heat loss, natural daylight, risk of overheating and acoustics. The selected light transmittance and G value will allow for a good balance between achieving good daylighting whilst avoiding the risk of overheating. The proposed G value of the glazing is subject to confirmation from detailed building modelling, however at this stage of the project a G value of 0.35 is a good target.

3.2.4 Air Permeability

The building is targeting a maximum air permeability rate of 3m³/(h.m²) @ 50Pa. Whilst this is low, it is an achievable target with modern construction techniques. This target exceeds the minimum requirements of the Building Regulations and is necessary to support the NZCiO target.

3.3 High Efficiency Systems

The following high efficiency systems have been deemed viable for the scheme and should be incorporated wherever possible:

3.3.1 Energy Efficient Lighting

Internal lighting within all areas of the building will incorporate energy-efficient LED lighting throughout. Lighting controls will be provided to limit energy use allowing luminaires to be dimmed on circuits adjacent windows should there be sufficient daylight to provide the minimum levels required.

Automatic presence detection has been included in appropriate areas. This form of control will ensure lights are automatically switched off during periods of non-occupancy.

Optimum glazing ratios and roof lights will be used to provide useful natural daylight to reduce the reliance on artificial lighting during daytime hours.

External lighting has been designed to incorporate energy efficient luminaires and an automatic lighting control system utilising daylight sensors and time clock control to ensure energy-efficient operation of the lighting.

3.3.2 Water Consumption

The process of treating and distributing potable water to developments involves a significant energy expenditure, as does the subsequent heating of water within those developments. Therefore, it becomes crucial to adopt measures that minimise water consumption wherever feasible. This can be achieved through various strategies such as implementing water metering systems to monitor usage, employing leak detection technologies to promptly identify and repair leaks, installing flow control devices to regulate water usage, and specifying sanitaryware with optimised flow rates.

The proposal for Hopwood Hall College is to distribute potable cold water around the college feeding all general outlets and local electric water heaters to minimise distribution energy losses.

A Cat 5 cold water distribution system will be provided to serve all relevant outlets including wash down points etc.

Water metering provides real-time data on water usage patterns, enabling proactive measures to be taken to optimise consumption. Leak detection technologies help mitigate water loss and prevent wastage, thus conserving both water resources and the energy expended in treating and distributing it. Flow control devices ensure that water is used efficiently without unnecessary wastage, while specifying sanitaryware with optimised flow rates contributes to overall water conservation efforts.

3.3.3 Ventilation

Occupied spaces are served primarily with local hybrid ventilation units or zonal MVHR/HRU units incorporating heat recovery to recover waste heat from the exhaust air. This is then used to heat the incoming fresh air and therefore reduce energy usage.

The incorporation of heat recovery systems into mechanical ventilation units is essential for ensuring optimal energy efficiency and indoor comfort. By mandating the inclusion of heat recovery in all mechanical supply and extract ventilation units, developments can uphold high standards of sustainability and reduce their environmental impact. This approach aligns with contemporary building regulations and green building certifications, which prioritise energy conservation and emissions reduction.

Mechanical ventilation will operate automatically based on CO₂ and room temperature readings. In the summer, the users will have local control to open the windows to boost the ventilation rates, subject to external noise levels.

Air handling plant has been designed to have a low specific fan power to minimise the energy used by the fans.

3.3.4 Space Heating

In order to reduce CO2 emissions as far as reasonably practical, a comprehensive feasibility review of various heating options was conducted.

As there is no existing or proposed district heating network in the vicinity of the development, the next option preferred by the DfE is ground source heat pumps. Given the lack of space on site, the agreed design solution is to provide air source heat pump technology to maximise efficiency. The heat pump system will provide the heat source for a low temperature hot water heating system which will be distributed around the building and be suitably zoned to offer out of hours heating to community spaces only.

The installation will provide a level of redundancy in the heating design and meet the Output Specification (OS). The peak heating load has been estimated from the energy model utilised to establish the Initial Baseline Energy Model. The heating emitters will be sized in accordance with the heat factors given in BS EN 12831.

To supplement the heat pump technologies and to achieve the necessary energy targets, solar photovoltaic (PV) panels will be installed on roof areas of the college and external walkway canopies. The positioning and orientation of the PVs has been considered to maximise their output.

3.3.5 Domestic Hot Water Generation

The proposal for Hopwood Hall College is to utilise local electric water heaters to provide domestic hot water close to the outlet. This is in line with the DfE Output Spec and ensures that distribution energy losses are minimised wherever possible.

3.3.6 Comfort Cooling

Comfort cooling is provided to a number of teaching spaces within the new building that have heavy ICT usage. These are rooms such as the games, VR, eSport, computing areas etc. where due to the high internal heat gains, passive design solutions would not be enough to maintain comfortable temperatures throughout the year.

Comfort cooling will be provided via VRF refrigerant condensers located at roof level capable of maintaining temperatures within this space at circa 23degC.

3.4 Low Carbon Transportation Measures

The following low carbon transportation measures have been identified as feasible for integration into the scheme and should be prioritised where applicable:

3.4.1 Electric Vehicle Charging Infrastructure

The project will include the installation of electric vehicle (EV) charging stations, aiming to accelerate the adoption of electric vehicles among staff and visitors.

3.4.2 Cycle Storage and Facilities

The project will provide cycle storage facilities, emphasising the importance of cycling as a sustainable mode of transportation. This initiative not only promotes physical activity and improves public health but also contributes to reducing traffic congestion and enhancing air quality in urban environments. By encouraging cycling through dedicated storage spaces, the development supports a healthier lifestyle choice while fostering a more sustainable community.

4.0 Thermal Comfort & Climate Change Adaptation

4.1 Thermal Comfort Requirements

The DfE Technical Annexes require that all new college buildings are required to demonstrate compliance with the Overheating Risk Assessment using a weather file that represents a 2degC global warming above pre-industrial levels. The weather file to be used for this assessment is the DSY1 2080 Low Emissions 50th percentile weather file that is most representative for the site.

In addition, the requirement is for new colleges to demonstrate how they could adapt to achieve compliance with 4°C warming above pre-industrial levels. Proposed adaptation measures should not include changes to the superstructure of the building and shall not use active cooling. The weather file to be used for this assessment is the DSY1 2080 High Emissions 50th percentile weather file that is most representative for the site.

The method of assessing overheating has been through the use of TM52: 2013 – The limits of thermal comfort: avoiding overheating in European buildings. Criterion 1 is the minimum requirement for compliance and criterion 2 and 3 are reported for information only.

Criterion 1 - Hours of Exceedance (He):

For colleges, the number of hours (He) that ΔT is greater than or equal to one degree (K) during the period 1st May to 30th September for the defined hours inclusive shall not be more than 40 hours.

Criterion 2 – Daily Weighted Exceedance (We):

To allow for the severity of overheating the weighted Exceedance (We) shall be less than or equal to six in any one day.

Criterion 3 - Upper Limit Temperature (Tupp):

To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4K.

Overheating calculations must be carried out using a dynamic simulation model. The model and analysis in question does comply to AM11 - Building Energy and Environmental Modelling and has been constructed using Thermal Analysis Software (TAS) produced by EDSL which is a dynamic simulation tool.

These new standards are a significant upgrade to the requirements previously defined in Technical Annex 2F and passive design solutions such as cross ventilation and exposed thermal mass will now need to be considered to enable the building to meet the standards.

4.2 Results

Our overheating modelling shows that all of the typical rooms modelled pass the Technical Annex criteria for the 2degC global warming.

This is mainly thanks to the passive design solutions included in the building, such as exposed thermal mass and cross ventilation via high level louvres.

However, there is also a requirement to demonstrate how the new college building could adapt to achieve compliance with 4degC warming above pre-industrial levels.

Our overheating modelling for this scenario shows that some spaces overheat when modelled against a 4degC temperature rise. In event of this scenario the college would be able to install additional thermal mass in the shape of phase change materials or a small scale GSHP system to pump cool borehole water through the building, making use of the existing batteries within the hybrid ventilation units and heat recovery units to provide cooling to the spaces that need it.

The future GSHP would be sized to prevent overheating in teaching spaces (not already provided with active cooling) rather than providing air conditioning (temperatures below 23degC) to spaces and therefore would be of a small scale to reduce space requirements and capital costs.

Space allowance has been provided within service zones in corridors and risers for this future expansion to occur.