Project:	**Millom Leisure Centre**
Document No.:	**14810-CGP-00-ZZ-RP-N-0002**
Document Title:	**Outline Sustainability Statement – Stage 3**
Date:	**27th June 2023**

1.1.1 INTRODUCTION

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

The project will need to achieve Building Regulation Part L2 (2021) compliance via modelling, modelling will be 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 following the energy hierarchy, with a 'Fabric First' approach whereby the construction budget is invested in the building fabric and energy efficiency measures, rather than relying on 'bolt on' and excessive amount of renewable energy technologies to achieve compliance.

1.1.2 THE ENERGY HIERACHY

Our approach to the building will follow the energy hierarchy as set out below:

Step 1: Eliminate Energy Need

The project will be developed with the rest of the design team to eliminate, where possible, the need for energy use, this will be achieved using the following measures:

- Design of the scheme layout
- Thermally efficient construction methods and materials
- Design features that eliminate the need for appliances
- Making optimal use of passive heating and cooling systems

Step 2: Use Energy Efficiently

Developments will incorporate energy efficient systems, equipment and appliances to reduce the remaining energy demand.

Energy storage devices may improve efficiency.

Step 3: Supply Energy from Renewable and Low Carbon Sources

The remaining energy need will be met from renewable and low carbon sources.

2.1.1 BUILDING FABRIC

New buildings are currently subject to Building Regulations requirements on energy efficiency which are set out in the 2021 edition approved document L2. This requires that new building meet a minimum Target Emission Rate (TER) for CO2 emissions.

For the proposed building, improvements on the minimum values have been proposed to minimise operational energy use and carbon dioxide emissions, as well as further exceed Part L requirements.

The final U-values are still subject to further energy modelling results and may be improved, if required, to comply with Building Regulations and Local Policies.

U-values (W/(m2K))	Building Regulations Part L (max)	Notional Building	Proposed Building (likely)
Roof	0.18	0.15	0.14
Wall	0.26	0.18	0.14
Curtain wall	2.2	1.6	n/a
Floor	0.18	0.15	0.14
Doors	1.6	1.6	1.4
Glazing elements/rooflight (including frame)	1.6	Windows U-Value=1.4; G-Value=0.4	Windows U-Value= 1.4; G-Value=0.36

Table 1: Comparison of building fabric parameters for Part L 2021 and the proposed design standards.

It should be noted that in buildings with high internal heat gains and long occupancy hours, similar to the proposed building, the effect of insulation on total energy use and occupant comfort should be carefully evaluated. It is recognised that low U-values are beneficial for winter periods as they prevent heat loss, however it's a delicate balance as increased thermal performance and air tightness can also lead to internal overheating issues which is currently a wide spread problem in the UK construction industry. In many cases over-insulation of the building retains high amounts of warm air, limits air extraction and leads to higher internal temperatures – in most cases creating an increased need for mechanical cooling systems.

2.1.2 GLAZING

Low U-values for glazing are as important as low U-values for fabric elements. Building design will utilise low U-value glazing in order to diminish heat losses over the winter period.

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

2.1.3 THERMAL BRIDGING

As per minimum Building Regs requirements, the building fabric will be constructed so that there are no reasonably avoided thermal bridges in the insulation layers caused by gaps within the various elements, at the joints between elements and at the edges of elements such as those around window and door openings. Non-repeating thermal bridge heat losses for each element will be allowed for by a method that satisfies BS EN 14683 and Part L Building Regulations.

2.1.4 AIR PERMEABILITY

The air tightness of a building impacts on its energy consumption and hence the CO_2 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 L of Building Regulations identifies that air permeability of less than $8m^3/hr$ per m^2 @ 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 $3m^3/hr$ per m^2 @ 50Pa for this building.

2.1.5 ORIENTATION

Visual comfort is an important part of ensuring building occupant health, comfort and wellbeing. Maximising exposure to natural daylight and providing an external view out provides users with a connection to nature. This can in turn support mental wellbeing, for example by improving people's mood and reducing the symptoms of depression. Increasing the level of daylight within the building also reduces the need for artificial lighting, which can reduce operational costs and environmental impacts of the building. Further to this, naturally lit environments increase occupant productivity and support the regulation of circadian rhythms. For these reasons, a good level of daylight through the windows will be provided.

2.1.6 USE OF MATERIALS

The use of construction products leads to a wide range of environmental and social impacts across the life cycle through initial procurement, wastage, maintenance and replacement. Taken together, construction products make a significant contribution to the overall life cycle impacts of a building. In some cases, they may even outweigh operational impacts (such as energy consumption).

Surface materials that are often used for landscaping and paving, and even the external finishes of surrounding buildings can affect the temperature of the surrounding air. Hard and dark coloured materials like concrete, brick and macadam have the tendency to absorb the sun's energy and heat generated during the day and re-radiate this at night. As a result of this, the night-time air temperature remains high. Elevation drawings denote that building's finishes colour will vary from white to medium brown colours, which will reflect 40-50% of Sun's radiation and will not significantly contribute to urban heat island effect. All materials specified will be of a robust and durable nature.

3.1.1 BUILDING SERVICES

In addition to upgrading the insulation and air tightness standards, it is important that the energy used within the building is efficient. Therefore, the building services systems should be designed to optimise the efficiency of the systems by matching installed capacity to anticipated building demand. Items of equipment, which make up the building's building services installation, will be specified to achieve high annual energy efficiency in operation and will be regularly serviced to maintain their performance. Please note that all systems have efficiencies and controls which will meet or exceed the requirements of the 2013 Non-Domestic Building Services Compliance Guide.

3.1.2 INTERNAL LIGHTING

The project team will incorporate energy-efficient LED lighting for the proposed building. According to the non-domestic building services compliance guide, the average initial efficacy should be not less than 95 luminaire lumens per circuit watt. Currently, the proposed lighting represents an improvement over and above the 2021 Part L Building Regulations with 100 luminaire lumens per circuit watt (Lm/W) as a minimum.

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.

3.1.3 BUILDING MANAGEMENT SYSTEM

Energy metering systems will be installed enabling at least 90% of the estimated annual energy consumption of each fuel type to be assigned to the various end-use categories of energy consuming systems. The energy consuming systems will be monitored using an appropriate energy monitoring system, such as a Building Management System (BMS). The BMS will be appropriately commissioned and the occupier/facilities team will be fully trained in the operation of the system. This will include meters and sub-metres installed in line with CIBSE TM39.

3.1.4 WATER FITTINGS

In England the average person uses about 150 litres of water a day for a range of uses including sanitation, where significant savings are possible. Given that climate projections forecast half as much rainfall in summer in the South East of England by 2080, it is important to build water efficiency in to our building stock and minimise the need for major infrastructure enhancements to meet these pressures as well as growing demands. Under these scenarios and with the expected high population growth, deficits are expected to be already widespread by the 2050s. The UK is expected to be in deficit by up to 16% of the total water demand in the 2050s and of up to 29% in the 2080s leading to major impacts on cost and resource levels. The fittings will be procured to meet a water consumption figure of no more than 110 litres/person/day:

4.1.1 DECENTRALISED PLANT

Connection to a decentralised energy network and the use of combined heat and power is a recognised method of generating energy more efficiently.

Following an initial review of Heat Map, it has been established that there are currently no existing district heating networks located in the vicinity, that the proposed development could link to.

4.1.2 COMBINED HEAT AND POWER

The installation of a Combined Heat and Power (CHP) unit for the development has also been considered. CHP units can achieve considerable savings in CO_2 emissions when installed and utilised correctly. To maximise the performance of a CHP, long operating hours are required and the heating demand of the development needs to match the power generation.

However, it has been decided not to implement a CHP system. This is due to the fact that Building Regulations have introduced new carbon factors; gas carbon factor will change from 0.216 $kgCO_2$/kWh to 0.210 and electricity factor from 0.519 $kgCO_2$/kWh to 0.233, which means that electrically powered equipment will have a similar or even lower carbon emissions impact when compared to the gas-powered equipment.

5.1 LOW AND ZERO CARBON TECHNOLOGIES

This section discusses the feasibility of using low and zero carbon (LZC) technologies for the proposed scheme.

In order to address the local planning requirement for the integration of LZC technologies on site, the installation of the technologies mentioned below has been investigated.

5.1.1 BIOMASS BOILER – NOT ADOPTED

A biomass system designed for this development would be fuelled by wood pellets due to their high energy content. Wood pellets also require less volume of storage than other biomass fuels, require less maintenance and produce considerably less ash residue.

A biomass system would not be an appropriate low-carbon technology for the site due to the burning of wood pellets releasing substantial amount of NOx emissions and storage and delivery of wood pellets would be difficult due to the site constraints and the lack of local biomass suppliers.

5.1.2 BIOMASS CHP – NOT ADOPTED

For the size of system required for this development, a biomass CHP is still in its infancy and brings several financial and technological risks. Therefore, this option is not considered feasible. For the reasons listed above, biomass is not considered feasible for this development.

5.1.3 WIND ENERGY – NOT ADOPTED

Due to the limited space on site, building-integrated turbines would be most suited to the development, as opposed to stand alone turbines. In urban areas the efficiency of wind turbines is limited due to reduced wind speeds (less than 5m/s), thereby reducing the ability of the wind turbines to operate efficiently. For these reasons, wind turbines would not be feasible for this project.

5.1.4 SOLAR PV-T PANELS – NOT ADOPTED

PV-T panels combine two well established renewable energy technologies, solar photovoltaics (PV) modules and solar thermal collectors, into one integrated component that removes generated heat from the Solar PV thereby improving electrical efficiencies.

Typically installed as a roof mounted technology, heat is extracted by either passing air or a liquid across the back of the panel, essentially drawing the heat away as it is generated and transferring it either indirectly (e.g., into a domestic hot water cylinder or space heating circuit) or directly (e.g., direct air space heating).

Combining solar photovoltaic and thermal energy generation into a single hybrid system offers many benefits. You can have a single solar system that delivers both electricity and hot water, that saves available roof space, if a solar PV system for electricity generation and a thermal system for hot water generation are considered. Furthermore, Solar PV panels are at their most efficient in cooler temperatures. When outdoor temperature begins to head over 25°C, the output system can drop by 0.5% for each degree. As solar thermal panels are designed to capture this heat, they act as a cooling circuit which increases the efficiency of the renewable electricity generation. Finally, Solar PV and solar thermal panels are very low maintenance and the same goes for solar PV-T systems too.

This technology is not currently considered for inclusion within the scheme but will be reviewed as the design of the domestic hot water system is developed.

5.1.5 PHOTOVOLTAIC PANELS – ADOPTED

Four types of solar cells are available at present; these are mono-crystalline, poly-crystalline, thin film and hybrid panels. Although mono-crystalline and hybrid cells are the most expensive, they are also the most efficient with an efficiency rate of 12-20%. Poly-crystalline cells are cheaper but they are less efficient (9-15%). Thin film cells are only 5-8% efficient but can be produced as thin and flexible sheets.

This technology is considered to be installed in the proposed development's roof to contribute to the energy generation from renewable energy sources and aide the council's carbon reduction commitment.

5.1.6 SOLAR THERMAL PANELS – NOT ADOPTED

Solar thermal arrays include evacuated tubes and flat plate collectors. Evacuated tubes are more efficient, produce higher temperatures and are more suited to the UK climate when compared to flat plate collectors. Evacuated tubes tend to be more costly than flat plate collectors.

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is most effective (during the summer months).

Solar thermal arrays would require additional plumbing which is likely to incur additional financial costs and solar PV would likely offer greater CO_2 emission reductions with the same area. Solar thermal technology and PV panels are in direct competition for the same roof space.

For these reasons, solar thermal technology would not be the most feasible option for the proposed development.

5.1.7 GROUND SOURCE HEAT PUMPS (GSHP) - NOT ADOPTED

A ground source heat pump system for the site would include a closed ground loop where a liquid passes through the system, absorbing heat from the ground and relaying this heat via an electrically run heat pump within the building.

A ground source heat pump system would deliver space heating through a low temperature efficient distribution network such as underfloor heating. The installation of ground source loops significantly increases the construction time and adds to the capital cost of the project.

As the demand for heating and cooling are not balanced. Demand for space heating and water heating is predicted to be an order of magnitude higher than demand for cooling.

A GSHP system on this site would not deliver substantial carbon savings per unit of cost in comparison to other renewable strategies, such as ASHP

For this reason, GSHPs would not be feasible for this development.

5.1.8 AIR SOURCE HEAT PUMPS (ASHP) – ADOPTED

Air source heat pumps (ASHPs) employ the same technology as ground source heat pump (GSHPs). However, instead of using heat exchangers buried in the ground, heat is extracted from the external ambient air.

Air source heat pumps use fuel efficiently compared to the gas-powered systems and have a relatively low capital cost. Additionally, this type of system is beneficial for this type of development as this technology can provide both heating and cooling, depending on the indoor conditions required.

For these reasons, this technology will be utilised for this development.