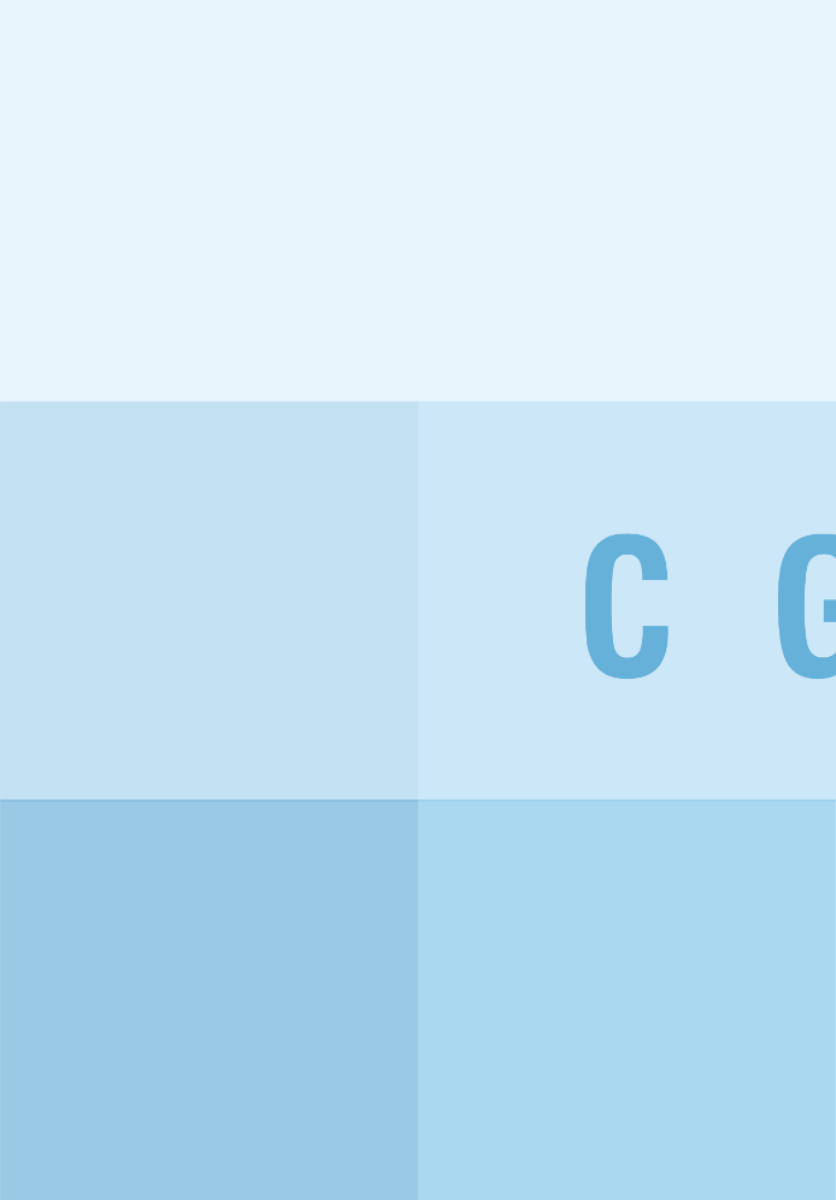




CGP | MEP

WYTHENSHAW PARK SPORTS HUB

Mechanical, Electrical and Public Health Services

Renewable and Sustainability Planning Report

DOCUMENT DETAILS

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1.0 INTRODUCTION

1.1 PROJECT INTRODUCTION

The Wythenshawe Park Sports Hub is a proposed new build development in Wythenshawe, Manchester, that will provide community facilities to the local area. The development will offer changing facilities, a bike workshop, bike storage, café and kitchen and General Practice (“GP”) surgery for health and wellbeing.



Figure 1 – Site location taken from Google Maps

The proposed development is a single storey building comprising of the following facilities as indicated on the drawing extracts in section 1.3:

- Changing Areas
- Bike Workshop
- External Bike Store
- Café / Reception
- Kitchen/Prep
- Office and Staff Area
- Community Spaces
- Triage
- Clinical Rooms
- Treatment Room
- Toilet Facilities
- Storage areas
- Circulation areas
- Plant areas

1.2 PURPOSE OF THIS DOCUMENT

This document has been prepared to provide an overview of the renewable and sustainable energy strategies that have been developed through the design of the facility to support the planning submission.

The proposals within this document are reflective of the current architecture and the mechanical, electrical and public health engineering services design at RIBA Stage 4.

1.3 PROPOSED BUILDING LAYOUTS

The following layout extracts are taken from the Norse Group architectural drawings and the Barnes Walker landscape plan.



Figure 2 - Proposed Ground Floor Layout



Figure 3 - Proposed Elevations



Figure 4 - Proposed Sections



Figure 5 - Proposed Site Plan

1.4 PROJECT OBJECTIVES

The primary objective of the project is to create a new, modern, state of the sports hub facility for the local community.

The Client is driven to provide an energy efficient and sustainable building through design solutions to ensure the operational performance of the building is as efficient as possible.

1.5 PLANNING POLICIES

The Manchester City Council planning policies relating to energy, operational carbon emissions and the application of low and zero

carbon (“LZC”) technologies have been identified as policies EN 4, EN 6 and EN 8.

The design for the development has considered these policies from concept, with a low carbon approach taken through passive measures including the orientation of the building and its form through to low carbon technologies being proposed.

1.5.1 POLICY EN 4 REDUCING CO₂ EMISSIONS BY ENABLING LOW AND ZERO CARBON DEVELOPMENT

Policy EN 4 Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development (“EN 4”) states that developments must follow the Energy Hierarchy approach to reduce energy consumption through passive measures, energy efficiency and LZC technologies.

The performance of the building fabric and the mechanical and electrical services have been designed to reduce energy consumption in the first instance and then offset the energy demand through LZC technologies in accordance with the energy hierarchy methodology (refer to section 2.1).

1.5.2 POLICY EN 6 TARGET FRAMEWORK FOR CO₂ REDUCTIONS FROM LOW AND ZERO CARBON ENERGY SUPPLIES

Policy EN 6 Target Framework for CO₂ Reductions from Low or Zero Carbon Energy Supplies (“EN 6”) has been partially superseded by PfE policy JP-S2 (“JP-S2”). The design approach taken has been to reduce carbon emissions where practical and feasible without impacting on the scheme delivery.

Improvements to the fabric of the building reduces the amount of heat lost and gained to reduce the heating and cooling demands for the building. The design looks to improve upon the fabric U-values, air permeability and solar control glazing against the values used in the Part L notional building.

Energy efficient systems including LED lighting and reduced energy pumps and fans reduce the electrical consumption of the building.

The energy consumption of the building is then reduced further through the proposed implementation of high-efficiency heat pump technologies and PV panels that will produce on-site electricity, reducing reliance from the grid.

1.5.3 POLICY EN 8 ADAPTION TO CLIMATE CHANGE

Policy EN8 Adaption to Climate Change (“EN 8”) states that developments are to consider flood risks, generation of urban heat islands, enhancing natural habitats and the reduction in overheating by passive design measures.

The building is orientated such that the main areas of glazing for the building are east and west facing, with no glazing facing south which would be subject to the highest levels of solar heat gain.

Solar control glazing has been applied throughout to reduce the solar heat gain, whilst maintaining good levels of light transmittance to promote wellbeing within the rooms.

The thermal performance of the building fabric has been enhanced above the minimum Part L values to reduce heat gains and losses further (refer to Table 1).

1.6 ENERGY

The following outlines the project requirements for Building Regulation Part L2 2021 (“Part L2”) compliance, our approach to energy and sustainability for the project and the Energy Performance Certificate (“EPC”) target.

1.6.1 PART L2

The project will need to achieve Part L2 compliance via modelling undertaken at key stages to ensure the overall design proposals from the design team achieve compliance and the Client’s aspirations for the building.

In order to meet these requirements, the building design will be developed with the design team with a ‘Fabric First’ approach whereby the construction budget is invested in the building fabric and energy efficiency measures, rather than relying on an excessive amount of renewable energy technologies to achieve compliance.

Our approach to the design of the building has followed the energy hierarchy described within section 2.1.

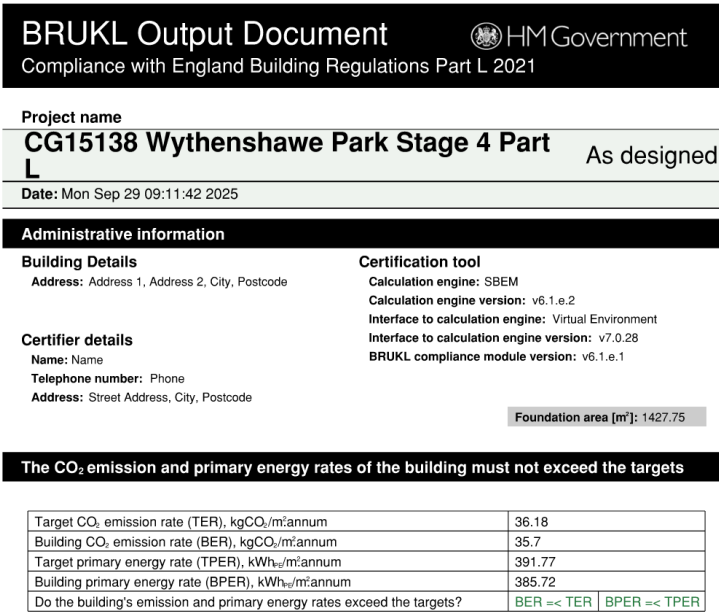


Figure 6 – Output from the Part L BRUKL report

1.6.2 ENERGY PERFORMANCE CERTIFICATE

The building will also be provided with an Energy Performance Certificate at handover, the target rating for the project is ‘A’.

2.0 ENERGY AND SUSTAINABILITY

2.1 ENERGY HEIRARCHY

In accordance with planning policy EN 4, the proposed design has been modelled on the energy efficiency hierarchy of “Be Lean, Be Clean, Be Green” approach to energy efficiency in buildings.

- Be Lean – Energy demand should be minimised by optimising the design and construction of the building through measures such as passive heating, cooling and ventilation, thermally efficient materials and considerate design of the layout.
- Be Clean - Energy efficient systems, equipment and appliances should be selected to reduce the remaining energy demand
- Be Green – Energy should be supplied from Low and Zero Carbon (LZC) energy sources, such as air source heat pumps, photovoltaic cells etc.

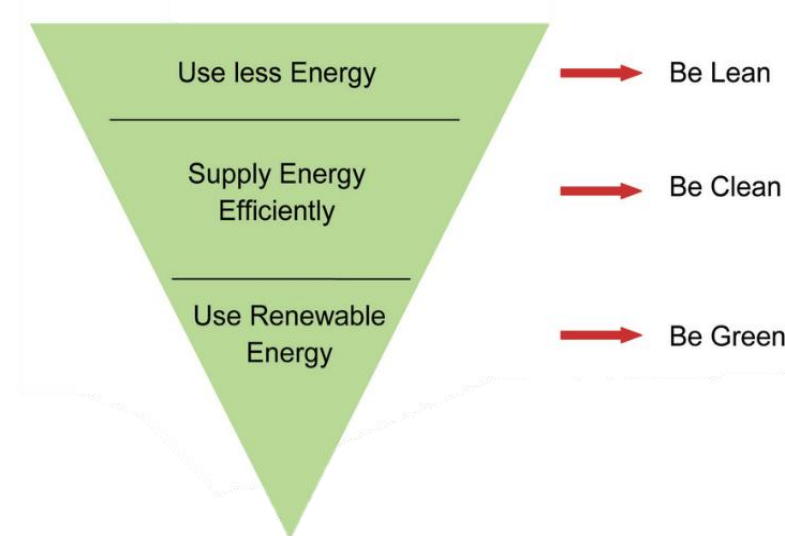


Figure 7 - Energy Hierarchy

An energy model was created using IES software to undertake the analysis of the Energy Hierarchy to determine the most feasible means of reducing energy consumption for the facility.

2.2 ‘BE-LEAN’ AND ‘BE CLEAN’

2.2.1 U-VALUES

To try and achieve compliance with Part L2 through passive measures, improvements on the minimum building fabric values

have been proposed to minimise the calculated operational energy use and carbon dioxide emissions. Table 1 demonstrates that fabric elements for the proposed building are surpassing the minimum Building Regulation standards and are either equal or an improvement on the notional building values which are used to calculate the TER.

Element	Building Regulation Maximum U-Values (W/m²K)	Building Regulation Notional U-Values (W/m²K)	Proposed U-Values (W/m²K)
Roof (flat)	0.18	0.14	0.14
Roof (pitched)	0.16	-	0.14
Wall	0.26	0.18	0.16
Floor	0.18	0.14	0.13
Doors	1.60	1.60	1.40
Glazing elements / roof windows (including frame)	1.60	1.30	1.30
Rooflights	2.2	2.01	2.01

Table 1 - Comparison of building fabric parameters for Part L2 2021 and the proposed design standards

2.2.2 AIR PERMEABILITY

The air tightness of a building impacts on its energy consumption and hence the CO₂ emissions. The lower the air tightness, the more heated warm air is retained within the occupied spaces of the building, therefore less energy is required to heat the building in winter. Part L2 identifies that air permeability of less than 8m³/hr per m² @ 50Pa should be achieved. It is the intention on this project to improve on the air permeability value to further minimise energy consumption with a target of 3m³/hr per m² @ 50Pa for this building.

Element	Building Regulation Maximum (m³/hr per m² @ 50Pa)	Building Regulation Notional (m³/hr per m² @ 50Pa)	Proposed (m³/hr per m² @ 50Pa)
Air permeability	8.0	3.0	3.0

Table 2 – Air permeability for Part L2 2021 and the proposed design standards

2.2.3 GLAZING PERFORMANCE

A low G-Value glazing (0.36) will be utilised for the glazing elements to reduce solar gains.

Element	Building Regulation Maximum g-value	Building Regulation Notional g-value	Proposed g-value
Windows	n/a	0.40	0.36
Rooflights	n/a	0.40	0.36

Table 3 - Comparison of glazing performance for Part L2 2021 and the proposed design standards

2.2.4 HEAT RECOVERY

The heat recovery efficiency within the ventilation systems has been set to 80%, an improvement against the minimum standards. This will reduce the heat load and energy consumption of the ventilation heating coils.

2.2.5 LOW SPECIFIC FAN POWERS

The specific fan powers for the ventilation units has been set to 0.8W/l/s to reduce the auxiliary energy load of the building.

2.2.6 VRF COEFFICIENT OF PERFORMANCE

The air-to-air VRF units coefficient of performance has been set to SCOP of 6.0 and SEER of 7.0 for heating and cooling respectively for all of the systems. These efficiencies are higher than those used with the Building Regulations notional model.

2.2.7 ENERGY EFFICIENT LIGHTING

Energy efficient LED lighting in combination with lighting controls will be used throughout the proposed buildings, as opposed to merely standalone LED lighting. Lighting control systems will include daylight sensing and PIR (passive infrared sensors) detection to assure that the energy use and associated carbon emissions of the building lighting installation are as low as possible. It is proposed that the lighting is improved over and above the 2021 Part L2 Building Regulations with 110 luminaire lumens per circuit watt (lm/W) as a minimum.

2.2.8 METERING

Energy and water meters have been allowed for to aid the energy management of facility including the consumption of power, lighting and water. These meters are to be monitored and recorded by the building management system.

2.2.9 Building Management System

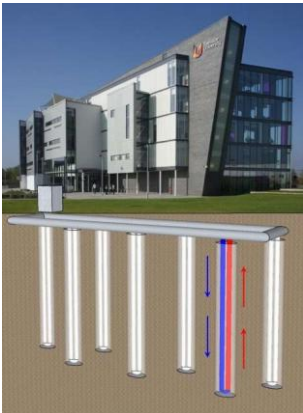
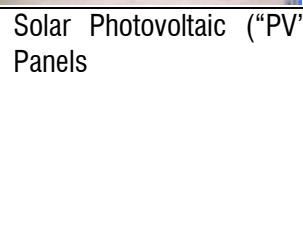
The building management system (“BMS”) provides automated control of the heating, ventilation and cooling systems within the building and monitors and records the energy and water consumption of the facility. This provides a means of energy management, allowing for evaluation of consumption of power, lighting and water usage.

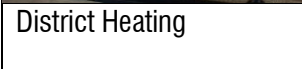
2.3 ‘BE GREEN’ - ENERGY EFFICIENCY MEASURES

The planning requirements for the developed are to promote sustainability and reduce carbon emissions in operation where possible.

To try and achieve compliance with Part L2 through passive measures, improvements on the minimum building fabric values have been proposed to minimise the calculated operational energy use and carbon dioxide emissions

The following table provides a high-level assessment of the potential feasibility of applying the technologies to the development.

Technology	Assessment	Feasible
Air-to-Air Heat Pump variable refrigerant flow ("VRF") 	Air-to-Air heat pumps would offer a viable source of low carbon technology to provide heating and cooling to the development.	✓
Air Source Heat Pump ("ASHP") 	Heat pumps would offer a viable source of low carbon technology to provide heating and potentially cooling to the development.	✓
Ground Source Heat Pump ("GSHP") 	Heat pumps would offer a viable source of low carbon technology to provide heating and potentially cooling to the development. With the surrounding landscaping works, ground source technology could be utilised as part of the grounds work installation.	✓
Biomass/Biofuels 	The issue of sourcing and delivery of biomass/biofuels as a low carbon fuel discounts this option.	×
Solar Photovoltaic ("PV") Panels 	The production of electricity from the PV panels can be utilised to offset the energy demand of the building. The roof of the building could be utilised for the installation of the panels.	✓

		
Solar Thermal Panels 	As all domestic hot water outlets are to be local point or use heaters and showers there is limited water storage that could be benefited by solar thermal panels. As such this technology has been discounted as being suitable.	×
Wind Turbines 	Whilst wind power could provide a suitable means of offsetting the electrical consumption for the development, the technology has been discounted due to potential planning implications and issue of shadow flickering to public spaces.	×
Combined Heat and Power ("CHP") Units 	CHP's are typically run off fossil fuels such as natural gas and oil. As fossil fuels are not proposed for the site this technology has been discounted.	×
Fuel Cells 	The provision of fuel cell plant is expensive and is an unfamiliar technology for most maintenance teams. As such this technology has been discounted as being suitable.	×
District Heating 	There is a feasibility review currently being undertaken	×

	regarding a district heating system to serve the £500m redevelopment of Wythenshawe Civic Centre. The review is at an early stage and as such is discounted as a potential energy source for this development, however, should the final heating solution include water distribution as opposed to refrigerant or direct electric, the future connection to a district heating system could be allowed for.	Water based heating systems could allow for future connection
Energy Storage 	The provision of energy storage is expensive. As such this technology has been discounted as being suitable.	×

LZC technologies are proposed to improve the energy performance of the building and reduce the reliance from grid-based electricity where feasible, for example where solar PV panels can generate on-site electricity.

During RIBA Stage 2, the feasible LZC technologies identified in the above table were individually assessed to determine whether they made a significant contribution to reducing the energy consumption and carbon emissions for the facility. Each technology was individually assessed within the Part L calculations.

Air-to-air heat pump

System: Air-to-air heat pump technology serving rooms with heating and cooling requirements, with direct electric heating serving heating-only rooms.

Result: The calculated BER within the Part L analysis is 16.7% above the TER and as such does not comply with the Building Regulation requirements.

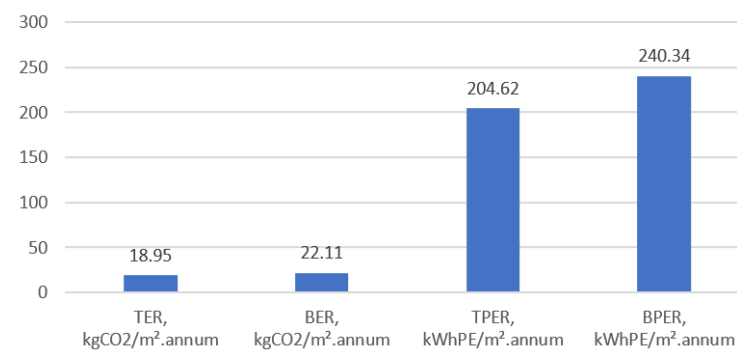


Figure 8 – Chart showing the Part L calculation with air-to-air heat pumps and direct electric

Air-to-water heat pump

System: Air-to-air heat pump technology serving rooms with heating and cooling requirements, with an air-to-water heat pumps serving rooms needing heating and cooling.

Result: The calculated BER within the Part L analysis is 1.4% above the TER and as such does not comply with the Building Regulation requirements.

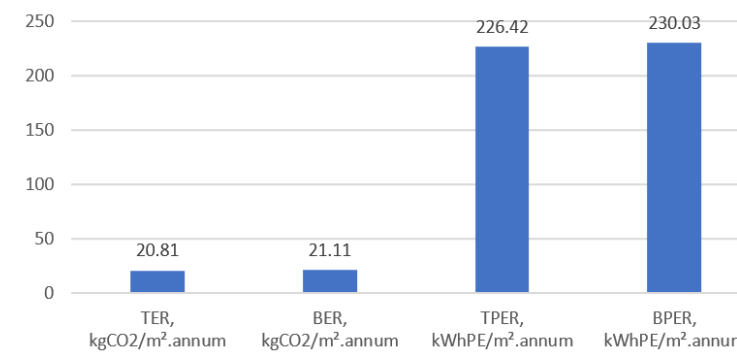


Figure 9 – Chart showing the Part L calculation with air-to-air heat pumps and air-to-water heat pump technologies

Ground source heat pump

System: Air-to-air heat pump technology serving rooms with heating and cooling requirements, with an air-to-water heat pumps serving rooms needing heating and cooling.

Result: The calculated BER within the Part L analysis is 1.2% above the TER and as such does not comply with the Building Regulation requirements.

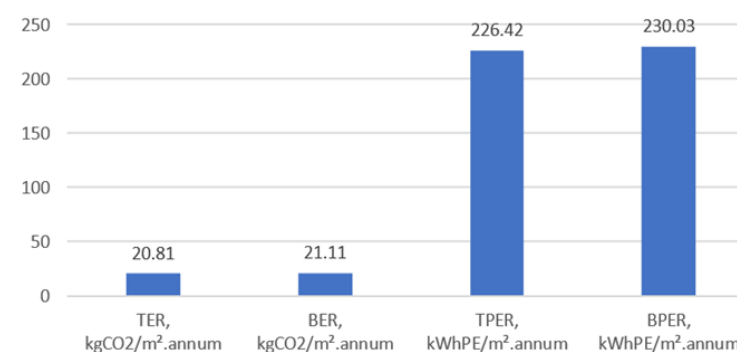


Figure 10 – Chart showing the Part L calculation with air-to-air heat pumps and ground source heat pump technologies

PV panels

System: Air-to-air heat pump technology serving rooms with heating and cooling requirements, with direct electric heating serving heating-only rooms. PV panels located on the roof of the facility with areas of 77.5m² and 155m².

Result: The calculated BER within the Part L analysis are 12.3% and 12.8% above the TER respectively and as such do not comply with the Building Regulation requirements.

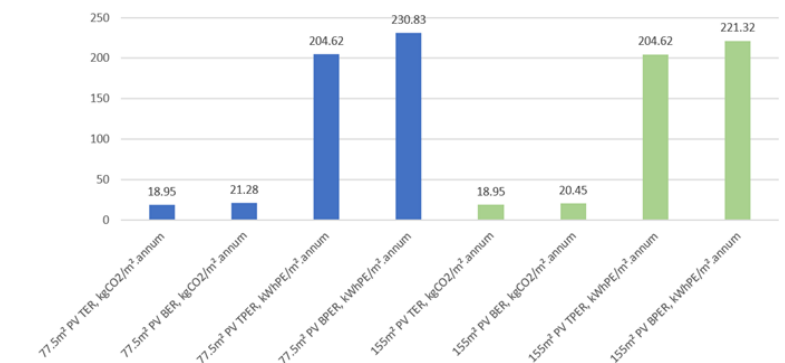


Figure 11 – Chart showing the Part L calculation with air-to-air heat pumps and roof mounted PV panels

2.4 SUMMARY AND RECOMMENDATIONS

Applying the 'Be Lean' and 'Be Clean' measures of the Energy Hierarchy, the building will not comply with Building Regulations Part L2.

Low and zero carbon technologies are required to improve the BER calculation but as demonstrated in section 2.3, applying a single LZC technology does not result in compliance with Part L. As such, a combination of technologies has been applied.

The LZC technologies proposed to serve the facility are air-to-air VRF heat pumps and solar PV panels, with the heat pumps providing a high-efficiency output of heating and cooling and the electrical demand offset by the PV array.

Air-to-Air VRF systems are used to provide heating and cooling to the café, bike workshop, office accommodation and GP area and to condition fresh air in the ventilation units serving the GP area and the kitchen. The efficacy of the heat pumps proposed at this stage of the design are SCOP of 5.0 in heating operation and an SEER of 6.0 in cooling operation. The efficiencies of these units are greater than those used within the Building Regulations notional model.

A PV panel array of 450m² and a peak output of 90.5kW has been allowed for within the Part L model, achieving compliance with Part L as shown in Table 4.

Energy Hierarchy Measure	Target Emission Rate, TER (kg.CO ₂ /m ² annum)	Building Emission Rate, BER (kg.CO ₂ /m ² annum)	Pass/Fail % Variance in CO ₂ emissions (BER / TER)
Be Green with Air-to-air heat pumps and 450m ² PV panels	36.18	35.70	Pass + 1%

Table 4 – ‘Be Clean’ with ASHP and PV panels TER and BER calculations

Energy Hierarchy Measure	Target Primary Energy Rate, TPER (kWh _{PE} /m ² annum)	Building Primary Energy Rate, BPER (kWh _{PE} /m ² annum)	% Variance in Energy Consumption against the Notional
Be Green with Air-to-air heat pumps and 450m ² PV panels	391.77	385.72	+ 2%

Table 5 – ‘Be Clean’ with ASHP and PV panels TPER and BPER calculations

3.0 FUTURE ADAPABILITY OF THE BUILDING

3.1 ADAPTION TO CLIMATE CHANGE

Since the 1970s, average temperatures for Central England have risen by nearly 1°C, and the last decade was the warmest on record. It is likely that the climate will continue to change with higher temperatures, changing rainfall patterns, rising sea levels and more unpredictable extreme weather ranging from floods, droughts and freezing winters. The UK Climate Change Risk Assessment: Government Report (2012) outlines the risks faced to businesses, buildings, and health and wellbeing in the future.

UK 2012 Climate Change Risk Assessment

Risks noted within this report include the likelihood of increased external temperatures, which could lead to a loss of staff hours, and damage to equipment due to high internal building temperatures. Increased external temperatures would also lead to increased energy demand for cooling, which would not only further increase atmospheric carbon emissions, but also put strain on the energy infrastructure. Energy infrastructure itself would also be at risk of disruption, meaning that there will be less energy available on the grid.

Passive design features of the Wythenshawe Park Sports Hub mean that the building is well adapted to these risks. Firstly, the energy demand has been reduced and thus the building will be less affected by the decreased availability of energy. Secondly, it will also have a lower carbon footprint, helping to stop the effects of climate change from increasing further.

A combination of the expected increase in external temperatures could mean future overheating problems. By orientating the building predominantly to the east/west and by having low g-value windows, there is less solar heat gain entering the rooms.

Surpassing the Building Regs minimum U-values and designed out thermal bridges will retain heat within the building. This combination of passive design measures will act to stabilise the

temperatures within the building and enable it to adapt to the likely extremes of both heat and cold.

Efficient lighting and mechanical systems will keep the internal heat gains to a minimum. The economic lifespan of this equipment is approximately between 15 to 20 years, during which period there will be continued development and improvements to the efficiency of the equipment. As such it is envisaged that the replaced plant and equipment in the future will be more efficient, thereby aiding the efforts to reduce the climate change impact. These features will mean that there will be a reduced demand for cooling, keeping the building's energy demand low.

A 450m² PV panel array has also been proposed to produce electricity on site to serve the facility and to reduce the reliance on the national grid.

4.0 CONCLUSION

The energy hierarchy has been applied through the design of Wythenshawe Park Sports Hub, looking to reduce energy consumption through passive measures such as improved building fabric and orientation of the building. The energy efficiency of plant and equipment have also been improved against the Building Regulation minimum requirements, including enhanced heat recovery efficiency and lighting system performance.

From reducing the energy consumption of the building through these measures, LZC technologies were then applied to reduce the carbon emissions of the facility further and to comply with the Part L requirements.

High-efficiency air-to-air VRF heat pumps and a 450m² PV panel array are proposed to serve the facility. This provides a low carbon means of producing heating and cooling, with on-site electrical generation to reduce carbon emissions and the resilience from the grid.

Through passive design measures including solar control glazing, a reduction in the energy consumption and the production of on-site energy, measures are built-in to provide adaptation to climate change. This will be increased further through the likely replacement more efficient technologies as the mechanical and electrical system approach the end of their economic life.