MONKS CROSS, YORK

DRIVE-THROUGH UNIT

ENERGY USAGE & SUSTAINABILITY STATEMENT

Revision	0	A	B	C
Remarks	First Issue.	Fig 1 updated to 2504 P432C Proposed Site Plan.		
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Project number	22-4004	22-4004		
File Location	Dave Dickinson & Associates\Regions - Documents\DON\Lidl Monks Cross, York 22-4004\K Reports			

TABLE OF CONTENTS

TABLE OF FIGURES

1.00 EXECUTIVE SUMMARY

DDA Consultant Engineers Ltd has been commissioned by Lidl GB Ltd to prepare an energy statement in support of the planning application for the proposed drive thru unit located on the new Lidl supermarket development at Monks Cross, York.

The development is required to demonstrate:

How the incorporation of passive design and energy efficient measures can contribute towards mitigating and adapting to climate change and reducing the development's carbon emissions and energy consumption.

How the incorporation of good building design with a holistic approach to sustainability can enhance the development's sustainable credentials.

How the incorporation of good building design with a holistic approach to sustainability can reduce the energy demand, carbon emissions and running costs.

How the incorporation of passive and active design strategies can reduce the development's regulated emissions to the highest of standards, exceeding the minimum requirements of Part L Volume 2 2021 Building Regulations and ensure the minimum standards of The City of Yorks Development Control Local Plan are met.

That carbon dioxide emissions associated with energy demand can be reduced in accordance with the energy hierarchy:

a) Minimising energy requirements.
b) Incorporating high efficiency systems and controls.
c) Incorporating low or zero carbon energy sources.

This energy statement shows that:

The developments incorporation of 'passive' design strategies will take advantage of:

a) Natural daylighting thus, reducing dependency on electric lighting and the associated running costs and carbon emissions through natural contribution towards internal lighting requirements.
b) Enhanced fabric efficiencies and thermal mass stabilise any temperature fluctuations within the building reducing heat gains and/or losses.

The incorporation of 'active' design strategies will take advantage of:

Separate sub-metering to allow for all energy consumed to be monitored and any discrepancies to be easily identified and fixed thus minimising wasted energy.

Low energy lighting with suitable controls provided.

High efficiency HVAC systems with low specific fan powers and reduced energy consumption through suitable local control strategies.

Combined Heat and Power (CHP) and De-centralised Energy Network (DEN) solutions have been reviewed and considered unviable for this development due to:

Unsuitable energy consumption profiles for CHP (require high domestic hot water (DWS) consumption). CHP systems are well suited for buildings that have all year demand for heat. They require predictable and relatively constant base load for optimum performance, which can be found in applications with high domestic hot water loads. The drive thru café is expected to have a low hot water demand requirement with a limited number of hot water outlets, therefore, connection to CHP plant would not be deemed viable, due to the lack of thermal demand.

No suitable DEN within the vicinity of the proposed development.

Alternative Low or Zero Carbon (LZC) technologies have been reviewed with the following deemed to be both viable and advisable:

Air Source Heat Pumps, or Aero-thermal Heat Pumps.

Photovoltaic Panels

- Panel Array – 9.30m²
- Panel Efficiency – 20.7%
- Panel Incline – 4.0°
- Orientation – 180° from North
- Annual Output – 1,510.36kWh/annum

The 'Baseline' building annual carbon emissions and energy consumption has been calculated as follows:

Regulated Annual Carbon Dioxide Emissions: 2,952.40kgCO_2/annum.

Regulated Annual Energy Consumption: 21,957.56kWh/annum.

The 'Be Lean', 'Be Clean', 'Be Green' actual building annual carbon emissions and energy consumption has been calculated as follows:

Regulated Annual Carbon Dioxide Emissions: 2,784.04kgCO_2/annum.

Regulated Annual Energy Consumption: 19,646.88kWh/annum.

The results show a 5.70% carbon dioxide reduction and a 10.52% energy reduction, when assessed to Part L Volume 2 2021 Building Regulations and accounting for the proposed passive, active and LZC strategies.

Furthermore, the introduction of roof mounted photovoltaic panels will provide an expected annual generation of 1,510.36kWh/annum. This represents >7.5% of the developments regulated energy consumption. It should be noted that the P.V. electrical generation may not correlate with the actual energy consumption profile, therefore, some of the on-site electrical energy generation may be exported back to the grid.

Note: This assessment is based on a 'Shell Only' development, therefore, the actual building services strategy and internal architectural layout is unknown. The inputs allowed for within the SBEM calculation, of which the results of this report are based, are made on realistic assumptions (refer to Appendix A for input assumptions). It will be the responsibility of the Fit-out team to ensure the actual development complies with all relevant national and regional planning requirements, building regulations and any other relevant standards. The actual performance of the Fit-out building will be subject to change as the detailed design stages progress.

2.00 INTRODUCTION

DDA Consultant Engineers Ltd has been commissioned by Lidl GB Ltd to prepare an energy statement in support of the planning application for the proposed drive through unit located on the wider Lidl retail development at Monks Cross, York.

The energy statement will demonstrate how the development will provide heating and power and meet the energy / carbon emission target set by national and local policy. The energy statement will demonstrate the design teams commitments to sustainable development and how they intend to reduce their annual carbon emissions and energy consumption through the utilisation of; good practice engineering, passive, and active strategies and Low or Zero Carbon (LZC) technologies.

The energy statement will demonstrate the design team's commitment to go above and beyond the requirements of Part L (Volume 2) 2021 minimum standards to ensure a high carbon reduction/off-set is achieved, as well as supply LZC technologies to contribute towards the annual regulated energy consumption.

2.01 Energy Statement Requirements

The objective of this report is to define and outline how the incorporation of sustainable building design, coupled with the incorporation of LZC technologies at an early stage of the design process can ensure compliance with relevant local and national planning policies, achieve building regulation compliance to a high standard and reduce the energy consumption, associated carbon emissions and running costs of a new build. The core design principals to be outlined within this report will be to:

- Reduce energy demand through the implementation of the energy hierarchy.
- Meet end-use energy demands efficiently and effectively.
- Supply LZC technologies to further reduce the development's energy demand, associated carbon emissions and utility costs.
- Enable effective energy management to ensure installed systems work to their maximum efficiencies.

The report will compare the energy usage and CO_2 emissions from a Notional Building (Building Regulation Part L Volume 2 2021 compliant) to that of the proposed building including energy efficiency measures, decentralised energy, and renewable energy systems (where appropriate).

3.00 SITE LOCATION AND DESCRIPTION

The site is located in the Monks Cross retail park at York and is in close proximity to residential properties and other retail premises and commercial units.

As shown in Fig 1, the drive thru is orientated with a highly glazed façade facing south and west. The emphasis on the southern orientation offers the advantage of natural daylighting contributions, however, may lead to excess solar gains and overheating risk if left unmanaged. This will increase potential mechanical cooling loads and energy consumption.

The site receives little over shading or overlooking, offering privacy to the development and maintained privacy to residential houses and commercial units surrounding the site.

Figure 1 - Site Context

4.00 PLANNING POLICIES & REFERENCE DOCUMENTS

The following documents offer a review of the necessary planning policies and requirements to be adhered to, to ensure sustainable design standards are met and the relevant targets set by local and national authorities understood.

4.01 National Planning Policy Framework (NPPF 2021)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations. The ministerial foreword of this NPPF highlights that 'the purpose of planning is to contribute to the achievement of sustainable development' and that at the heart of the framework is a presumption in favour of sustainable development.

Sustainable development is defined in the NPPF as comprising developments "meeting the needs of the present without compromising the ability of future generations to meet their own needs" in line with the definition of the Brundtland Commission ('Our Common Future', 1987). The NPPF also refers to the three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways – an economic objective, a social objective and an environmental objective.

4.02 City of York Development Control Local Plan (Approved April 2005)

The Local Pan is the spatial development strategy for the City of York. It defines the spatial vision for Leeds Metropolitan District to 2028 with an aim for Leeds to be the 'Best City' in the UK.

The object of the Local Plan is to ensure development proposals conform to all relevant aspects of the Plan unless relevant planning reasons can be put forward which indicate why the provisions of the Local Plan should be set aside.

The Plan aims to enhance the health, safety and amenity of the public, improve the natural and built environment and to achieve more sustainable forms of development.

Policy GP4a 'Sustainability' confirms the Leeds principles for minimising greenhouse gas emissions.

POLICY GP4a: SUSTAINABILITY

Proposals for all development should have regard to the principles of sustainable development as summarised in criteria a–l below.

All commercial and residential developments will be required to be accompanied by a sustainability statement. The document should describe how the proposal fits with the criteria listed below and will be judged on its suitability in these terms.

Development should:

a) provide details setting out the accessibility of the site by means other than the car and, where the type and size of the development requires, be within 400m walk of a frequent public transport route and easily accessible for pedestrians and cyclists;

b) contribute toward meeting the social needs of communities within City of York (including, for Example, housing, community and recreational facilities, car clubs, recycling facilities and communal laundry blocks) and to safe and socially inclusive environments;

c) maintain or increase the economic prosperity and diversity of the City of York and maximise employment opportunities (including supporting local goods and services providing training and employment for local unemployed and young people);

d) be of a high quality design, with the aim of conserving and enhancing the local character and distinctiveness of the City;

e) minimise the use of non-renewable resources, re-use materials already on the development site, and seek to make use of grey water systems both during construction and throughout the use of the development. Any waste generated through the development should be managed safely, recycled and/or reused. The ‘whole life’ costs of the materials should be considered;

f) minimise pollution, including that relating to air, water, land, light and noise;

g) conserve and enhance natural areas and landscape features, provide both formal and informal open space, wildlife areas and room for trees to reach full growth;

POLICY GP4a: SUSTAINABILITY (CONTINUED)

h) maximise the use of renewable resources on development sites and seek to make use of renewable energy sources, such as heat exchangers and photovoltaic cells;

i) make adequate provision for the storage and collection of refuse and recycling.

4.03 Building Regulations Approved Document Part L: 2021

Part L of the current Building Regulations (2021) considers the reduction of carbon emissions in new and existing buildings. As the proposal consist of the creation of new non-domestic space it falls under Part L Volume 2 of the Regulations.

The overall structure of compliance with the 2021 Building Regulations for new buildings includes five criteria to comply with:

Criterion 1 – The Building Emission Rate (BER) should be better than the Target Emission Rate (TER) and the Building Primary Energy Rate (BPER) should be better than the Target Primary Energy Rate (TPER).

Criterion 2 - Limit on design flexibility.

Criterion 3 - Limiting effects of heat gain in summer.

The energy strategy for the scheme has been developed to ensure the scheme meets the relevant requirements of the Building Regulations.

5.00 ENERGY HIERACHY

The Energy Statement has been prepared using the “fabric first” approach of the ‘Be Lean’, ‘Be Clean’, ‘Be Green’ Governmental energy hierarchy:

Be Lean – reduce the need for energy.

Be Clean – supply and use energy in the most efficient manner.

Be Green – supply energy from renewable sources.

Figure 2 - Energy Hierarchy

Adhering to the principles of the Energy Hierarchy has several benefits:

By reducing the energy requirement of the building, the potential renewable requirement shrinks in proportion. This has obvious cost benefits and will help reduce the building’s energy requirements and carbon emissions for the lifespan of the development.

The sustainable credentials of each development are enhanced and are not validated by simply bolting on expensive renewable equipment. By focusing on fabric performance and the provision of efficient heating systems each building is intrinsically “green”.

Provides reassurance to the end user the building is performing to its highest potential and all systems are working to their maximum efficiencies with minimal energy waste, thus reducing dependencies on natural resources (gas & electric) as well as minimising running costs.

The incorporation of energy efficiency measures and a holistic approach to building design will ensure that the carbon emission from the building will be kept to a minimum.

6.00 ASSESSMENT METHODOLOGY & DYNAMIC SIMULATION SOFTWARE

6.01 Calculation Process

To detail the benefits of adhering to the energy hierarchy, we must first create a baseline to compare against. This is done using a Dynamic Simulation Modelling software tool which follows a set methodology for calculating the buildings carbon emissions and associated energy use. Dynamic Simulation Modelling (DSM), as used for Part L Building Regulations compliance, has been carried out using the EDSL TAS software, Version 9.5.5, in accordance with CIBSE AM11.

The TAS software has been deemed appropriate for this project, as it allows a single model to be used for all required analysis relating to the building energy performance regarding passive and active strategies, energy efficient mechanical and electrical systems, and LZC technologies.

6.02 TAS Software

TAS is a governmentally approved software capable of analysing multiple environmental credentials of a building. By creating a virtual environment where, geometric form, thermal mass, interaction with local weather & climate, fabric performance, energy consumption and carbon emissions are analysed, different design strategy characteristics and benefits can be assessed and discounted (where necessary).

The TAS software analyses two buildings in parallel with each other, the first representing the notional building as defined by the National Calculation Method (NCM), and the second the building as proposed. The difference in CO_2 emissions and energy consumption between the models represents the CO_2 reduction achieved by the proposed low energy and low carbon design.

By modelling each area to be analysed, and inputting a series of parameters, the software can give projected annual loadings for heating and cooling requirements, carry out Part L2 compliance checks through the SBEM tool as well as multiple other dynamic simulations.

6.03 National Calculation Methodology

The National Calculation Method (NCM) is the methodology used for demonstrating compliance with Part L of the Building Regulations for buildings other than dwellings. Annual energy use and associated emissions for a proposed building are calculated and compared with the energy use and emissions of a comparable notional building. Both calculations make use of standard sets of data for different activity areas (internal conditions) and common databases are used to calculate emission factors, weather data, and set variables of construction and service elements.

The NCM allows the actual calculation to be carried out either by an approved simulation software or by a simplified tool. For this report, the building has been assessed using the Dynamic Simulation Software, TAS.

6.03.1 Weather Data

External weather conditions and variables must be considered within the Dynamic Simulation software.

The UK Meteorological Office (MO) collects and analyses weather data across the UK. They account for multiple climate variables such as wind speed and direction, air pressure, relative humidity, air temperature etc. across 14 locations. The weather data variables are broken into two types of weather files: Design Summer Year (DSY) and Test Reference Year (TRY)

Design Summer Year (DSY): This set of data represents a warmer than typical year and is used when calculating maximum resultant temperatures, cooling loads, TM52 calculations etc. as it will give a worst-case scenario with regards to UK temperatures.

Test Reference Year (TRY): This set of data represents a typical/average year and is used for calculating average energy uses within buildings for steady state calculations and for Part L compliance.

For the purposes of this report, the Test Reference Year (TRY) has been used to calculate the development's energy and carbon emissions and compliance with Part L2.

6.03.2 Internal Conditions

To determine the energy requirement of each zone, internal conditions are assigned to all relevant areas. An internal condition details the conditions to which each zone will be maintained and accounts for parameters such as occupancy gains, equipment gains, lighting, infiltration and ventilation, upper and lower temperatures. The NCM calculation methodology has pre-defined internal conditions which must be used to ensure consistent Part L2 calculations.

6.04 Building Geometry

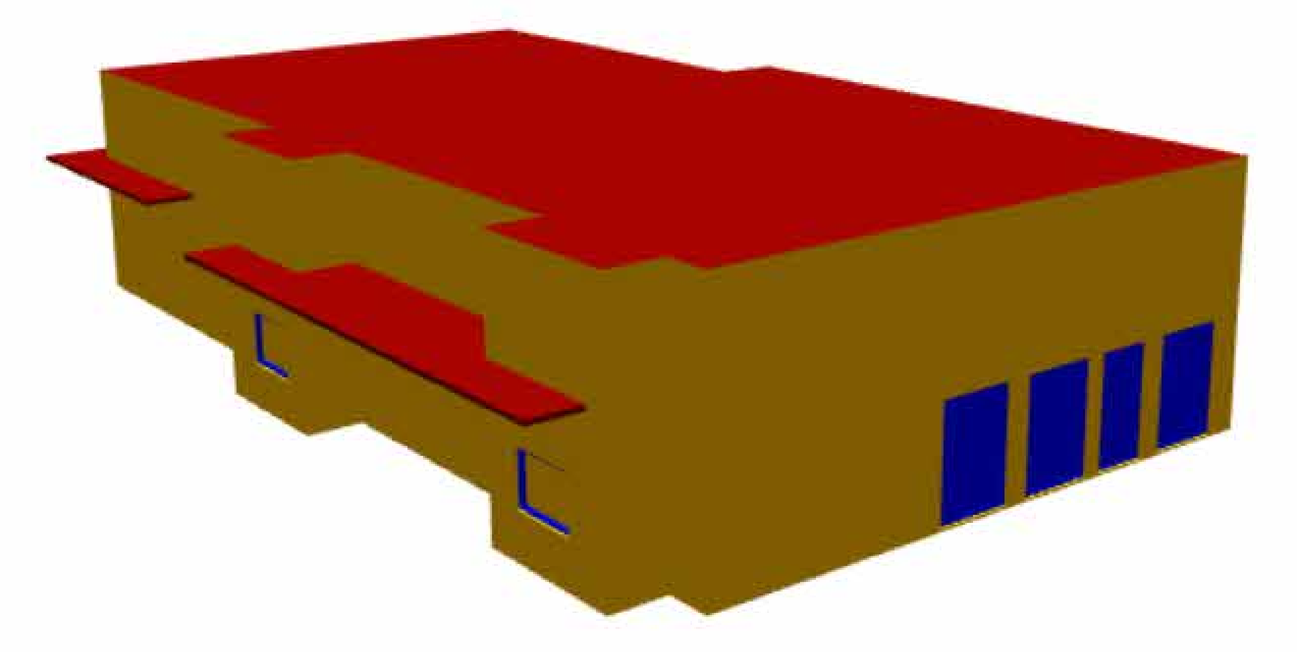


Figure 3 - North View

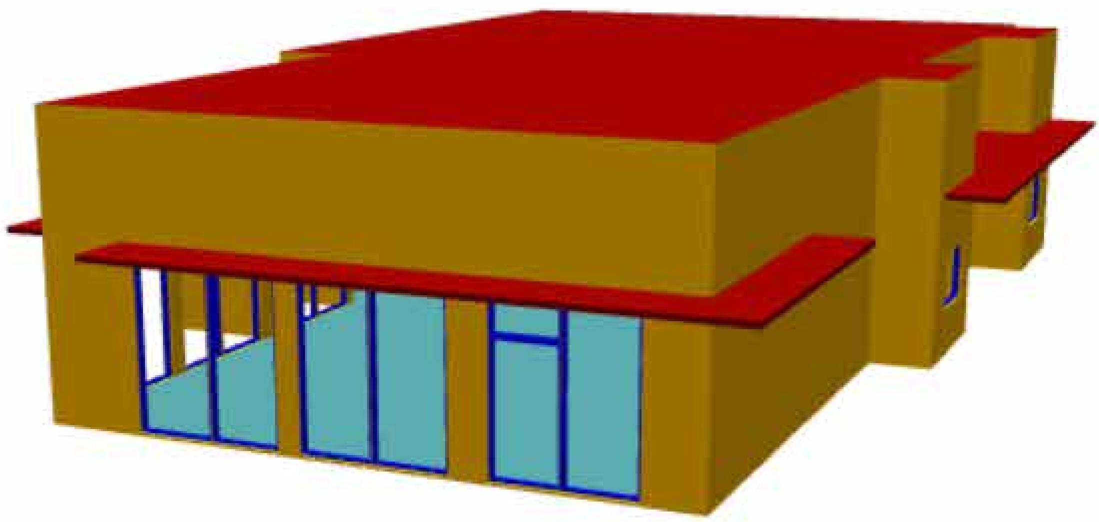


Figure 4 - East View

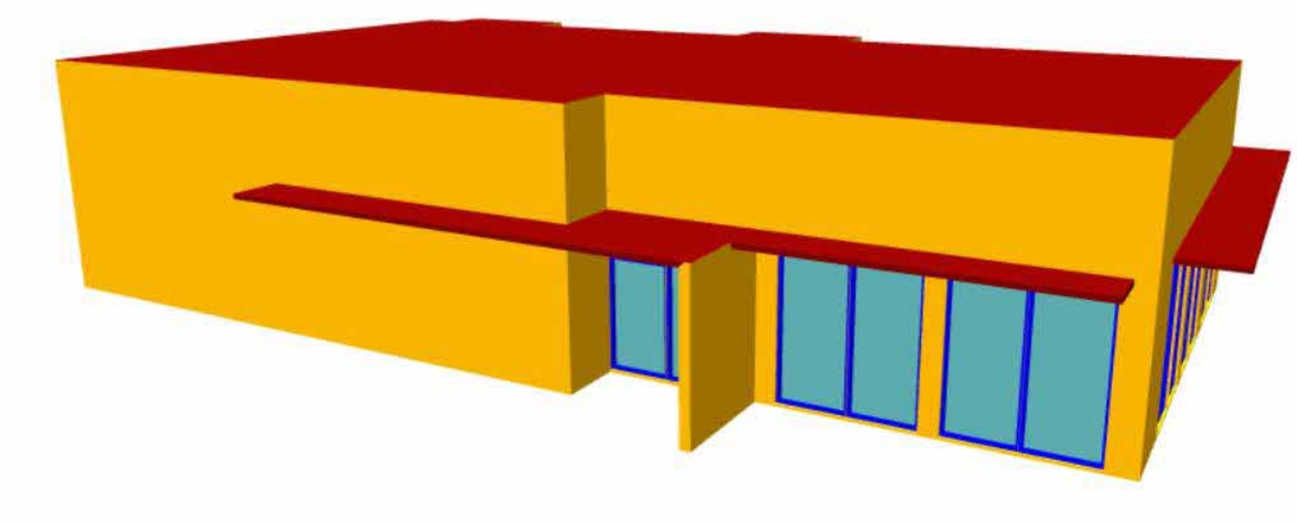


Figure 5 - South View

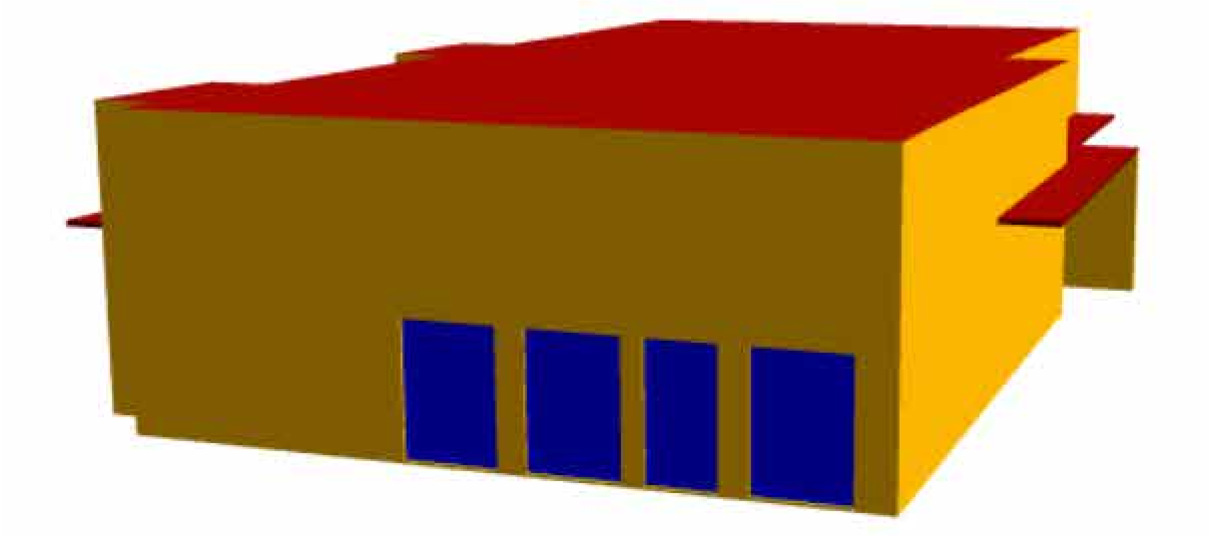


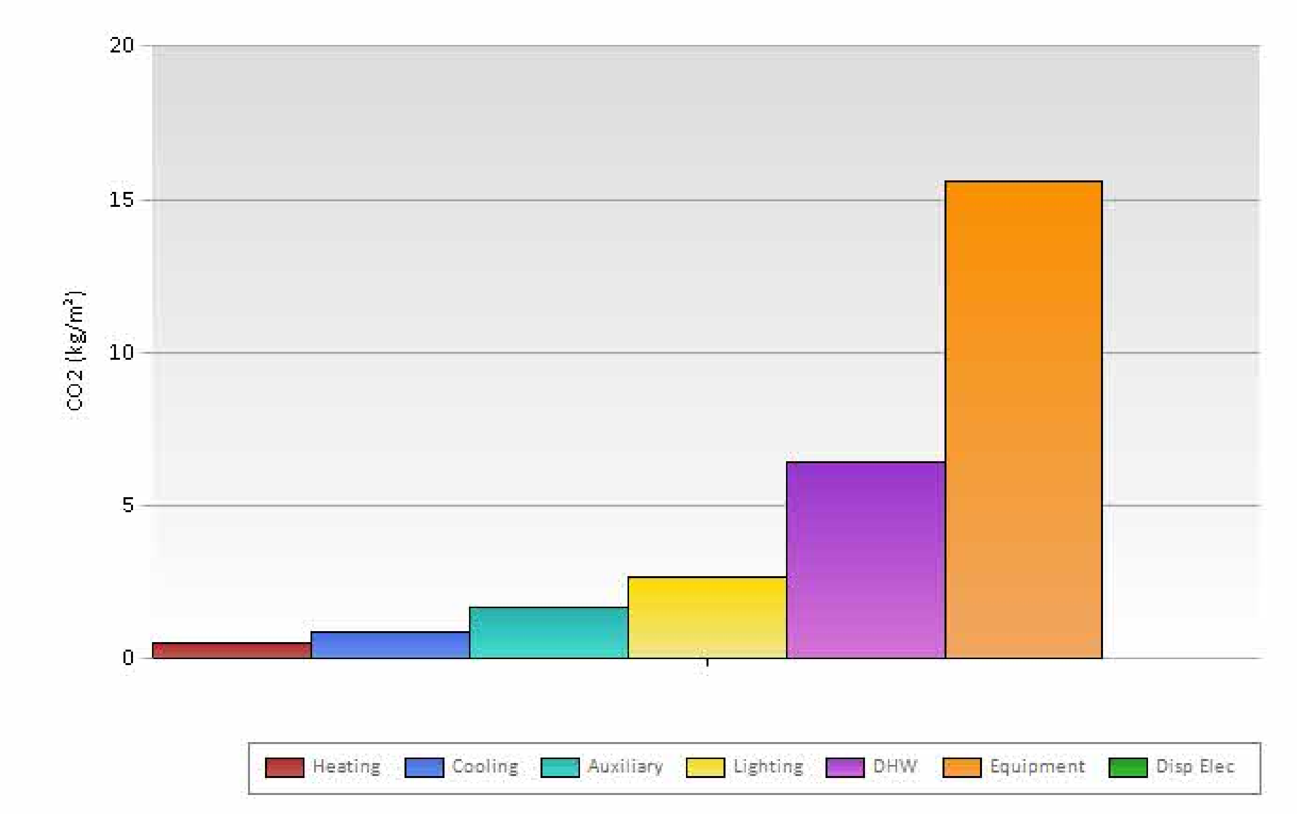
Figure 6 - West View

7.00 'PART L' – BASELINE PREDICTED ENERGY USAGE

The baseline against which each step of the energy hierarchy will be compared is the 'yard stick' determined by the Part L 2021 notional building.

The following section details the carbon emissions and annual energy consumption of the notional building. This offers a baseline for comparison which will be bettered by the actual design proposals put forward in this report.

7.01 Annual Carbon Dioxide Emissions of the Baseline Building

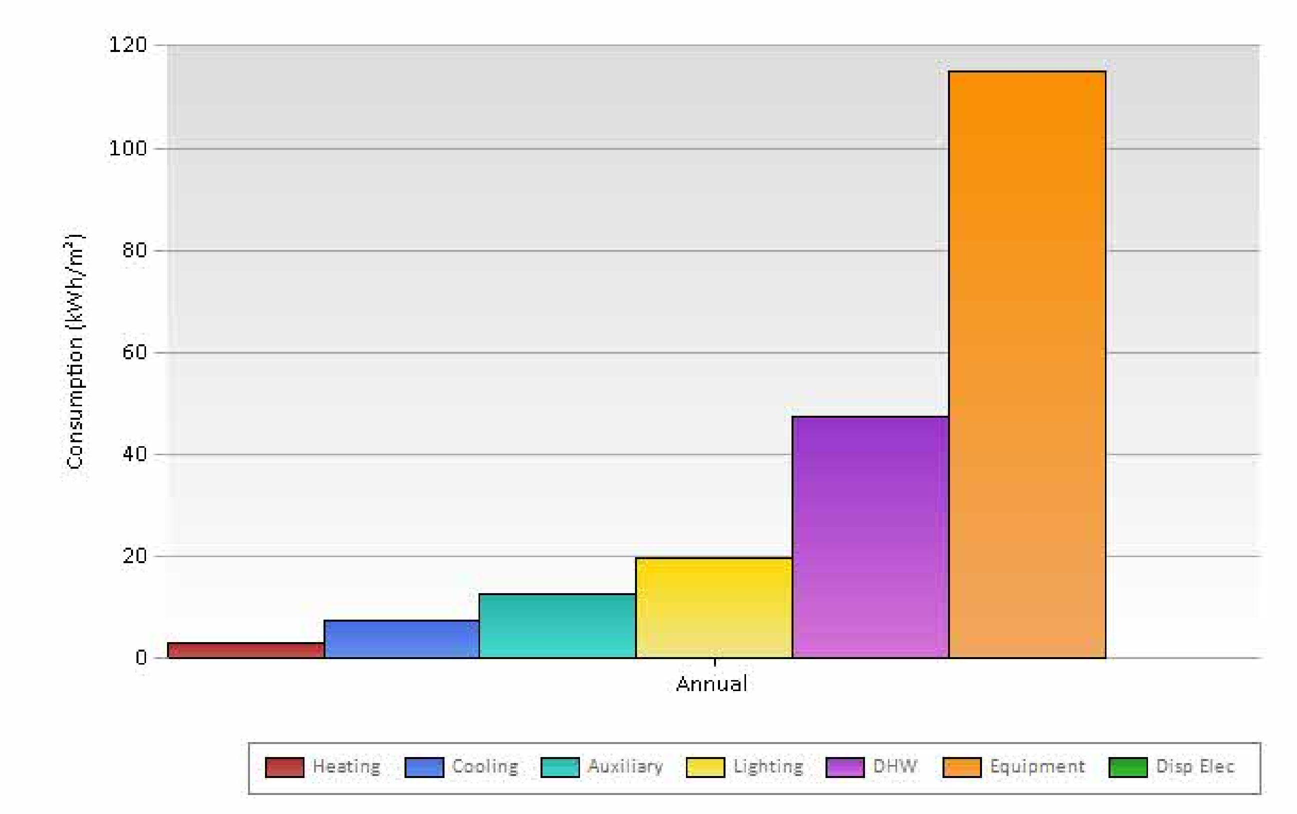


	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
CO2 (kg/m²)	0.47	0.86	1.69	2.67	6.41	15.57	0.00

Figure 7 - Annual Carbon Emissions - Baseline

Fig 7 above shows an annual baseline CO_2 emissions rate of 2,952.40kgCO_2/year of regulated emissions and 6,680.72kgCO_2/year inclusive of unregulated emissions.

7.02 Annual Energy Consumption of the Baseline Building



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	3.14	7.33	12.47	19.62	47.43	115.14	0.00

Figure 8 - Annual Energy Consumption - Baseline

Figure 8 above shows an annual baseline energy consumption rate of 21,957.56kWh/year of regulated energy and 50,051.72kWh/year inclusive of unregulated emissions.

8.00 'BE LEAN' – PASSIVE & ACTIVE DESIGN STRATEGIES

This section of the report describes the passive and active energy reduction features which have been considered and incorporated into the design. These constitute the 'Lean' measures.

8.01 Orientation and Site Location

The proposed drive through unit is located at the Monks Cross retail development, York.

The development is orientated with a heavily glazed façade facing south and west. The emphasis on the southern orientation offers the advantage of natural daylighting contributions, however, may lead to excessive levels of solar gains. This can lead to overheating and / or increase the mechanical cooling loads where left un-managed. The design team have proposed to mitigate this problem through the implementation of an efficient glazing specifications. This reduces the dependency on electric lighting through the natural contribution towards internal lighting levels, whilst ensuring mechanical cooling loads are minimised through reduced solar gains. In addition to the high glazing specification, solar shading will be provided through the use of architectural overhangs and horizontal shades.

The site receives little over shading or overlooking offering privacy to the development and maintained privacy to the residential houses surrounding the site.

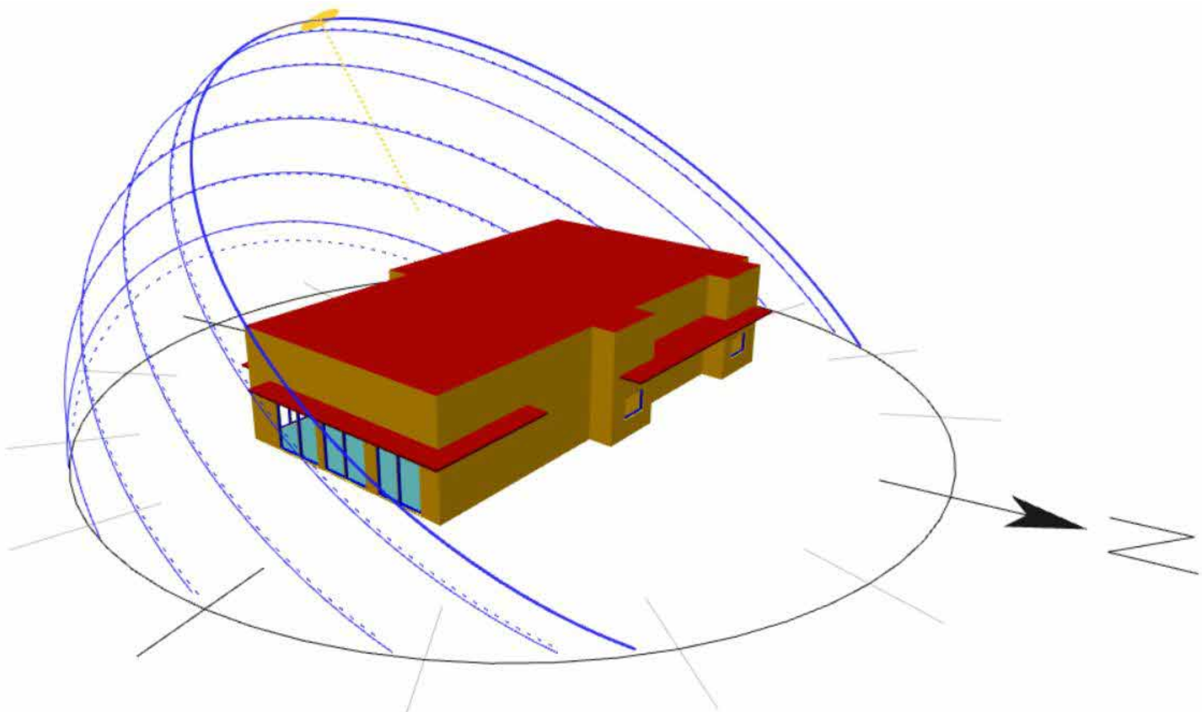


Figure 9 - Orientation & Sun Path Image

8.02 Fabric Performance and Thermal Mass

Focusing on the fabric thermal performance, ensures the building has reduced conductive heat loss during winter months and reduced conductive heat gains during summer months. This allows the internal environmental conditions to be better managed with reduced reliance on mechanical systems. This will in turn reduce energy demand, running cost and emissions whilst offering enhanced occupancy satisfaction.

With enhanced glazing properties, solar penetration is controlled reducing the potential for excess solar gains, as well as excessive levels of heat loss during winter months. The design team will specify a high-performance glazing system to minimise the heat loss and enhance the insulation properties, whilst minimising solar gains to avoid overheating.

The following table details the anticipated fabric efficiency standards to be incorporated into the design. The values are yet to be confirmed by the developer, however, represent the minimum performance standards to be achieved.

Exposed element	New Part L2 2021 Minimum Standards
Roofs	0.16 W/m^2K
Walls	0.26 W/m^2K
Ground Floors	0.18 W/m^2K
Windows	1.60 W/m^2K (G-value 0.4)
Pedestrian doors	1.6 W/m^2K
High usage entrance door	1.60 W/m^2K (G-value 0.4)
Air Permeability	$5m^3/m^2$ Hr @ 50Pa

Figure 10 - U-value Comparison

By ensuring the fabric thermal performance meets the minimum standards required by Part L ensures the development will have reduced heat loss / gains, thus reducing energy consumption. The thermal performance values ensure the optimum building standards with minimal heating / cooling loads. This demonstrates the design team's commitment to going above and beyond to ensure a sustainable development.

8.03 Thermal Mass

The concrete floor slab of the proposed drive thru has been specified to give a relatively high thermal mass which will assist in reducing internal temperature fluctuations due to external temperature variations, to give a more easily controlled environment inside the building. The building would be considered to have low to medium thermal mass.

8.04 Natural Ventilation

Due to the anticipated function of the development, a natural ventilation strategy is not deemed suitable. A form of fresh air supply and extract will be required to ensure steam and moisture created from the café operation is exhausted to prevent condensation and or internal moisture risk.

8.05 Mechanical Ventilation

It is expected that a mechanical supply and extract system with heat recovery will be incorporated. This will provide occupancy fresh air and moisture control through a mechanical ventilation system. The heat recovery associated with the system will ensure fresh air is provided into the space at a treated temperature. This has the benefit of reducing space heating / cooling loads associated with fresh air and ventilation requirements.

8.05.1 Low Energy Fans

Low energy fans will be used with specific fan powers as good as or better than the limiting efficiencies detailed in Approved Document Part L2, Table 6.9, Maximum specific fan power (SFP) in air distribution systems in new and existing buildings.

8.05.2 Variable Speed Drives

Variable speed drives will be used to ensure fans operate no faster than required, thereby reducing energy consumption.

8.06 Sub-Metering

Separate sub-metering will be installed. This has obvious financial and sustainable benefits, allowing for financial verification with regards to consumption vs cost as well as allowing for consumption figures to be monitored and any out-of-range values easily identified, and energy wastage eliminated.

8.07 Low Energy Lighting and Controls

A high proportion of glazing will significantly reduce the dependences and output requirements on electric lighting offering reduced energy demand and carbon emissions and enhanced occupancy comfort.

LED lamps will be provided throughout, both for internal spaces and the external car park. LED lamps have a very low energy consumption and have a life expectancy exceeding that of conventional light bulbs. This reduces both energy use and waste.

The main café / seating area will be provided with photo electric dimming controls. This ensures internal lux levels are achieved with a reduced reliance on electrical means, thus reducing energy consumption.

8.08 Building Energy Performance

All the above systems will be designed in accordance with the ‘Non-Domestic Building Services Compliance Guide’, CIBSE recommendations and relevant British Standards. The incorporation of ‘Good Practice’ engineering design coupled with the provision of renewable systems (described below) will ensure that an energy efficient development is achieved, minimising the energy consumption and associated CO_2 emissions through its life cycle.

9.00 'BE CLEAN' – DECENTRALISED LOW CARBON TECHNOLOGIES

A low or zero carbon technology is defined as something which either; produces energy through an endless, renewable source with low or zero carbon emission throughout its operation, or one in which uses a specific energy source i.e., electricity and provides a significantly higher output to input ratio.

Detailed below are the types of low or zero carbon technologies considered for implementation on this development. A series of centralised and decentralised systems have been analysed and viability stated to offer justification for use or omission.

9.01 Combined Heat and Power (CHP)

Combined Heat and Power (CHP) is the on-site generation of electricity and the recovery of the normally wasted heat produced during this process.

The operation of CHP plant can offer significant CO_2 emission rate reductions when compared to conventional methods of energy generation and use.

Most large conventional power stations currently generate electricity at 30-50% efficiency (due to waste heat and transmission/distribution loss).

'Good quality' CHP schemes achieve overall efficiencies of 70-85% by making use of waste heat and eliminating transmission losses.

The efficient use of CHP typically depends on finding a use for the heat generated by the process. Issues to consider include:

If heat is not used, then the system is effectively just an electricity generator and electricity will be greener and cheaper if sourced from the national grid.

If excess electricity is generated on site this can be exported (sold) back to the grid whereas excess heat needs to be rejected (wasted). Exported electricity can count towards reducing the site's CO_2 emissions.

Exported electricity will typically not be financially attractive as exports tend to coincide with low demand periods on the national grid. The cost of producing the electricity on site can be less than the prices received for the exported electricity.

9.01.1 Viability

The introduction of a CHP unit will reduce running costs and carbon dioxide emissions associated with the operation of the building when compared to employing a conventional generator and/or boiler. However, the CHP plant should always operate as the lead heat source to maximise savings.

CHP systems require steady, constant loads all year round for best performance, with high running hours. This type of running schedule will usually be found in applications with high domestic hot water loads such as hotels, hospitals, care homes etc. The drive thru development is expected to have a low hot water demand and therefore a CHP plant would not be deemed viable due to the lengthy amount of the year where the CHP engine would be sitting idle due to lack of thermal demand.

It can therefore be concluded that the possibility of introducing a combined heat and power system is both un-sustainable and un-economically viable on this project.

9.02 Decentralised Energy Networks (DEN)

9.02.1 Heat Density

Based on the heat density map below from The Department for Business, Energy and Industrial Strategy, the surrounding area has a moderate heat density around the site and associated with the local area. Much of the associated heat density is associated with residential properties, with a small amount associated with commercial premises and light industrial. The low heat density associated with commercial units renders the possibilities of introducing a district heating network to the area low due to the high cost and low return potential.

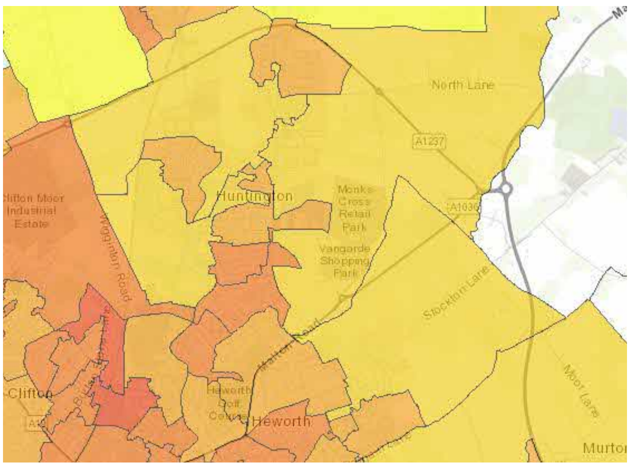


Figure 11 -The Department for Business, Energy & Industrial Strategy Heat Density Map

9.02.2 Existing Networks

The below map from The Department for Business, Energy and Industrial Strategy shows there are no local current district heating schemes within the area which would be suitable for connection to. The only local network serves the hospital and would not be available or suitable for connection. The distance to the network is to great to offer any justification associated with the install of services and the associated distribution losses.

Figure 12 - The Department for Business, Energy & Industrial Strategy Current District Heating Schemes

9.02.3 Viability

As detailed in the above Heat Map, there are no suitable current district heating networks, so the building services design strategy cannot be focused on the connection to a decentralised system.

10.00 'BE GREEN' – LOW OR ZERO CARBON TECHNOLOGIES

A low or zero carbon technology is defined as something which either; produces energy through an endless, renewable source with low or zero carbon emission throughout its operation, or one which uses a specific energy source i.e., electricity and provides a significantly higher output to input ratio.

Due to the unviable incorporation of Combined Heat and Power (CHP), and current lack of existing district heating networks, the development will be required to incorporate "Individual building renewable systems" to ensure compliance with local and national planning requirements.

10.01 Biomass Boiler

Biomass in the form of logs, wood chips and wood pellets are classified as a low carbon source of energy because the carbon dioxide emitted when the biomass is burned has been taken out of the atmosphere by the growing plants, even allowing for emissions of carbon dioxide in planting, harvesting, processing, and transporting the fuel. Replacing fossil fuel with biomass fuel will typically reduce net CO_2 emissions by over 90%.

Wood fuel efficiencies vary enormously due to several factors including the moisture content of the fuel. Fuels with high moisture content requires more energy to be combusted as it must first dry out before it can be converted to energy. This emphasises the need for good quality onsite storage facilities and a good quality fuel supply.

Wood fuels also have varying calorific value. A high calorific value refers to the amount of energy the wood contains compared to waste products such as bark, which can form ash as a by-product.

Biomass boilers are unsuitable for applications that have large fluctuations in thermal loads, unless a large heat sink or buffer vessel is used.

Unlike most other renewable energy sources, biomass can be stored and used on demand to give controllable energy. It is therefore free from the problem of intermittency, which affects both solar and wind technologies. However, unlike wind and solar, biomass energy is not "free" and so a reliable, sustainably managed, and cost-effective source of biomass needs to be secured.

10.01.1 Fuel delivery & fuel storage:

Fuel storage and regular supply is key for efficient running of Biomass boilers. Biomass fuel will absorb moisture if exposed to it and can biodegrade if not kept dry, therefore, the store must be well maintained to prevent contact between moisture and pellets. The storage facility must also allow for easy access to ensure deliveries can be made efficiently. A larger storage facility will allow for less frequent deliveries and more reserve in case of delays. The National Biofuel Supply Database shows there are several suppliers within a reasonable radius of the site.

10.01.2 Viability

This technology can provide the development with significant savings for a relatively low cost however, an overriding reason against using a biomass system is the space restrictions on this site and the lack of available space for the storage and delivery of the fuel. In addition to this, the high NO_x emissions, and particle content of the exhaust gases from typical small-scale biomass units may raise objections from the Environmental Agency and planning department.

Considering this, biomass boilers are considered not to be a viable option for the proposed development.

10.02 Solar Thermal

Solar thermal collectors utilise solar radiation to heat water for use in water heating of a building. The radiation is converted using a solar collector, of which there are two main types available: Flat Plate and Evacuated Tube collectors. Evacuated tube systems occupy a smaller area and are more efficient, but also generally more expensive. Flat plate systems are cheaper to install but generally less efficient.

The solar coverage indicates the percentage of the annual domestic hot water energy requirement that can be covered by a solar water heating system. The higher the solar coverage, the more conventional energy usage can be offset, but this can cause excess heat generation in the peak summer months and generally lower the average collector efficiency. Therefore, solar coverages of 40-70% are recommended for domestic applications and up to 40% in non-domestic buildings.

Solar thermal systems in the UK normally operate with a backup fuel source, such as gas or electricity. The solar system pre-heats the water up to a maximum hot water temperature. If there is not enough solar power available to fully meet the required hot water load, then the backup fuel system fires up to meet this short fall.

The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30º from the horizontal.

For the solar water heating system to run safely and efficiently, a series of temperature sensors are connected to a digital solar controller to switch the system on or off according to the solar energy available.

10.02.1 Viability

Solar thermal panels are suited to buildings with a high and consistent hot water demand. This development is expected to have a relatively low hot water demand and therefore, a solar thermal array would not be deemed viable or cost effective.

10.03 Air Source Heat Pump (ASHP)

Air source heat pumps exchange heat between the outside air and a building to provide space heating in winter and cooling in the summer months. The efficiency of these systems is inherently linked to the ambient air temperatures. Air source heat pumps operate best in environments with long, mild, mid-season periods, as the heating efficiency drops at lower ambient temperature in winter.

Unlike some other sources of renewable energy, heat pumps do require electricity to pump and compress refrigerants through the system. However, heat pumps supply more energy than they consume, by extracting heat from their surroundings. Heat pump systems can supply as much as 4kW of thermal energy for just 1kW of electrical energy input, which is why they are recognised as a renewable technology under the Renewable Energy Directive 2009/28/EU.

10.03.1 Viability

ASHP's have been deemed a suitable way of offering space heating to the development.

Actual units are yet to be selected which will be determined at the detailed design stage. However, for the purposes of this report, the following system efficiencies can be expected:

Seasonal Coefficient of Performance: 4.5
Seasonal Energy Efficiency Ratio: 7.00

The efficiencies detailed above exceed minimum national standards, ensuring the heating and cooling provided is of the highest standards available on the market for the selected type of Air Source Heat Pump.

The domestic hot water for the drive thru will be provided by a packaged heat pump water cylinder with an anticipated efficiency of 2.91 (COP).

10.04 Photovoltaics (PV)

Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a chemical layer between. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current.

A range of Photovoltaic products and colours are available, varying in efficiency and cost. These include Monocrystalline, Polycrystalline, Thin Film and Hybrid Panels. Hybrid Panels are the most energy efficient and Thin Film the least.

All the above technologies can be installed in roof and wall mounted arrays or as integrated building members, giving the additional benefit of offsetting the cost of other construction materials, such as weatherproof roof membranes or integrated into glazed wall constructions.

10.04.1 Viability

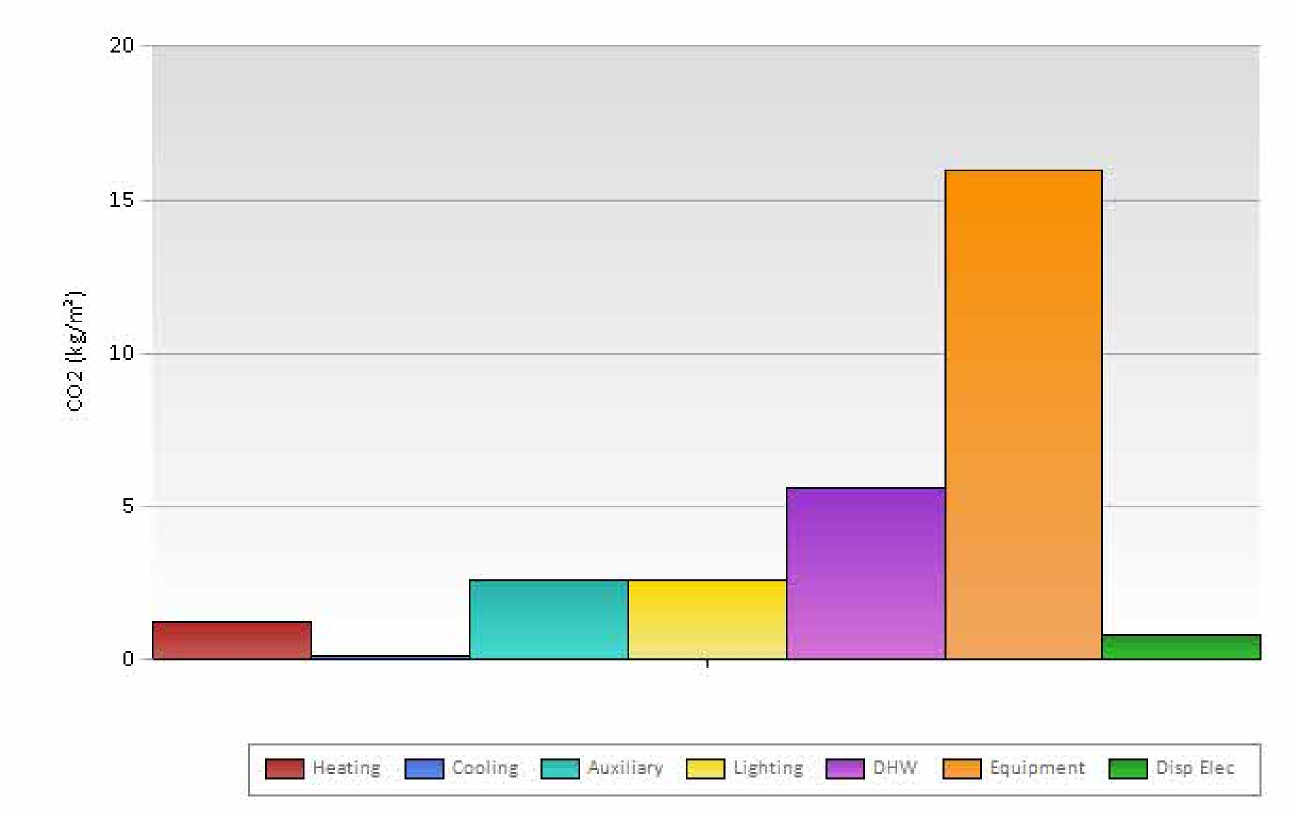
Photovoltaic panels have been deemed a suitable way of offering significant on-site energy generation to reduce the requirement for imported electrical energy. P.V. panels will be incorporated into the building services strategy:

- Panel Array – 9.30m²
- Panel Efficiency – 20.7%
- Panel Incline – 4.0°
- Orientation – 180° from North
- Annual Output – 1,510.36kWh/annum

11.00 'BE LEAN', 'BE CLEAN' AND 'BE GREEN' – PREDICTED ENERGY USAGE

The following section details the predicted annual carbon emissions and energy consumption based on the TAS model of the building once all passive and active design strategies detailed in section 8.00, 9.00 and 10.00 have been allowed for.

11.01 Predicted Annual Carbon Emissions of the Actual Building

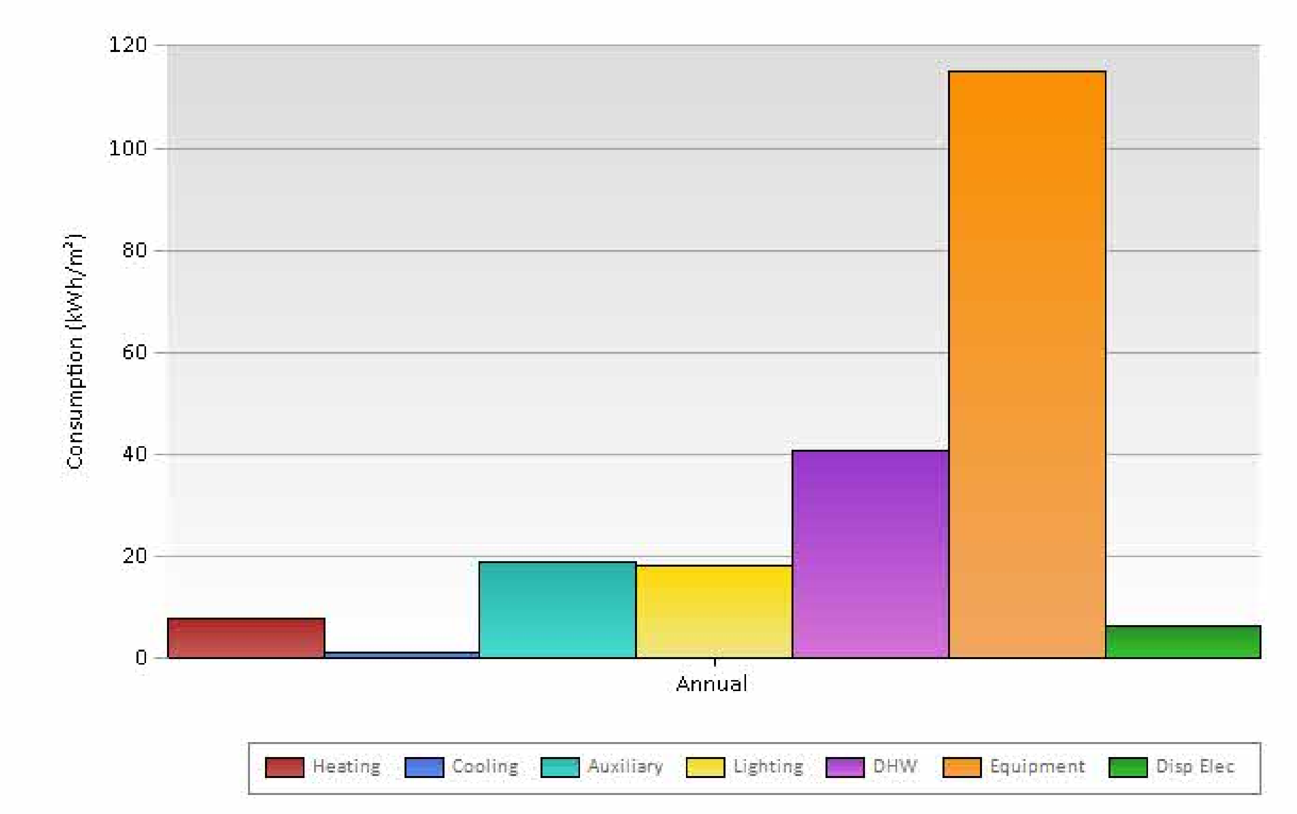


	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
CO2 (kg/m²)	1.23	0.15	2.60	2.58	5.63	15.97	0.78

Figure 13 - Annual Carbon Dioxide Emissions - Be Green

Figure 13 shows an annual CO_2 emissions rate of 2,784.04kgCO_2/year of regulated emissions and 6,680.72kgCO_2/year inclusive of unregulated emissions. This represents a 5.70% regulated carbon dioxide saving and a 1.05% saving inclusive of unregulated emissions over the 2021 baseline detailed within section 7.0.

11.02 Predicted Annual Energy Consumption of the Actual Building



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	7.91	1.27	18.72	18.25	40.56	115.14	6.19

Figure 14 - Annual Energy Consumption - Be Green

Figure 14 above shows an annual energy consumption requirement of 19,646.88kWh/year of regulated energy and 47,741.04kWh/year inclusive of unregulated energy. This shows an annual energy consumption saving of 10.52% and 4.62% respectively over the 2021 baseline detailed within section 7.0.

The renewable technology energy generation contribution is expected to be, 1,510.36kWh/annum. This represents more than 7.5% of the anticipated annual energy consumption. It should be noted, the energy consumption profile may not correlate with the on-site energy generation, therefore, some of the electrical energy generated by the P.V. panels may be sent back to the grid, not used on site.

12.00 CONCLUSION

The energy statement has demonstrated the proposed drive through unit located at Monks Cross, York will:

Incorporate passive design strategies to take advantage of:

- Natural daylighting through careful building and glazing orientation. This will offer a reduced dependency on electric lighting through the contribution of natural lighting to achieve the required Lux levels.
- Enhanced fabric efficiencies and thermal mass have been allowed for to help stabilise any temperature fluctuations within the building reducing heat gains and/or losses.

Incorporate active design strategies to reduce energy consumption by:

- Introduce separate sub-metering to allow for all energy consumed to be monitored and any discrepancies easily identified and fixed thus minimising wasted energy.
- Low energy lighting will be installed with suitable controls to ensure lights are not left on unnecessarily. Suitable controls will eliminate human error.
- High efficiency HVAC systems with low specific fan powers and reduced energy consumption through suitable local control strategies.

The Part L2 2021 baseline annual carbon emissions and energy consumption has been calculated as follows:

- Regulated Annual Carbon Dioxide Emissions: 2,952.40kgCO_2/annum.
- Regulated Annual Energy Consumption: 21,957.56kWh/annum.

Combined Heat and Power and De-centralised Energy Network (DEN) solutions have been reviewed and discounted to be unviable for this development due to:

- Unsuitable energy consumption profiles for CHP (require high DWS consumption).
- No suitable De-centralised Energy Networks (DEN) in the vicinity of the development.

Alternative Low or Zero Carbon (LZC) technologies have been analysed with the following deemed to be both viable and advisable:

- Air Source Heat Pumps, or Aero-thermal Heat Pumps.
- Photovoltaic Panels
  - Panel Array – 9.30m^2

Panel Efficiency – 20.7%

Panel Incline – 4.0°

Orientation – 180° from North

Annual Output – 1,510.36kWh/annum

The 'Be Green' actual building annual carbon emissions and energy consumption has been calculated as follows:

Regulated Annual Carbon Dioxide Emissions: 2,784.04kgCO_2/annum.

Regulated Annual Energy Consumption: 19,646.88kWh/annum.

These show a 5.70% carbon dioxide saving and a 10.52% energy saving, when assessed to Part L2 2021 Building Regulations and accounting for the proposed passive, active and LZC strategies.

The expected annual energy generation through low and / or zero carbon technologies will be 1,510.36kWh/annum. This represents >7.5% of the anticipated annual energy consumption. It should be noted that the P.V. electrical generation may not correlate with the energy consumption profile, therefore, some of the on-site electrical energy generation may be exported back to the grid.

Note: This assessment is based on a 'Shell Only development, therefore, the actual building services strategy and internal architectural layout is unknown. The inputs allowed for within the SBEM calculation, of which the results of this report are based, are made on realistic assumptions (refer to Appendix A for input assumptions). It will be the responsibility of the Fit-out team to ensure the actual development complies with all relevant national and regional planning requirements, building regulations and any other relevant standards. The actual performance of the Fit-out building will be subject to change as the detailed design stages progress.

APPENDIX A – PART L 2 SBEM INPUT SUMMARY

Drive Thru, Monks Cross, York
SBEM Input Summary
Date: 16.10.23
Rev: 0

Drawings

- 2504 P132A Ground Floor Plan - Drive Thru
- 2504 P231A Proposed Elevations - Drive Thru
- 2504 P432B Proposed Site Plan (Type 1500)

U-values and Fabric Performance

Element	U-value
External Wall	0.26W/m²K
Ground Floor	0.18W/m²K
Roof	0.16W/m²K (Flat Roof)
Glazing	1.60W/m²K (Inc. Frame) – G-value: 0.40
Glazed Doors	1.60W/m²K (Inc. Frame) – G-value: 0.40
Personnel Doors	1.60W/m²K
Air Permeability	5m³/m²Hr @ 50Pa
Thermal Bridging	Accredited

The values detailed above for the assumed fabric performance are based on the limiting values detailed in table 4.1 of Approved Document Part L Volume 2 2021.

Building Services

Is Mains Gas Available?	No
Light Metering with warnings about out-of-range values?	No
Electricity Power Factor	<0.90

Lighting Parameters

Zone	Efficacy (Lumens/Circuit Watt)	Presence Detection	Daylight Control	Back Space Sensor	Photocell Sensor on Time Clock	Maintenance Factor	Design Room Illuminance	Display lighting (Lumens/Circuit Watt)
Café Seating	110		PEC - Dim	Yes	Yes	0.8	200	95

HVAC Systems

DX Split with MVHR	
System Description	Space heating and cooling via DX split Air Source Heat Pumps. Ventilation via mechanical ventilation with heat recovery.
Heat Exchanger:	Plate – 75% Efficient
Specific fan Power	0.75W/l/s (Supply), 0.75W/l/s (Extract)
Heating System:	DX Split ASHP
Cooling System:	DX Split ASHP
Domestic Hot Water:	Packaged Heat Pump Water Cylinder
Zones Served:	Café seating

Heating Systems

System	Distribution Efficiency	Fuel Source	Heat Pump	Efficiency / SCOP
DX Split ASHP	100%	Grid Supplied Electricity	Yes	4.50 (SCOP)

Cooling Systems

System	Distribution Efficiency	Fuel Source	Heat Pump	Efficiency / SEER
DX Split ASHP	100%	Grid Supplied Electricity	Yes	7.00 (SEER)

Domestic Hot Water Systems

System	Distribution Efficiency	Storage Tank	Heat Source	Efficiency / COP	Comments
Packaged Heat Pump Water Cylinder	98%	302	Direct Electric	2.91 (COP)	Assumed to be a Stiebel Eltron WWK 302 H Set

Renewables

Existing P.V. Array

- Incline: 4°
- Derating Factor: 0.848
- Overshading: None or very little
- Type: Mono Crystalline Silicon
- Orientation: 180° (From North)
- Output @ STC: 205W/m²
- Surface Area: 9.30m²
- Panel Efficiency: 20.7%

APPENDIX B – ‘BE GREEN’ BRUKL OUTPUT DOCUMENT

BRUKL Output Document

Compliance with England Building Regulations Part L 2021

HM Government

Project name

Monks Cross - Drive Through

As designed

Date: Mon Oct 16 11:01:36 2023

Administrative information

Building Details

Address: Monks Cross, York,

Certifier details

Name: Andrew Parry

Telephone number: 01925265757

Address: RCM Business Centre, Sandbeds Trading Estate, Dewsbury Road, Ossett, Wakefield, WF5 9ND

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.5"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.5

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

Foundation area [m²]: 243.71

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	12.1	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	11.4	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	132.45	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	122.72	
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	0.26	0.26	External Wall
Floors	0.18	0.18	0.18	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.16	0.16	Roof
Windows** and roof windows	1.6	1.6	1.6	Window T1 - Glazing
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	1.6	1.6	Solid Door
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	1.6	1.6	Glazed Door - Door

$U_{a-Limit}$ = 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
m³/(h.m²) 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- DX Split with MVHR (Cafe Seating - EatDrink 1)

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	4	7	-	1.5	0.7
Standard value	2.5*	5	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- Stiebel Eltron

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	2.91	0
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Cafe Seating - EatDrink 1	-	-	-	1.5	-	-	-	-	-	-	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
Cafe Seating - EatDrink 1	110	95	-

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?**
Cafe Seating - EatDrink 1	NO (-64%)	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]	244	244
External area [m^2]	850	850
Weather	LEE	LEE
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	251	264
Average U-value [W/m^2K]	0.3	0.31
Alpha value* [%]	20.45	5.45

* 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
100	**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
	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/m^2]

	Actual	Notional
Heating	7.91	3.14
Cooling	1.27	7.33
Auxiliary	18.72	12.47
Lighting	18.25	19.62
Hot water	40.56	47.43
Equipment*	115.14	115.14
TOTAL**	**86.72**	**89.98**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	6.19	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*6.19*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	153.65	153.58
Primary energy [kWh_{PE}/m^2]	122.72	132.45
Total emissions [kg/m^2]	11.4	12.1

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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	118.9	33.7	8.3	1.3	19.7	4	7	4	7
	Notional	31.4	122.2	3.3	7.7	9	2.64	4.4	----	----

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