Heat Decarbonisation Report

Marl Pits Leisure Centre

Prepared by: Mark Humphreys
Job Title: Energy Consultant

Job Number: BA6722

Version: v3.3
Date: 13/01/2025

Zenergi Ltd - Head Office
3 Benham Road, Benham Campus
University of Southampton Science Park

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Version Tracker

Comments	Version	Created By	Checked By	Approved By	Date
Final Version	3.3	Mark Humphreys	Leon Korner	Leon Korner	14/01/2025

Management Summary

This report has been prepared by Zenergi Consulting Engineers on behalf of Rossendale Borough Council to assess the challenges and opportunities to decarbonise Marl Pits Leisure Centre based on a site survey completed in November 2024.

The focus of the report is to identify both operational and capital investment project opportunities relating to energy saving and, in particular, de-carbonisation of the building's heating system.

As the ultimate aim is to replace the building's fossil fuel-fired heating systems with electric heat pump systems, it is important to reduce the heat losses from the building as much as possible. This will be achieved with building fabric upgrades where possible.

It is also vital to minimise the impact of adding electrical heating systems by reducing the existing grid electricity consumption using a mix of behavioural, control adjustment and energy efficiency initiatives.

"The survey has identified a total of 16 energy saving opportunities that can be carried out on the buildings to improve the energy performance of the buildings and reduce carbon emissions. Overall, the projects, based on current unit rates, are predicted to incur an additional annual energy running cost of £27,929. It is recommended that those measures which do not meet your capital expenditure policies, or with no financial saving, such as the installation of heat pumps, are reviewed as energy supply cost change as they may yield an improved financial business case in the future.

The forecast annual energy and carbon savings are 864,546 kWh and 194.5 tCO2e, respectively.

Description	Estimated cost savings (£)	Estimated CO2e savings (tonnes)	Estimated consumption savings (kWh)	Estimated cost (£)	Payback period (years)	Implementation Date
Optimisation	£572	2.43	13,256	£0	0.0	May-25
Training	£985	3.65	20,111	£4,500	4.6	May-25
Pipe and Valve	£634	2.69	14,676	£2,407	3.8	Jul-25
MM&T	£1,223	0.52	5,397	£1,976	1.6	May-26

Lighting	£2,907	1.65	12,828	£16,360	5.6	Nov-25
Renewables	£8,120	2.58	35,834	£87,900	10.8	Aug-27
Heating	-£26,298	135.09	596,930	£1,059,159	-	Aug-27
DHW	-£13,447	12.21	19,472	£51,840	-	Aug-27
Pool	-£2,625	33.64	146,039	£470,506	-	Aug-31

Table 1 - Management summary

There are many benefits to having well insulated heating and hot water pipes and valves, not only for financial and efficiency reasons.

- Insulation helps reduce heat loss, ensuring that more heat reaches its intended destination. This improves the overall efficiency of the heating system and reduces energy consumption.
- By minimizing heat loss, insulation reduces the amount of energy required to maintain desired temperatures, leading to lower energy bills.
- Insulation prevents condensation on cold surfaces, which can help avoid moisture damage and corrosion.
- In colder periods, insulation is crucial for preventing pipes from freezing and bursting, which can cause significant damage, costly repairs and potential loss of revenue.

Converting all lighting fixtures to low energy LED equivelants offers numerous benefits, to name just a few;

- LEDs use up to 90% less energy than incandescent bulbs and about 80% less than CFLs. This significant reduction in energy consumption helps lower electricity bills.
- LED bulbs can last up to 25 times longer than traditional incandescent bulbs. This means fewer replacements and lower maintenance costs over time.
- LEDs are more environmentally friendly as they consume less energy and contain no harmful substances like mercury, which is found in CFLs.

- LEDs provide better light quality with more focused and consistent illumination.

Renewables – Solar PV

Solar Photovoltaics (PV) is an active solar technology which produces electricity from solar radiation using solar cells encapsulated in panels called PV modules. There are no moving parts and minimal maintenance. Installing a solar PV system to generate electricity would reduce the grid consumption, energy costs and carbon emissions. Additionally, renewable energy technologies can provide resilience to economic changes in the form of fluctuating energy prices, and improved energy supply security using decentralised generation.

With regard to the proposed heat decarbonisation scheme, solar PV will benefit the installation of electric heat pump technology, by reducing the impact of the additional electricity consumption on the grid electricity requirements.

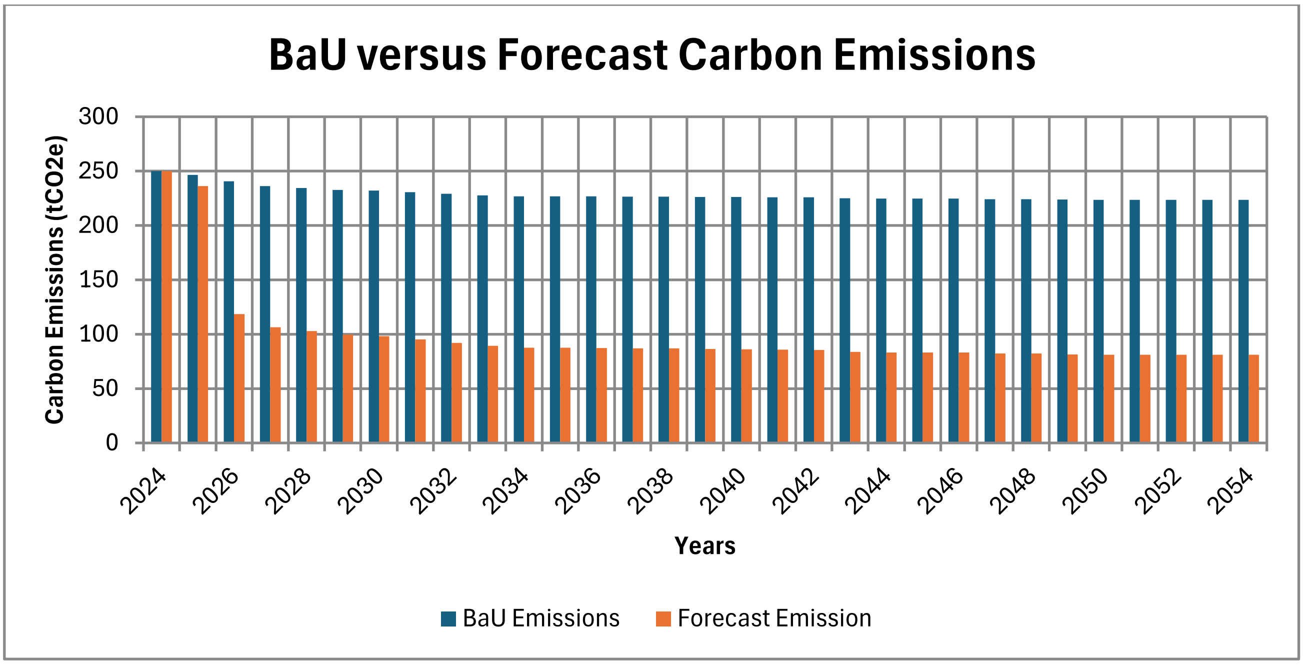

Figure 1: Business as usual vs forecast carbon emissions

Total carbon emissions are forecast to fall from 250.1 tCO2e in 2024 to 223.7 tCO2e by 2053 if no energy efficiency measures are undertaken (business as usual). This is based on the forecast reduction in fossil fuels used in central electricity generation and the increasing use of renewable generation sources such as wind and solar PV

Site Introduction

Marl Pits Leisure Centre based in Lancashire, where the site is situated in Rossendale and run by Rossendale Leisure Trust on behalf of Rossendale Borough Council.

Originally built in 1974, Marl Pits was a public swimming baths, before being refurbished and extended in 2012 to include a fitness gym, studio and new lobby/reception area.

General opening hours are between 6am – 10pm Monday to Friday and 8am – 5pm Saturday and Sunday. The leisure centre employs around 20 staff members and has a total floor area of 1,660 m^2.

Due to the recent refurbishment works completed on the building, there are no fabric improvements recommended and nor are there any planned construction works in the near future.

Figure 2, below, shows an outline of the buildings surveyed and its situation in relation to the surrounding buildings.

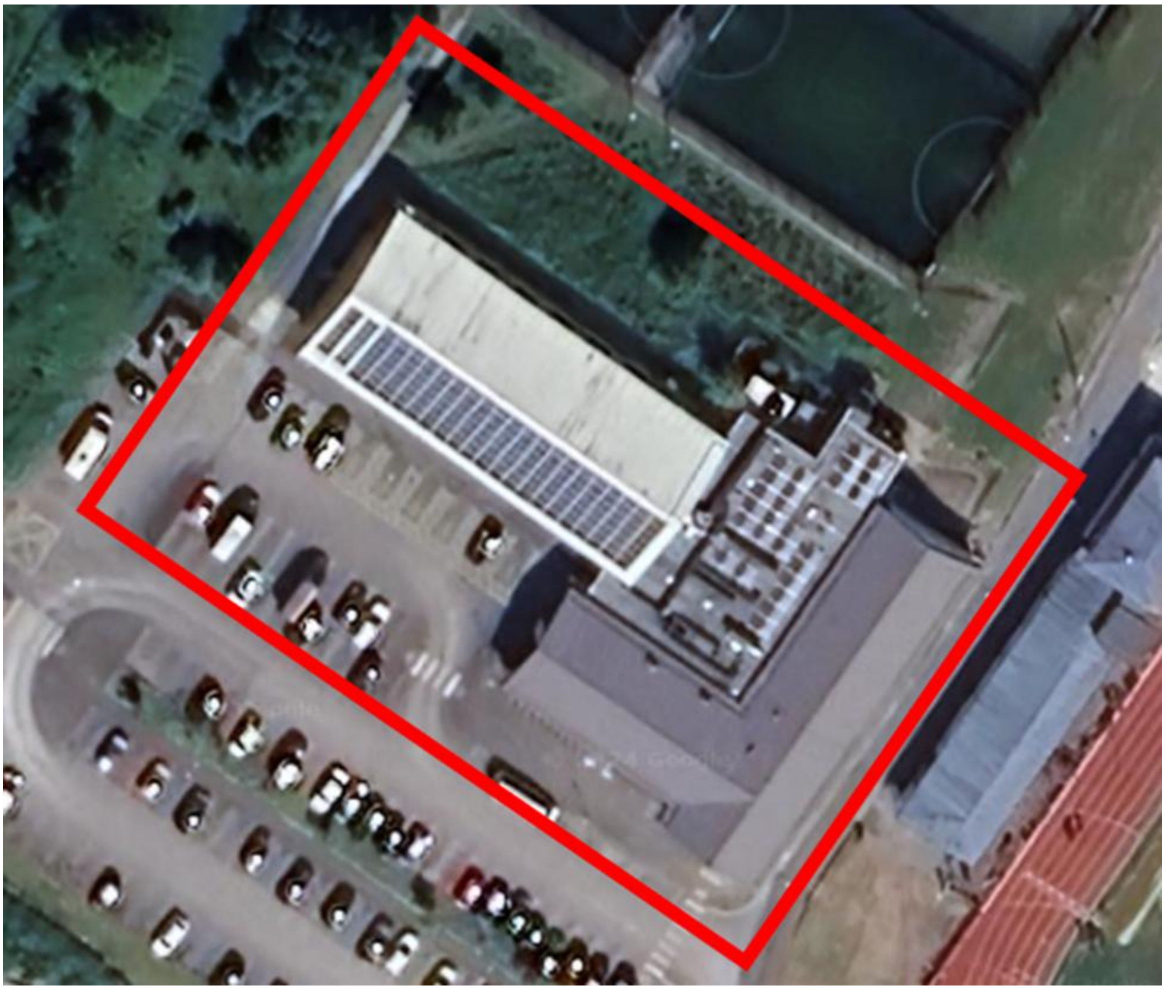

Figure 2 – Aerial view of the site and surrounding buildings

Review of Current Energy Consumption

Annual Consumption Overview

Natural gas and electricity usage data was taken from the council's in–house energy data portal. **April 2023** to **March 2024** has been chosen as the reporting period as it was the most recent twelve-month period available and is assumed to be reflective of business as usual.

Utility	Consumption kWh	Consumption %	Cost £	Cost %	Carbon Emissions tCO_2e	Carbon Emissions %
Grid Electricity	191,398	13%	43,373	45%	75.52	13%
Natural Gas	1,220,254	84%	52,678	55%	508.15	87%
Solar PV	33,317*	2%	0	0%	0	0%

**Solar PV data was not available during the project so generation has been modelled via PVGIS based on installed KWp*

Table 2 - Utility summary table

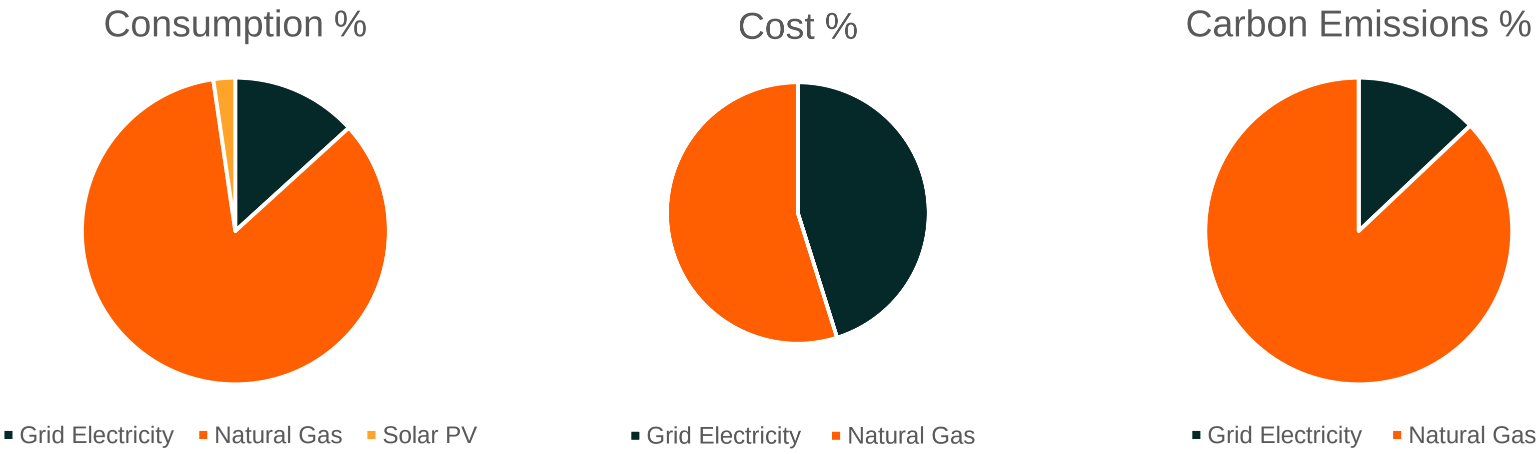

Figure 3 - Utility summary charts

The unit rates for grid electricity and gas are 22.66 and 4.31 p/kWh respectively. These rates were typical of the time and all calculations have been based on these figures. However, due to the volatility of the market, these prices are likely to fluctuate.

Monthly Energy Profile Charts

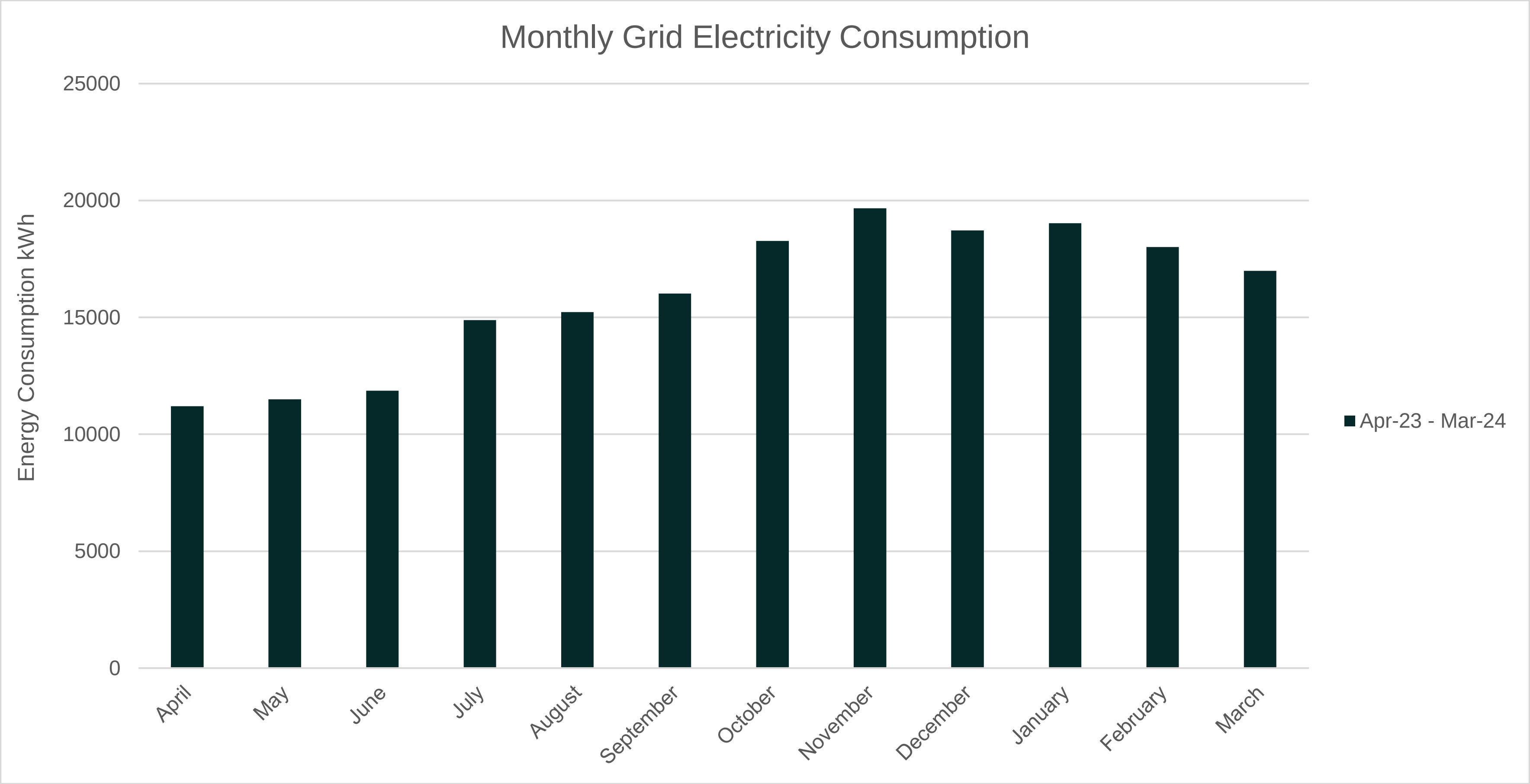

Figure 4: Grid electricity profile chart

The monthly electricity consumption chart shows a degree of seasonality; however, electricity demand is consumed for both heating ancillaries and cooling systems which are spread across the year.

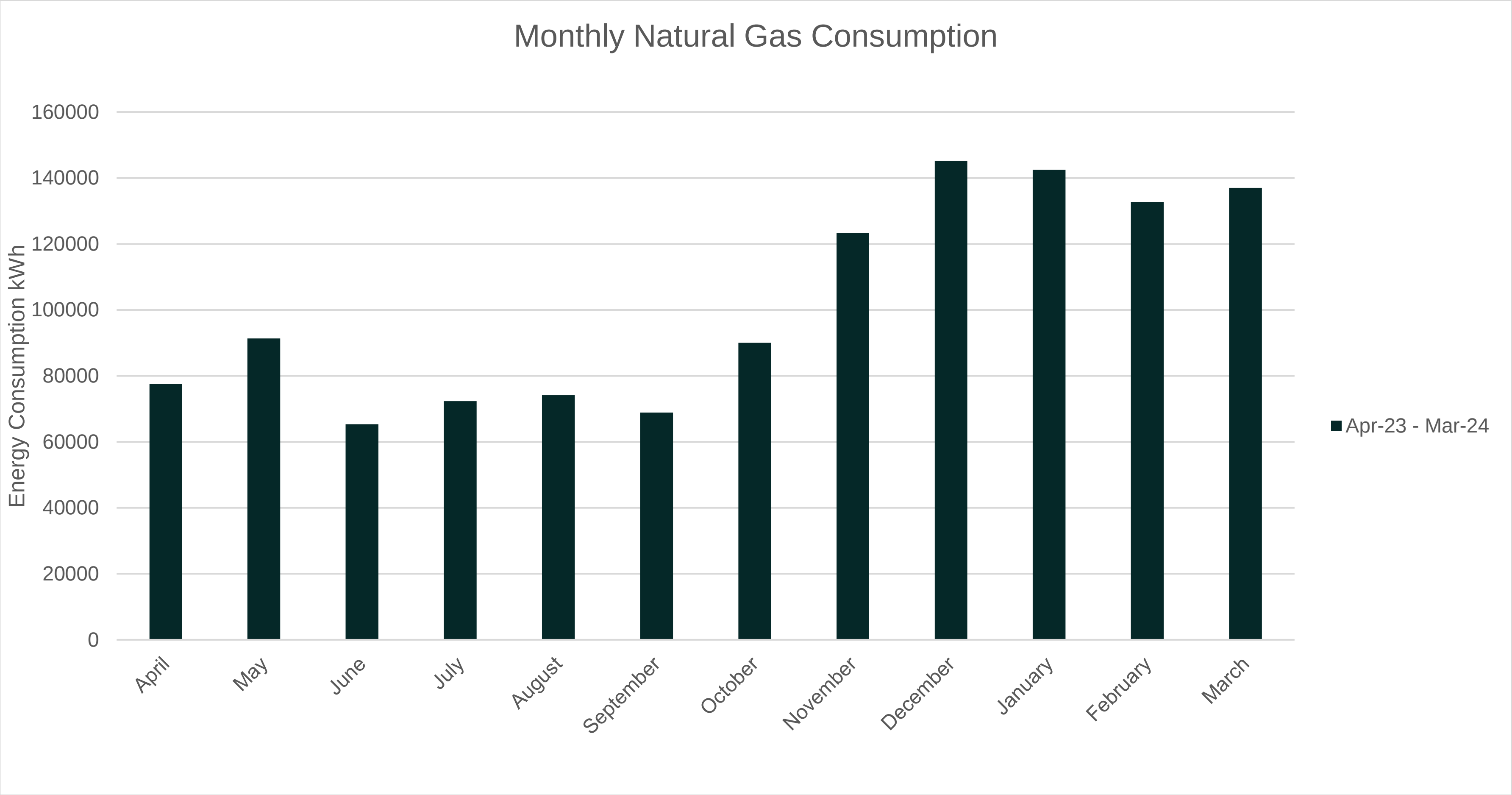

Figure 5: Natural gas profile chart

The seasonal influence on monthly gas usage is more defined, peaking in the winter month of December at 145,132 kWh. With the pool in constant use, all year round and gas being the soul heating source, this explains the high gas consumption through the summer months.

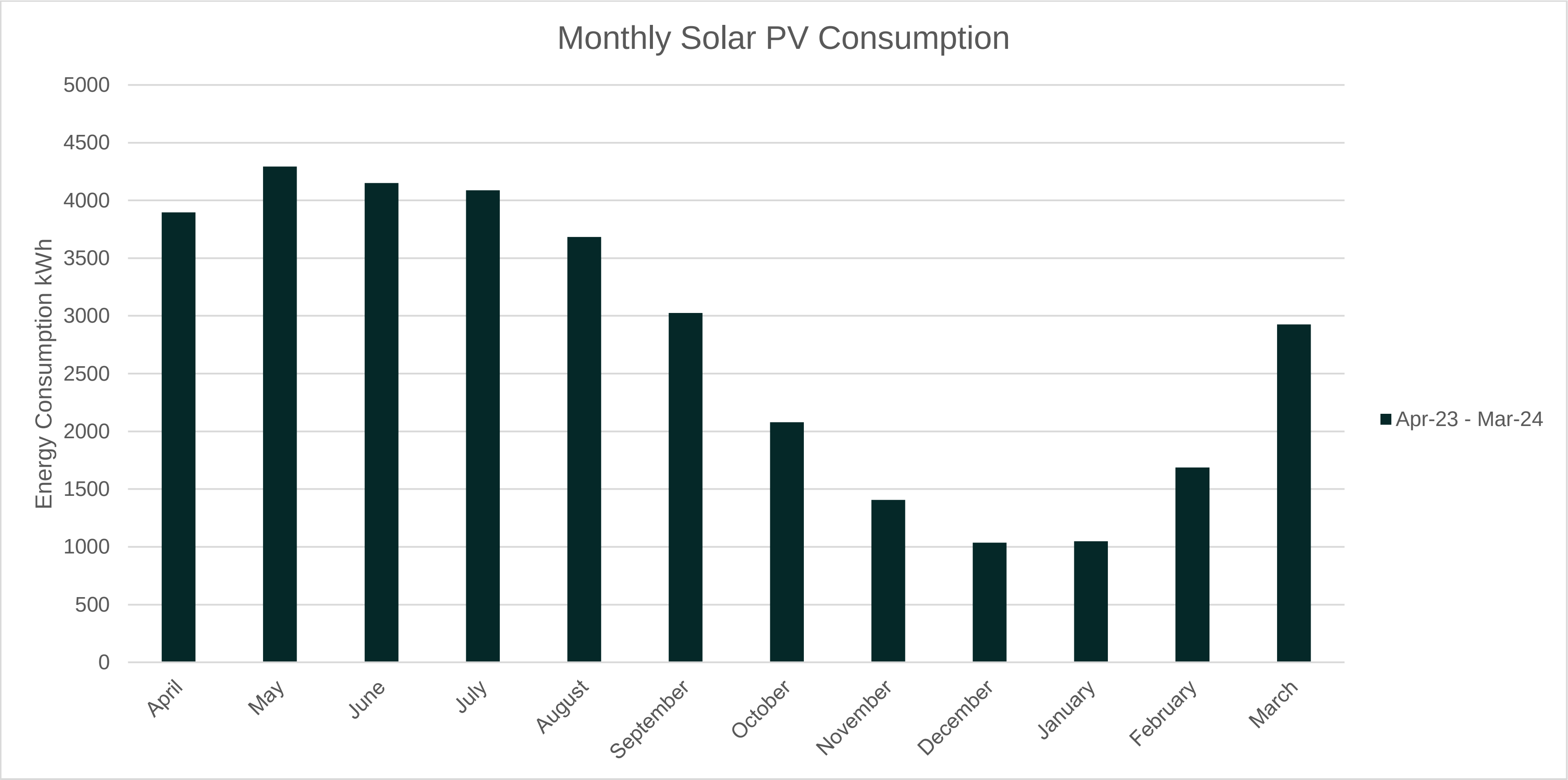

Figure 6: Solar energy profile chart

The monthly solar PV consumption is based on PVGIS modelled generation.

Regression Analysis

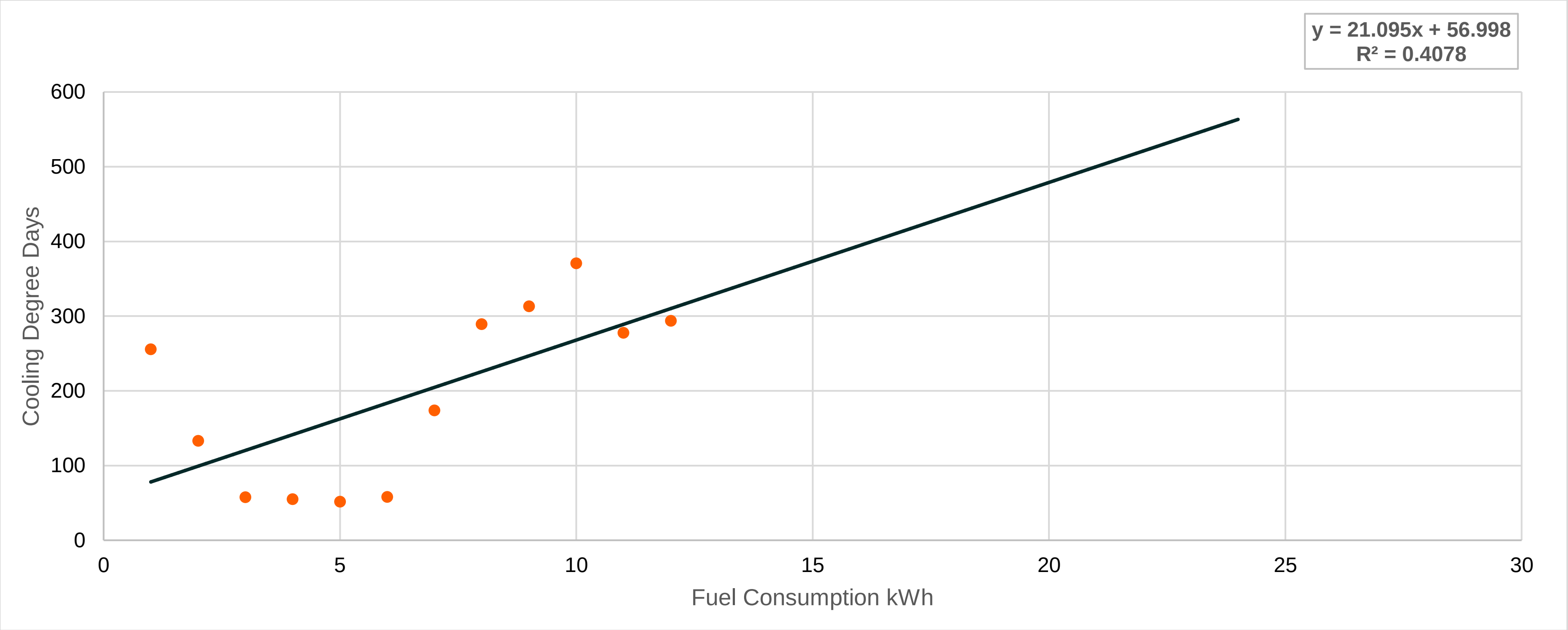

Figure 7: Grid electricity cooling degree days linear analysis

The correlation factor (R^2) of 0.4078 shows a poor relationship between consumption and demand. This may be down to above average cooling demands for the fitness and studio areas as well as the fact that the data includes all electricity usage, not just that used for cooling, therefore impacting the analysis.

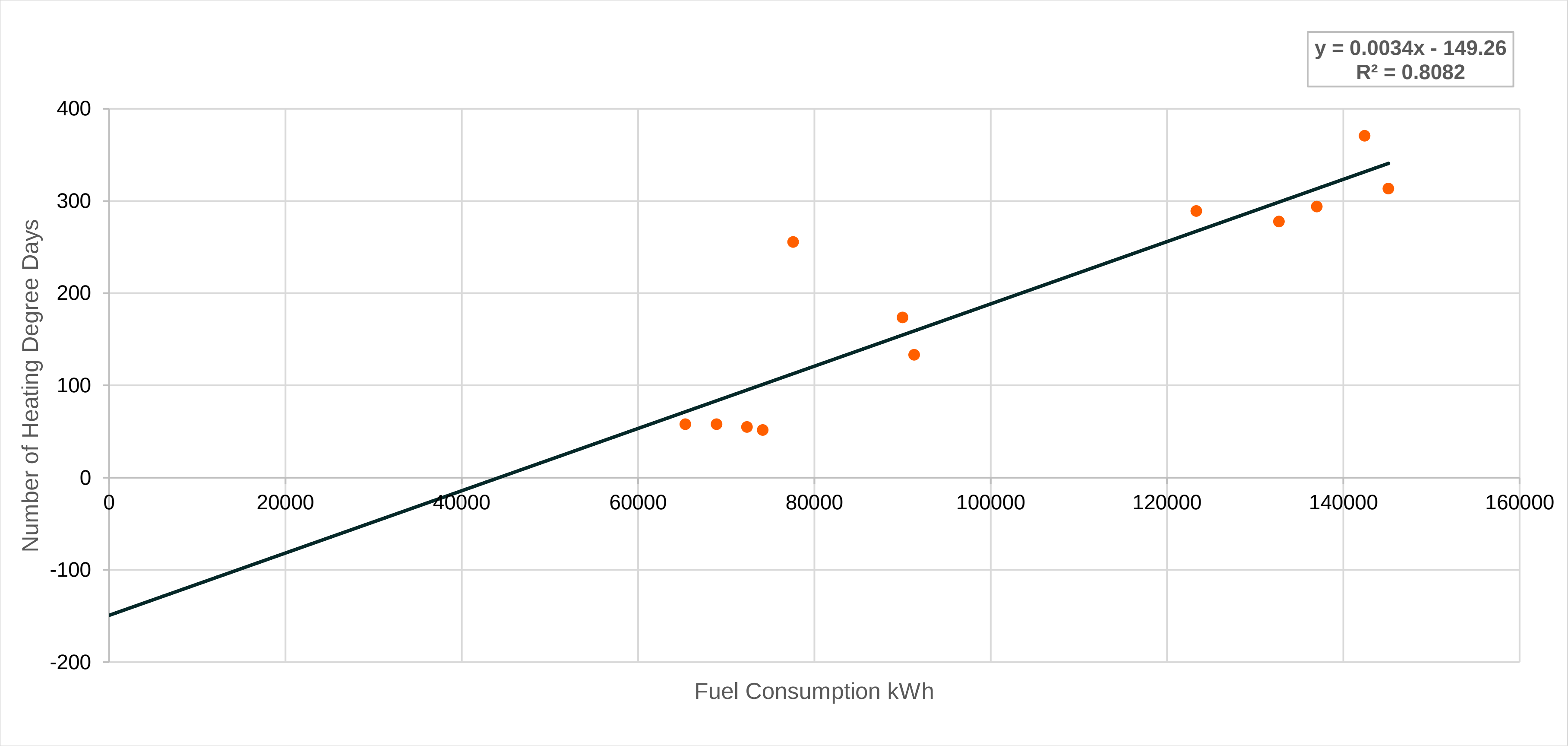

Figure 8: Natural gas heating degree days linear analysis

The correlation factor (R²) of 0.8082 indicates that a positive relationship exists between the gas consumption and degree days which suggests good control of heating plant. A negative intercept may be down to granularity of data, re-running the analysis with HH data may remove the negative intercept and will undoubtably give more accurate results.

CIBSE Energy Benchmark

CIBSE benchmark comparison								
Building	**Use**	**Area (m^2)**	**Electricity typical (kWh/m^2)**	**Electricity actual (kWh/m^2)**	**Rating**	**Fossil fuel typical (kWh/m^2)**	**Fossil fuel actual (kWh/m^2)**	**Rating**
Pool hall	Swimming Pool	650	245	206	✓	1,130	1,128	✓
Changing rooms / Lobby	Swimming Pool	375	245	89	✓	1,130	1,298	✗
Extension	Swimming Pool	635	245	20	✓	1,130	0	✓

Table 3 - CIBSE benchmark comparison

The above table shows a comparison of the current energy consumption per m^2 compared to the typical energy consumption per m^2 as stated by the CIBSE TM46 Energy Benchmarks. The consumptions with a green tick ✓show the which buildings on the site are performing better than the typical energy benchmark, with the ones with a red **X** performing worse than the benchmark, and yellow ● is where sites have consumption the same as the benchmark energy profiles.

As can be observed from the above table, electricity consumption for the whole site combined is lower than that of the CIBSE TM46 Energy Benchmark. This is a sign that the electrical energy management is of a good standard. However, savings can still be made to bring the electric consumption down as we will explore further in this report.

The fossil fuel consumption on site is slightly above the benchmark. Opportunities outlined within this report, if followed, will bring the centre's consumption down to a similar or below level to that of the CIBSE Benchmark.

Building Summary

Building(s) summary					
Name	**Year of Construction**	**Use**	**Area (m2)**	**Ventilation**	**Notes**
Pool hall	1974	Swimming Pool	650	Natural	
Changing rooms / Lobby	1974	Swimming Pool	375	Natural	
Extension	2012	Swimming Pool	635	Natural & mechanical	

Table 4 - Building summary

Building Fabric

The below U-value are estimates which derive form current Building Regulations Part L2 of non-domestic buildings.

Building fabric						
Name	**Wall**	**Rating**	**Roof**	**Rating2**	**Glazing**	**Rating3**
Pool hall	Cavity brick / block - assumed insulated and timber frame - insulated	✓	Metal clad assumed insulated	✓	Double - UPVC & aluminium frames	✓
Changing rooms / Lobby	Cavity brick / block - assumed uninsulated	●	Flat, single ply - assumed insulated	✓	Double - UPVC	✓
Extention	Cavity brick block - assumed insulated	✓	Metal clad assumed insulated	✓	Double - aluminium frames	✓

Table 5 - Quality of building fabric

The condition of the building fabric has been defined by the **red X, yellow circle** ●, and **green tick** ✓scheme above. Poor quality (X) means the building fabric should be upgraded in order to help decarbonise the building. Fair quality (●) means the building fabric could be upgraded but is not essential to decarbonise the building. Good quality (✓) means the building fabric is of high quality and does not need to be upgraded to decarbonise the building.

Building U-values (W/m^{2}K)			
Name	**Wall**	**Roof**	**Glazing**
Pool hall	1.60	1.40	3.30
Changing rooms / Lobby	1.6	1.4	3.3
Extension	0.27	0.25	2.7

Table 6 - Building fabric U - values

HVAC Summary

Energy Type	Location	Make	Model	Application	Output (kW)	Qty	Efficiency	Year Installed	No. of Duty Boilers	Circuits	Area Served	Pipe System	Capacity (litres)	Emitters	Controls
Natural Gas	1	ACV	Heat Master	Space Heating, Domestic Hot Water and Pool	218	2	91%	2012	2	1 x VT	Circulation / Lobby, Extension	Twin Pipe	400	Double panel steel radiators	BMS
Natural Gas	2	Nordair Niche	10946/1	Space Heating	595	1	90%	2011	1	N/A	Pool hall	AHU	N/A	Convector units	BMS

Table 7 - HVAC information

Heading and HWS controls										
Location	**Plant room**	**Controls**	**Application**	**Time on**	**Time off**	**Typical Operating Days**	**Setpoint (°C)**	**Max Flow Temp (°C)**	**Return Temp (°C)**	**Comments**
Circulation / Lobby	1	BMS	Space Heating, Domestic Hot Water and Pool	07:00 13:00 07:00 13:00 08:00	12:00 20:00 13:00 19:00 16:00	Mon - Thurs Fri Sat - Sun	21	79	71	
Pool hall	2	BMS	Space Heating	08:00	22:00	Mon - Sun	29	0	0	

Table 8 - HVAC controls

Other Energy Users

Lighting

Lighting across the site is a mixture of fluorescent and tubular fittings with minimal LED low energy bulbs.

Catering

There are no catering facilities on site.

Other Energy Users

Other significant energy users came from IT equipment and hand/hair dryers.

Compliance Checker

The compliance status of Marl Pits Leisure Centre with Display Energy Certificate (DEC), Energy Performance Certificate (EPC) and Air Conditioning Inspection Certificate (ACIC) requirements has been reviewed.

Display Energy Certificate (DEC)

The leisure centre currently holds a DEC with a rating of D. This rating is valid until 31st July 2025. This rating reflects the building's operational energy efficiency based on actual energy usage over the past year. Regularly monitoring and updating the DEC rating provides an opportunity to track the impact of energy-saving measures and improve operational performance.

Energy Performance Certificate (EPC)

The centre holds a valid EPC, with a rating of B and is due to expire on 19th May 2026. EPCs are a legal requirement where a building is newly constructed or put up for Let/Sale.

Air Conditioning Inspection Certificate

Marl Pits currently holds an ACIC. It is a legal requirement to acquire inspection certificates for air conditioning systems that exceed 12 kW, every 5 years. This ensures that the systems are energy efficient and compliant with legal standards.

Key Recommendations

Table 9 below highlights the key energy saving opportunities identified during the site survey at Marl Pits Leisure Centre.

Opportunity	Project Description	Fuel Type	Estimated cost savings (£)	Estimated CO2e savings (tonnes)	Estimated consumption savings (kWh)	Estimated cost (£)	Payback period (years)	Implementation date
1	Changing rooms / Lobby - Reduce setpoint by 1 oC (1 - ACV boiler)	Natural Gas	£572	2.43	13,256	£0	0.0	May-25
8	Whole Site - Metering, Monitoring & Targeting (Grid Electricity)	Grid Electricity	£1,223	0.52	5,397	£1,976	1.6	May-26
10	Extension - Replace existing fluorescent lighting with new LED fittings	Grid Electricity	£1,578	0.90	6,965	£11,104	7.0	Nov-25
12	Extention - Install 32 kWp Solar PV System	Grid Electricity	£5,095	1.62	22,484	£48,000	9.4	Aug-27

Table 9 - Key recommendations

The table above outlines four key energy-saving opportunities identified for the site. These key recommendations are focussed around saving energy, along with the generation of renewable electricity to relieve capacity once fossil fuel heating systems are taken away and replaced with electric systems. An estimated 67,315 kWh can be saved with these measures alone, avoiding 18 tonnes of CO2 emissions annually.

Low Carbon Strategy

Table 10 below includes the measures necessary to decarbonise Marl Pits Leisure Centre through replacement of the current fossil fuel appliances.

			Estimated annual savings					
Opportunity	Description	Fuel Type	Estimated cost savings (£)	Estimated CO2e savings (tonnes)	Estimated consumption savings (kWh)	Estimated cost (£)	Payback period (years)	Implementation date
13	1 - Install Air Source Heat Pump (air to water)	Natural Gas	-£4,538	23.50	99,227	£231,408	-51.0	Aug-27
14	2 - Install Air Source Heat Pump (air to air)	Natural Gas	-£21,761	111.59	497,703	£86,370	-4.0	Aug-26
15	1 - Install Direct electrical cylinder	Natural Gas	-£13,447	12.21	19,472	£3,240	-0.2	Aug-27
16	Swimming pool - Install Air Source Heat Pump (air to water)	Natural Gas	-£2,625	33.64	146,039	£26,184,461	-9974.1	Aug-31
16	Swimming pool - Install Air Source Heat Pump (air to water)	Natural Gas	-£2,625	33.64	146,039	£26,184,461	-9974.1	Aug-31

Table 10 - Decarbonisation opportunities

Conclusions

This report has identified several energy-saving and decarbonisation opportunities for Marl Pits Leisure Centre, each contributing to reducing energy consumption and carbon emissions. Key measures include reducing heating setpoints for improved efficiency and installing pipe/valve/flange insulation to minimise heat loss. The installation of a solar PV system and transitioning from gas to electric heating systems further support the centres transition to low-carbon technologies. Together, these initiatives represent a holistic approach to enhancing energy performance and achieving long-term sustainability goals.

Next Steps

- Implementation of Energy-Saving Measures **-** Prioritise and schedule of the implementation of identified opportunities, starting with low-cost and high-impact measures such as housekeeping initiatives and minor adjustments to heating setpoints.
- Planning for Solar PV Installation **-** Begin feasibility studies and secure funding for the proposed solar PV system to reduce grid electricity consumption. Ensure that structural assessments and grid connection requirements are met to streamline installation.
- Assessment of ASHP Feasibility **-** Conduct a detailed site assessment for Air Source Heat Pump (ASHP) installations. Address potential challenges such as noise mitigation, vandalism risks, and securing planning permission.

Additonal Information

Cost evidence

The implementation costs presented in this report are based on quotations obtained from previous projects of a similar scope and scale. These figures are further informed by Zenergi's industry experience, ensuring they reflect current market conditions and align with established benchmarks. Costs are likely to change over time and are to be used as an indication.

Energy Saving Calculations

The methodology and assumptions underlying each calculation in this report can be provided upon request. All calculations have been developed in line with best practice guidelines, such as those issued by CIBSE and Salix, and are further informed by Zenergi's extensive industry experience. This ensures that the report adheres to professional standards, maintains transparency, and provides a reliable foundation for the analysis presented.

The low carbon heating solutions have been sized by reviewing the sites current peak heat loss per building, accounting for any reductions in heat loss from building fabric upgrades (wall insulation, glazing etc), and sizing the new system to provide that peak heat demand. The peak heat demand is based on an outdoor air temperature of -5°C and desired indoor air temperature of 21°C.

The low carbon domestic hot water solution has been determined by estimating the number of uses per building, and the specific building usage (i.e., catering facilities, sports facilities etc) and therefore estimating the amount of hot water required per day per person on site following the Institute of Plumbing guidelines, as well as Zenergi's industry experience.

Further details of the above can be provided upon request.

Feasibility

Heat Pumps have been determined the most appropriate Low Carbon Heating solution for this site. Based on the following factors. All of the following sections should be read in conjunction with the results of the Options Appraisal at Appendix 4 and the sections of the report that have dealt with the low carbon heating solution.

Cost

The following table gives a high-level view of each Low Carbon Heating Option

Technology	Estimated Project Cost
Ground Source Heat Pumps	£1.958m
Air Source Heat Pumps	£1.572m
Water Source Heat Pumps	No Water Source

Technologies excluded:

- District Heating – there is no local network available
- Electric Boilers – very high running costs associated with the 1:1 efficiency vs a heat pump
- Biomass – difficulty sourcing good quality fuel; maintenance concerns; carbon cycle concerns of the fuel

Legal

Liaison with the Rossendale Borough Council planning team has confirmed the following:

- Solar PV may be permitted development if it meets certain conditions however due to the following it is the case that a planning application will need to be submitted anyway
- ASHP will require a planning application

Other considerations will include

- Ecological assessments to support planning applications.
- Noise assessments for local residents. This is seen as low risk due to the distance from the proposed location of the outdoor units, the noise insulation from the swimming pool hall & the fact the existing gas-fired AHU is located in the same position.
- Possible requirement for a glint & glare study for the solar PV – glint & glare studies the impact of short bursts of light reflecting off a solar panels surface as well as longer term glare impacts. Often required as part of an Environmental Impact Assessment, to minimise disruption to local residents & for aviation safety.

Whilst all the above are not deemed a major risk to project feasibility they will need to be planned for within the programme delivery of the project. At this stage it is not believed that planning consent will fail because of any of the above.

Technical

- Space – the existing plant room has a reasonable amount of space, with further being made available following strip out of the existing boilers. Should further space be required there is an existing enclosure directly on the back of the plantroom (currently housing the gas-fired AHU & pool pump equipment), this area can be enlarged and is suitable for a prefabricated plantroom should one be deemed appropriate (this has not been costed for).
- Emitters – Heat pumps generally operate with lower flow temperatures (than existing fossil fuel boilers), circa 45 to 55°C, and therefore the Delta T of the systems are lower. Elements such as heating coils within AHUs, calorifiers as well as existing radiators and the pool water heat exchanger, may no longer be suitable and will require replacement.
- Asbestos – there is an asbestos register on site with some asbestos noted across the original lobby area and the plantroom. This may need to be remediated in order to deliver the project. Further information will need to be available to the project team and asbestos will need to be removed by a licenced contractor.
- Noise – an acoustic enclosure will be required to house any outdoor equipment however the extent of this will remain unknown until a noise survey and assessment, in accordance with BS4142, has been commissioned.

Delivery

Whilst delivery is covered in the programme at Appendix 7 it is important to assess the feasibility of the programme against a number of key points

- Resource – project specific resource will be required from Rossendale Borough Council, under sizing the project team will impact the delivery of the project and potentially impact the revenue stream of the leisure centre due to delays. It is believed that this resource is available.
- Consents – engaging with planning early will ensure that the process of gaining all consents does not hold up the project. These should be factored into the programme.
- Capacity – an electrical upgrade will be required and a budget cost has been provided. It is recommended to take this to a full quote as soon as possible to ensure that capacity is secured, the cost is known and that prices don't rise. An upgrade is deemed feasible based on the budget estimate provided by the DNO.
- Lead Times – Lead times are another key element in ensuring projects are kept to programme. Ordering equipment as soon as it's possible to do so will reduce the chance of delays and cost increase.

None of the above impact the feasibility of the project if they are well managed, however they do impact the ability to deliver on time if they are not carefully planned for at the outset. It should be noted that things change quickly within the field of heat decarbonisation and therefore project feasibility can change within a matter of months, particularly around cost & delivery.

Electrical Infrastructure

Full electrical supply analysis will need to be completed, however it is evident that the current agreed capacity of 20kVA is insufficient for the increased load of circa 190kW from the Air Source Heat Pump installation.

Current Capacity (kVA)	Current Max Demand (KW)	Proposed Capacity Increase (kVA)	Cost	Source of Capacity Increase Cost
20 (from contract Rates File)	49KW	750	£160,000 + VAT	Budget estimate provided by Rossendale BC for a request for 750kVA at the Marls Pits site

Main fuseboard – not accessible on visit

Fiscal Electricity Meter Serial E10BG07275

200A Schneider Switchgear

Solar PV Export Meter Serial 16062378

Monitoring and Verification Plan

A Measurement and Verification (M&V) Plan outlines the approach to quantifying energy savings and carbon reductions achieved through identified energy conservation measures (ECMs) at Marl Pits Leisure Centre. The plan will utilise a mixture of IPMVP Options B & C, leveraging technology specific metering & whole-facility energy monitoring, regression analysis, and weather-normalised adjustments. Baseline conditions will be determined using historical utility consumption data, with ongoing data collection conducted through fiscal meters, sub-meters and local weather data to enable precise and comprehensive monitoring. The M&V plan will include energy price estimates, employee (or contractor) roles, and responsibilities, ensuring transparent reporting and validation over a defined timeline, supporting informed decision-making aligned with CIBSE and, where applicable, Salix standards.

Examples include:

- ASHP metering of electricity in & heat out, with metering connected to the BMS
- Solar PV inverter monitoring
- Fiscal (and sub-metering where installed and relevant) metering for technologies such as P&V*, insulation*, optimisation*, training, lighting

**may utilise BMS data where available*

Limitations and Accuracy of Information

Whilst every effort has been made to ensure the information and figures provided in this document are accurate, please be aware that this is influenced by a number of factors including the accuracy of data or information provided by Rossendale Borough Council. Zenergi Consulting Engineers (the Consultant) actively works to minimize inaccuracies; however, at times these can be unavoidable. Where the Consultant is aware of issues with the quality of data or pertinent information and assumptions need to be made, this will be highlighted within the report.

The payback timescales provided in the report are indicative, often based on the average cost of equipment and installation. It should be noted that costs can vary widely according to the technology, manufacturer, installer, and site-specific conditions, particularly if a recommendation relates to a large capital project. The project timescales do not allow for all of these factors to be investigated; therefore, indicative payback timescales are provided. It is strongly recommended that an investment-grade audit is undertaken and that a minimum of three quotes are secured prior to making an investment decision, and payback timescales are recalculated based on the preferred supplier quotation.

It is expected that recommendations made within the report will go through Rossendale Borough Council's own validation and approval process prior to implementation.

Considerations

Air source heat pumps

Planning Permission

The installation of AHSPs on non-domestic buildings and land is not considered 'permitted development' and so you will need to apply to the Local Planning Authority for planning permission.

Building Regulations

Installation of either a ground source or air source heat pump will have to comply with building regulations.

It is advisable to contact an installer who can provide the necessary advice, preferably one who belongs to either the Microgeneration Certification Scheme or the relevant Competent Person Scheme.

DNO Notification and Approval

When planning a heat pump project, it is strongly advised that you contact your DNO early in the planning process. As a simple rule of thumb, in your timing plan, allow as much time for information exchange and dialogue with your DNO during the planning phase as you allow for installation and commissioning.

It is essential that the heat pump that you wish to purchase is identified and considered prior to making your order. Some equipment has a high impact on the electricity network whereas other types can be accommodated more easily.

Installer Competence

It is recommended that the installation of the heat pump is undertaken by suitably qualified persons, in particular installers should be certified to the MCS (Microgeneration Certification Scheme) or relevant Competent Persons scheme.

MCS is an internationally recognised quality assurance scheme supported by the Department for Energy Security and Net Zero (DESNZ), formerly known as the department for Business, Energy & Industrial

Strategy (BEIS). MCS certifies both products and installation companies to help ensure that microgeneration products are installed to a high standard.

Ground source heat pumps

Planning Permission

The installation of GHSPs on non-domestic buildings and land may be 'permitted development' with no need to apply to the Local Planning Authority for planning permission. There are, however, important limits and conditions which must be met to benefit from these permitted development rights. This means the following conditions must be observed:

- When no longer needed for microgeneration pumps should be removed as soon as reasonably practicable and the land should, as far as reasonably practicable, be restored to its condition before the development took place, or to the condition agreed in writing between the local planning authority and the developer.
- The total area of excavation must not exceed 0.5 hectares.
- Only one ground source heat pump is located within the curtilage of the building. Any more than one will require planning permission.

Note, if you are a leaseholder you may need to get permission from your landlord, freeholder, or management company.

Building Regulations

Installation of either a ground source or air source heat pump will have to comply with building regulations.

It is advisable to contact an installer who can provide the necessary advice, preferably one who belongs to either the Microgeneration Certification Scheme or the relevant Competent Person Scheme.

DNO Notification and Approval

When planning a heat pump project, it is strongly advised that you contact your DNO early in the planning process. As a simple rule of thumb, in your timing plan, allow as much time for information exchange and dialogue with your DNO during the planning phase as you allow for installation and commissioning.

It is essential that the heat pump that you wish to purchase is identified and considered prior to making your order. Some equipment has a high impact on the electricity network whereas other types can be accommodated more easily.

Installer Competence

It is recommended that the installation of the heat pump is undertaken by suitably qualified persons, in particular installers should be certified to the MCS (Microgeneration Certification Scheme) or relevant Competent Persons scheme.

MCS is an internationally recognised quality assurance scheme supported by the Department for Energy Security and Net Zero (DESNZ), formerly known as the department for Business, Energy & Industrial Strategy (BEIS). MCS certifies both products and installation companies to help ensure that microgeneration products are installed to a high standard.

Solar PV

The following points should be considered in advance of implementing the proposed solar PV project:

Planning Permission

The installation of solar panels on non-domestic buildings and land may be 'permitted development' with no need to apply to the Local Planning Authority for planning permission. There are, however, important limits and conditions which must be met to benefit from these permitted development rights. This means the following conditions must be observed:

- Equipment should be sited, so far as is practicable, to minimise the effect on the external appearance of the building and the amenity of the area.
- When no longer needed, the equipment should be removed as soon as reasonably practicable.

The following limits must also be met for roof mounted systems:

- Solar panels installed on a wall, or a pitched roof should project no more than 200mm from the wall surface or roof slope.
- Where panels are installed on a flat roof the highest part of the equipment should not be more than one metre above the highest part of the roof (excluding the chimney).
- Equipment mounted on a roof must not be within one metre of the external edge of that roof.
- Equipment mounted on a wall must not be within one metre of a junction of that wall with another wall or with the roof of the building.
- The panels must not be installed on a listed building or on a building that is within the grounds of a listed building, or on a site designated as a scheduled monument.
- If the building is on Article 2(3) designated land[1] the equipment must not be installed on a wall or a roof slope which fronts a highway.
- If the equipment is on the roof of the building the capacity for generation of electricity across the whole of the site cannot exceed 1 megawatt.
- Other than microgeneration solar thermal equipment or microgeneration solar PV equipment, if there is to be any other solar PV equipment installed on the roof of a building then the Prior Approval (56 days) of the Local Planning Authority is required. This will assess the design and external appearance of the development, particularly in respect of the impact of glare on occupiers of neighbouring land.

Note, if you are a leaseholder you may need to get permission from your landlord, freeholder or management company.

Building Regulations

If you wish to install solar panels onto a roof, then building regulations will normally apply. The ability of the existing roof to carry the load (weight) of the panels will need to be checked and proven. Some strengthening work may be needed.

Building regulations also apply to other aspects of the work such as fire protection and weather proofing. It is advisable to contact a qualified installer who can provide the necessary advice.

DNO Notification and Approval

When installing solar PV or any form of electricity generation to a grid connected property, the local DNO (District Network Operator) will need to be informed. Depending on the size of the system this can either be done retrospectively, unless prior permission needs to be granted. If prior DNO permission is required for an installation this can take up to 11 weeks to be granted. The size of the PV system is based on the AC inverter rating rather than the peak DC rating of the panels.

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[1] Designated land includes national parks and the Broads, Areas of Outstanding Natural Beauty, Conservation Areas and World Heritage Sites.

If the system size is under 16A per phase (3.68 kWp for a single-phase supply or 11.04 kWp for a three-phase supply) then the DNO will just need to be notified within 28 days of the system's commissioning. Prior permission is not required as the addition of such small systems is very unlikely to cause any load issues to the current infrastructure of the local grid. All new installations meeting these criteria must adhere to the new EREC G98 standard.

However, if the solar PV system to be installed is greater than 16A per phase then prior permission will need to be granted. This is because the grid needs to conduct a network study to determine whether the local grid can handle the added load. The grid may state that additional work needs to be done prior to the installation to cope with the extra energy that the system generates. The DNO will work to a worst-case scenario and will design and set requirements in line with these, even if incredibly unlikely, to ensure the security of the grid.

DNO permission is also required for any battery system that has backup functionality and that 'islands' the property from the grid in the event of a power cut. All new installations meeting these criteria must adhere to the new EREC G99 standard.

Once the DNO application has been made the DNO will conduct their assessment and will produce a connection offer. This will detail the maximum specification of the allowed connection and whether there are any associated connection charges. The typical three outcomes from the offer in order of likeliness are:

- The application is accepted and the system size that was requested can be installed with no additional charges or amendments.
- The system size is capped at a given kWp AC rating and export limitation is needed. A witness test could be required to ensure the limitation is put in place, which would incur a small fee.
- To install the requested system, size the supply needs to be upgraded from single to three phase and the system can't be connected until the required works have been completed. The charge for this can be very expensive and will vary from site to site.

Installer Competence

It is recommended that the installation of a new solar PV is undertaken by suitably qualified persons, in particular installers should be certified to the MCS (Microgeneration Certification Scheme).

MCS is an internationally recognised quality assurance scheme supported by the Department for Energy Security and Net Zero (DESNZ), formerly known as the department for Business, Energy & Industrial Strategy (BEIS). MCS certifies both products and installation companies to help ensure that microgeneration products are installed to a high standard.

Maintenance

Solar PV installs will require a degree of maintenance to ensure that they continue to operate efficiently and meet the expected energy generation profile. A maintenance budget should be allocated to allow the following common maintenance tasks:

- **Cleaning of panels** – The panels will require periodic cleaning to remove soiling which reduces the light reaching the solar PV cells and therefore reduces the power generated. An indicative cleaning cost is £4/kWp/year though costs will vary depending on access to the panels, and how the panels are arranged on roof spaces.
- **Inverter replacement** – Inverters typically have a guaranteed operating life of between 5 and 10 years depending on the size and manufacturer. Since the solar panels will typically have an expected life in excess of 20 years, it is likely that the inverter(s) will need to be replaced around the 10-year and 20-year point. Allowing a budgetary cost of £3/kWp/year is typical.

Export metering – If a separate export meter is required then there will be a one-off installation cost of circa £500 and then an annual data and billing charge of £250 per year.

Appendices

Appendix 1: Opportunities Detail

Appendix 1.1: Controls

			Estimated annual savings					
Opportunity	**Description**	**Fuel Type**	**Estimated cost savings (£)**	**Estimated CO2e savings (tonnes)**	**Estimated consumption savings (kWh)**	**Estimated cost (£)**	**Payback period (years)**	**Implementation date**
1	Changing rooms / Lobby - Reduce setpoint by 1 oC (1 - ACV boiler)	Natural Gas	£572	2.43	13,256	£0	0.0	May-25

Table 11 - Control opportunities

The boiler setpoint is currently set to 21˚C, it is recommended this is reduced by 1°C. Typically, a 1°C temperature reduction saves 8% energy.

This opportunity is predicted to provide a 13,256 kWh energy saving equivalent to £572.

Inside Temp Setpoint 10:15

21.0 °C

Range 16 to 30

Figure 9: Current heating setpoint

Appendix 1.2: Staff Awareness

			Estimated annual savings					
Opportunity	**Description**	**Fuel Type**	**Estimated cost savings (£)**	**Estimated CO2e savings (tonnes)**	**Estimated consumption savings (kWh)**	**Estimated cost (£)**	**Payback period (years)**	**Implementation date**
2	Changing rooms / Lobby - House Keeping (Natural Gas)	Natural Gas	£841	3.56	19,472	£3,839	4.6	May-25
3	Extention - House Keeping (Grid Electricity)	Grid Electricity	£145	0.08	639	£661	4.6	May-25

Table 12 - Staff awareness opportunities

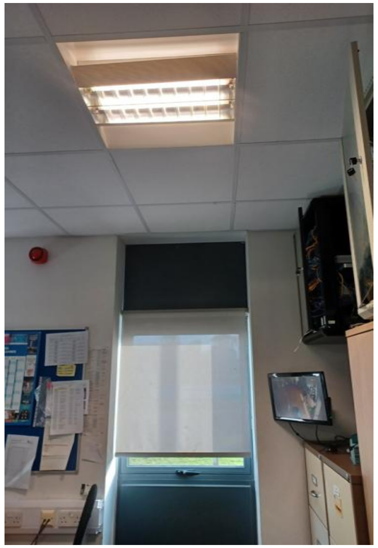


Figure 10: Energy management

Electrical energy management at Marl Pits Leisure Centre is fair. However, there are still some opportunities for Energy savings to be achieved through a formal energy awareness programme involving staff and management. Opportunities include:

- Maximise the use of daylight – use blinds only to eliminate solar glare and don't leave blinds closed unnecessarily with lighting on.
- Closing windows when the room is not occupied. The Health and Safety Executive (HSE) covid ventilation guidance should be followed for multi-occupancy rooms.
- IT equipment – ensuring that energy-saving modes are correctly set up and switching off equipment where possible. Many IT systems can switch off all equipment out of hours.
- Computer equipment – the centre should consider using a master control to switch off all PCs to reduce energy rather than just letting the PCs go into sleep mode.

In addition to the electrical consumption, energy savings can be achieved for gas consumption. Opportunities include:

- Ensure the Space heating setpoints are not too high, which can encourage people to open the windows.
- TRVs are set at maximum, preventing effective heating control.
- Where installed, adjust thermostatic valves (TRVs) to control room temperatures appropriately. TRVs should be set as follows:
    - Classroom/office: set to '3', which equates to 19-21°C.
    - Circulation areas: set to '2', which equates to 16-18°C.
    - Unoccupied rooms: set to '1', which equates to 13-16°C.
    - Ideally, lockable TRVs should be used.

It was also observed whilst on site that the Air handling unit (AHU) needed maintenance / cleaning. It is imperative that the filters and grids are kept clean and clutter-free to not impede air flow. Any obstruction can cause the unit to work harder, thus drawing more power than is needed.

Assumptions

We have based our calculations on the assumption that improved energy management practices will result in reducing overall electricity consumption by 0.4%.

It is expected that savings related to gas will total 1.6%.

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

Effective energy management is an ongoing process as people are prone to slip back into bad habits. Continuous monitoring of performance and refreshing of messages will be required.

Appendix 1.3: Metering, Monitoring, and Targeting (MM&T)

			Estimated annual savings					
Opportunity	**Description**	**Fuel Type**	**Estimated cost savings (£)**	**Estimated CO2e savings (tonnes)**	**Estimated consumption savings (kWh)**	**Estimated cost (£)**	**Payback period (years)**	**Implementation date**
8	Whole Site - Metering, Monitoring & Targeting (Grid Electricity)	Grid Electricity	£1,223	0.52	5,397	£1,976	1.6	May-26

Table 13 - MM&T opportunities

The purpose of metering, monitoring, and targeting (MM&T) is to:

- Enable an understanding of your energy consumption data.
- Identify underlying factors which impact upon consumption.
- And set appropriate targets that allow you to review performance.

In order to quantify performance, there must be an effective and efficient way of gathering and analysing consumption data at the leisure centre.

MM&T is the use of site consumption information (derived from metering systems) for monitoring of plant and building performance and the setting of targets for improvement. MM&T will identify trends in consumption, possibly indicating problems or maintenance requirements such as high electrical baseloads. Thus, enabling the maintenance staff to investigate and be proactive to minimise energy wastage.

Successful implementation of a metering system will also assist the centre in measuring the success of any energy conservation initiatives proposed within the report. Successful implementation of MM&T should lead to identifying opportunities such as:

- Examining energy demand during out-of-hours (i.e., baseload analysis)
- Statistical analysis of data to understand the relationships between energy demand and drivers, such as weather.
- Implementing automatic exception reporting to flag when energy use falls outside expected norms.

This opportunity recommends AMR logging equipment is installed on all existing main and sub-meters complete with energy management software.

Assumptions

It is estimated that the implementation of MM&T could save approximately 3% electricity consumption.

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

- Staff resource (or external resource) will be needed to analyse metering data and implement Monitoring and Targeting. Without resource to look at the data, there is limited value in metering.

Appendix 1.4: Lighting

			Estimated annual savings					
Opportunity	**Description**	**Fuel Type**	**Estimated cost savings (£)**	**Estimated CO2e savings (tonnes)**	**Estimated consumption savings (kWh)**	**Estimated cost (£)**	**Payback period (years)**	**Implementation date**
9	Changing rooms / Lobby - Replace existing fluorescent lighting with new LED fittings	Grid Electricity	£1,329	0.76	5,863	£5,255	4.0	Nov-25
10	Extension - Replace existing fluorescent lighting with new LED fittings	Grid Electricity	£1,578	0.90	6,965	£11,104	7.0	Nov-25

Table 14 - Lighting opportunities

Figure 11: Lights to be replaced with LED equivalents

It is recommended that the school consider a full roll out of LED fittings across the site, not only to realise the energy savings and load reduction benefits associated, but also to attain a significant ongoing saving through reduced maintenance (typically LED fittings have an extended life expectancy of up to 50,000 hours). Completing the installation of LED lighting will also improve the aesthetics of the lighting on site.

The lighting spreadsheet included with Appendix 9 gives an appropriate breakdown of the existing lighting with its proposed LED replacement.

This is based on available access at the time of survey and provides a useful estimate of the scope and opportunity across the site. It is typical that additional fittings will be found during detailed implementation of this recommendation (up to 10% additional).

Assumptions

The lighting period used in calculations is assumed to be 2,000 hours per year for internal lighting.

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

- Establish and implement appropriate health and safety protocols prior to installation, especially relating to working at heights and review the asbestos register prior to commencing work on site.

Appendix 1.5: Thermal Upgrades

			Estimated annual savings					
Opportunity	**Description**	**Fuel Type**	**Estimated cost savings (£)**	**Estimated CO2e savings (tonnes)**	**Estimated consumption savings (kWh)**	**Estimated cost (£)**	**Payback period (years)**	**Implementation date**
4	Changing rooms / Lobby - Install 150 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 150 mm)	Natural Gas	£82	0.35	1,911	£255	3.1	Jul-25
5	Changing rooms / Lobby - Install 50 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 50 mm)	Natural Gas	£295	1.25	6,824	£1,168	4.0	Jul-25
6	Changing rooms / Lobby - Install 40 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 40 mm)	Natural Gas	£168	0.71	3,894	£827	4.9	Jul-25
7	Changing rooms / Lobby - Install 25 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 25 mm)	Natural Gas	£88	0.37	2,047	£157	1.8	Jul-25

Table 15 - Thermal upgrade opportunities

Figure 12: Pipe and valve insulation to be installed

In general, heating pipes in the plant room are reasonably well insulated, however, there are a number of exposed heating pipe valves across the plant room which would benefit from insulation to minimise heat loss. Valve jackets can be purchased that can be fitted by site maintenance staff to avoid additional installation costs.

Assumptions

Savings assume heating operates for 2,079 hrs per year and that hot water operates for 4,550 hrs per year.

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

- Ensure valve jackets are replaced following any maintenance procedures.

Appendix 1.6: Renewables

			Estimated annual savings					
Opportunity	**Project Description**	**Fuel Type**	**Estimated cost savings (£)**	**Estimated CO2e savings (tonnes)**	**Estimated consumption savings (kWh)**	**Estimated cost (£)**	**Payback period (years)**	**Implementation date**
11	Extention - Install 19 kWp Solar PV System	Grid Electricity	£3,025	0.96	13,350	£39,900	13.2	Aug-27
12	Extention - Install 32 kWp Solar PV System	Grid Electricity	£5,095	1.62	22,484	£48,000	9.4	Aug-27

Table 16 - Renewable energy opportunities

Solar Photovoltaics (PV) is an active solar technology which produces electricity from solar radiation using solar cells encapsulated in panels called PV modules. There are no moving parts and minimal maintenance. Installing a solar PV system to generate electricity would reduce the grid consumption, energy costs and carbon emissions. Additionally, renewable energy technologies can provide resilience to economic changes in the form of fluctuating energy prices and improved energy supply security using decentralised generation.

Marl Pits Leisure Centre already benefits from a solar PV installation located on the roof of the pool hall. Regarding the proposed heat decarbonisation scheme, further solar PV will benefit the installation of electric heat pump technology, by reducing the impact of the additional electricity consumption on the grid electricity requirements.

If energy saving measures are implemented within the building (for example improved housekeeping which leads to a reduction in the unoccupied baseload, or the implementation of energy efficient technologies such as LED lighting) then the amount of generated electricity that would need to be exported could increase, thus lengthening the payback period of the project.

Figure 13: Solar PV opportunity

Total System Performance

It is estimated the proposed system could generate a total of circa 35,834 kWh of electricity in the first year, which is equivalent to 20% of the sites current annual electricity consumption.

Assumptions

The energy savings and financial calculations assume that all the solar generated electricity will be used on site i.e., with no exporting of generated electricity

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

- Whilst planning permission may not be required, permission from the DNO will be needed to connect the system to the grid
- Installation of the solar PV system will involve a degree of disruption, though this will largely be constrained to the exterior of the building
- A structural survey will need to be carried out across the site to see which roofs are most suitable to house the PV system.

Appendix 2: Utilities on site

Location	Utility	MPAN/MPRN	MSN	Area Served	ASC (kVA)	Max Demand
Outside plant room	Natural Gas	9306157002	M160K0164511D7	Pool hall, Changing rooms / Lobby	0	0
Outside plant room	Grid Electricity	1.6E+12	E10BG07275	Pool hall, Changing rooms / Lobby, Extention	0	0
Plant room 1	Solar PV	*16062378*	LM3AABNBNH-C	Changing rooms / Lobby, Extention, Pool Hall		

Table 17 - Utilities summary

Appendix 3: Complete List of Opportunities

Measure	Project Description	Current Energy Use (kWh)	Current Energy Type	Forecast Energy Use (kWh)	Forecast Energy Type	Annual Energy Saving (kWh)	Saving (%)	Estimated Project Cost (£)	Estimated Financial Saving (£)	Simple Payback (Years)	Implementation Date	Average Annual Carbon
1	Main Building - Reduce setpoint by 0.5 oC (Main plant room - Hamworthy boiler)	116,335	Burning Oil	112,690	Burning Oil	3,645	3.1%	0	266	0.0	May-25	0.9
1	Changing rooms / Lobby - Reduce setpoint by 1 oC (1 - ACV boiler)	1,220,254	Natural Gas	1,206,998	Natural Gas	13,256	1.1%	0	572	0	May-25	2.4
2	Changing rooms / Lobby - House Keeping (Natural Gas)	1,206,998	Natural Gas	1,187,526	Natural Gas	19,472	1.6%	3,839	841	5	May-25	3.6
3	Extension - House Keeping (Grid Electricity)	179,898	Grid Electricity	179,259	Grid Electricity	639	0.4%	661	145	5	May-25	0.1

4	Changing rooms / Lobby - Install 150 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 150 mm)	1,187,526	Natural Gas	1,185,616	Natural Gas	1,911	0.2%	255	82	3	Jul-25	0.3
5	Changing rooms / Lobby - Install 50 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 50 mm)	1,185,616	Natural Gas	1,178,792	Natural Gas	6,824	0.6%	1,168	295	4	Jul-25	1.2
6	Changing rooms / Lobby - Install 40 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 40 mm)	1,178,792	Natural Gas	1,174,898	Natural Gas	3,894	0.3%	827	168	5	Jul-25	0.7
7	Changing rooms / Lobby - Install 25 mm pipe, valve & flange insulation (Heat Master boiler - Space Heating 25 mm)	1,174,898	Natural Gas	1,172,850	Natural Gas	2,047	0.2%	157	88	2	Jul-25	0.4
8	Whole Site - Metering, Monitoring & Targeting (Grid Electricity)	179,259	Grid Electricity	173,862	Grid Electricity	5,397	3.0%	1,976	1,223	2	May-26	0.5
9	Changing rooms / Lobby - Replace existing fluorescent lighting with new LED fittings	173,862	Grid Electricity	167,999	Grid Electricity	5,863	3.4%	5,255	1,329	4	Nov-25	0.8

10	Extension - Replace existing fluorescent lighting with new LED fittings	167,999	Grid Electricity	161,034	Grid Electricity	6,965	4.1%	11,104	1,578	7	Nov-25	0.9
11	Extension - Install 19 kWp Solar PV System	13,350	Grid Electricity	13,350	Solar PV	13,350	100.0%	39,900	3,025	13	Aug-27	1.0
12	Extension - Install 32 kWp Solar PV System	22,484	Grid Electricity	22,484	Solar PV	22,484	100.0%	48,000	5,095	9	Aug-27	1.6
13	1 - Install Air Source Heat Pump (air to water)	147,315	Natural Gas	48,088	Grid Electricity	99,227	67.4%	273,659	-4,538	-	Aug-27	23.5
14	2 - Install Air Source Heat Pump (air to air)	733,457	Natural Gas	235,754	Grid Electricity	497,703	67.9%	785,500	-21,761	-	Aug-26	111.6
15	1 - Install Direct electrical cylinder	97,359	Natural Gas	77,888	Grid Electricity	19,472	20.0%	51,840	-13,447	-	Aug-27	12.2

16	Swimming pool - Install Air Source Heat Pump (air to water)	194,719	Natural Gas	48,680	Grid Electricity	146,039	75.0%	470,506	-2,625	-	Aug-31	33.6
Total		9,063,786		8,235,078		864,542		1,694,647	-27,929			194.4

Table 18 - Complete table of opportunities

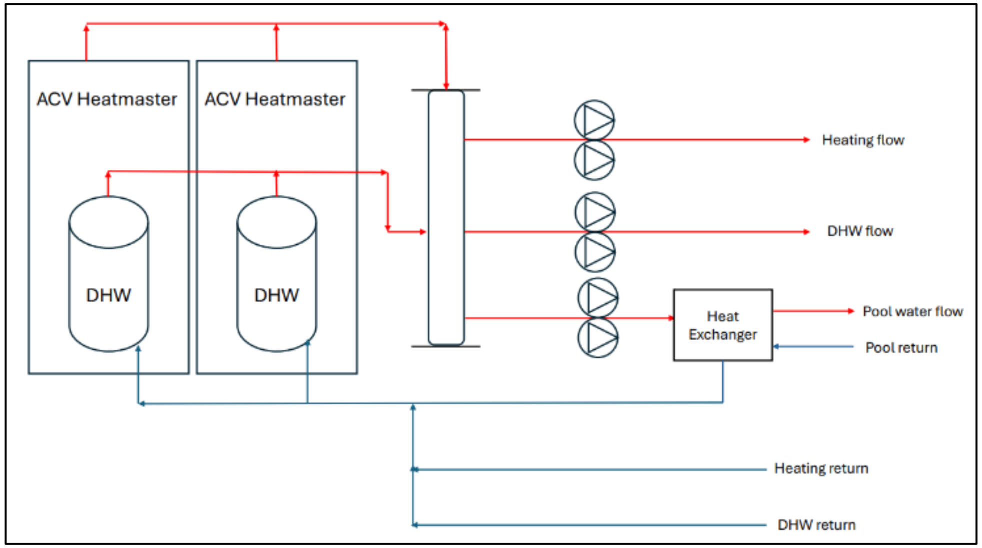
Appendix 4: Options Appraisal

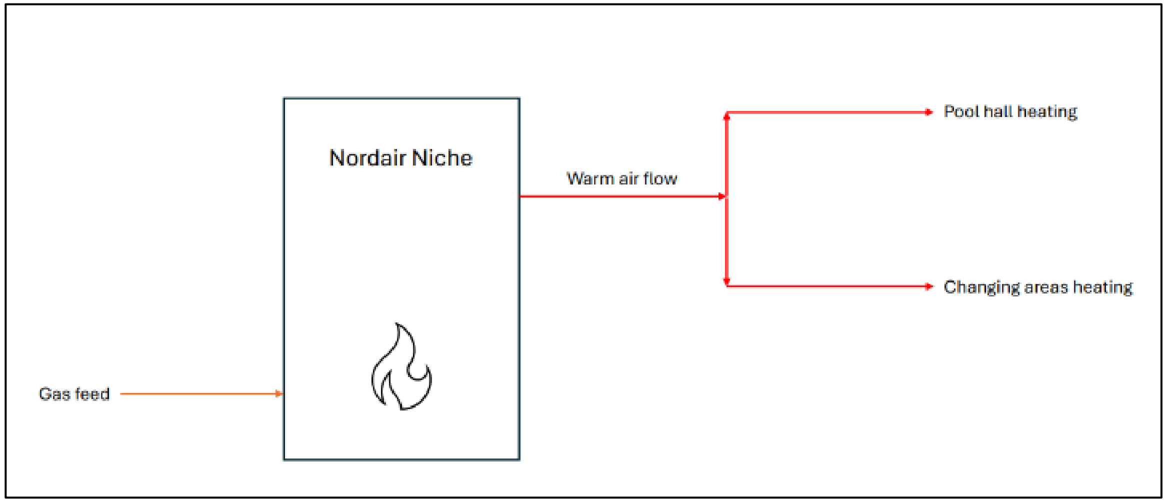
	Technology	Characteristics	Detail	Ease of Installation	Cost Effectiveness	Reliability	Maintenance Requirements	Carbon Impact	Electrical Upgrade Required	Overall Feasibility
Low Carbon Heat	**Ground Source Heat Pumps**	Takes up heat from ground and releases it at higher temperatures. Heat can be used for space heating and domestic hot water	It is our considered recommendation that a ground source heat pump should not be installed in this particular scenario. Several key factors have led to this conclusion. The upfront installation costs are significantly higher compared to alternative heating systems, making it economically less viable.	1	1	3	2	3	Yes	2
	Air Source Heat Pumps	Takes up heat from ambient air and releases it at higher temperatures. Heat can be used for space heating and domestic hot water.	ASHPs offer higher energy efficiencies compared to alternatives (biomass, electric boilers etc), resulting in lower carbon emissions, and reduced operating costs compared to conventional heating methods. Their versatility and adaptability make them a technologically sound choice for this sites application. The current heating system can be adapted to make an ASHP a viable option.	**2**	**2**	**3**	**2**	**3**	**Yes**	**3**
	Water Source Heat Pumps	Water Source Heat Pump (WSHP) works in a similar way to a GSHP except instead of using the ground for the heating source, they use water from a lake, stream, river etc	As there is not a viable water source present at the site it is therefore not a viable opportunity for this site.	1	1	2	1	3	Yes	1
	Biomass	Used plant-derived organic material (relatively carbon neutral). Can produce heat or biogas depending on the type of technology	Biomass relies on wood pellets or agricultural residues for fuel, which lead to significant logistical challenges in terms of sourcing, transportation, and storage. Biomass systems require substantial space for fuel storage and emissions control equipment. Additionally, the efficiency of biomass systems is significantly less than heat pumps, potentially resulting in higher operational costs and as well increased carbon emissions.	1	1	1	1	2	No	1
	Electric Boiler	Electricity is fed to the boiler from the mains electricity supply to the heating element within the boiler	Electric boilers are most beneficial when replacing small/domestic sized boilers due to their simplicity and reliability. However, for larger heating systems they are less suitable due to the size of electrical demand required and reduced efficiency compared to heat pumps.	3	1	3	2	1	Yes	2
	Local Electric Heating	Heat source is 100% efficient (not effective as heat pumps), however is extremely flexible in terms of locating emitters and cables are far easier to conceal than pipework.	Similar to an electric boiler, local electric heating is only suitable on a small scale. However, for larger heating systems they are less suitable due to the size of electrical demand required and reduced efficiency compared to heat pumps.	3	1	2	2	1	Yes	1
	Gas Boiler	Gas is fed to the boiler from a mains gas supply to a traditional boiler system	Gas boilers have not been considered as they are not a decarbonising approach. The electricity carbon emission factor is gradually reducing due to the increase in renewables being implemented into the grid; compared to natural gas, where there is currently no expected reduction in the carbon factor, thus gas boilers are not a decarbonising approach.	3	3	3	3	1	No	1
	District Heat Network	A district heat network supplies heat from a central source to consumers, via a network of underground pipes carrying hot water. Heat networks can cover a large area or even an entire city, or be fairly local supplying a small cluster of buildings.	There are no current or planned DHN in the area of the leisure centre. If there were, the main barrier to using a district heating network is the cost to lay the pipework for connection. Based on industry quotes an average price to connect to a heat network is in the region of £1,000/m. This cost includes all design, project management, materials and civil engineering costs that are typical with connecting to district heat network. The cost of connecting to a district heat network foften far outweighs the cost of installing an air source heat pump system at each site.	1	1	3	3	2	No	1

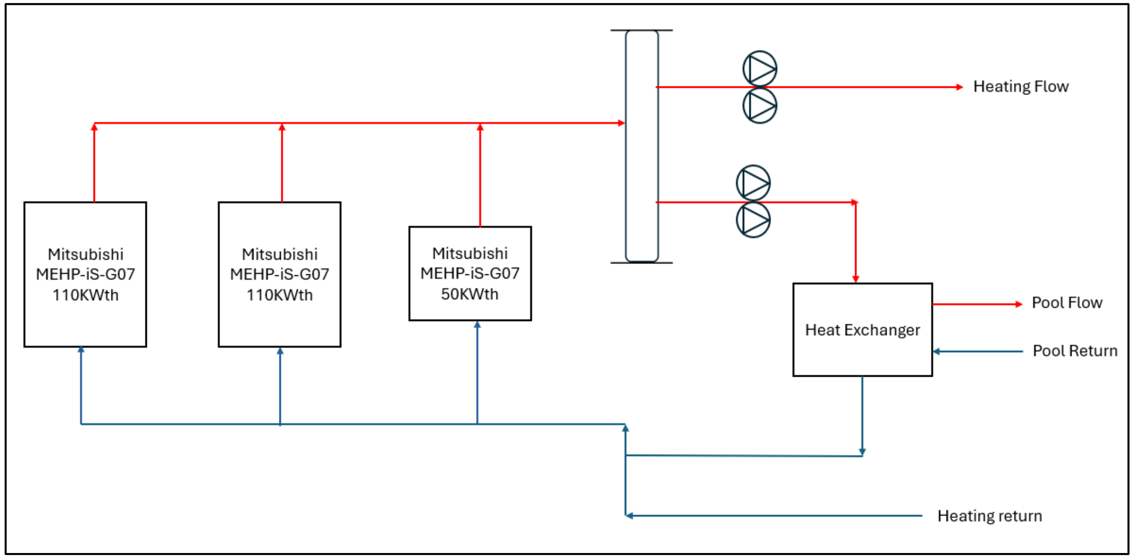
	Technology	Characteristics	Detail	Ease of Installation	Cost Effectiveness	Reliability	Maintenance Requirements	Carbon Impact	Overall Feasibility	Final Comments
Fabric Improvements	**Cavity Wall Insulation**	Cavity wall insulation is the process of filling the cavity between the two layers of a wall in a building. Insulating this gap helps to improve the thermal efficiency of the building by reducing heat loss, thus making the building warmer and more energy-efficient.	The pool hall has external cladding in place already and the extension was constructed to 2010 Building Regs and is therefore already insulated. The changing area and lobby has a very limited area of exposed wall being mostly surrounded by the pool hall, extension and plant room.	2	3	3	3	3	No opportunities	No viable and cost effective option on this site, the small potential option available would result in a long payback due to the cost involved vs the very small thermal improvement
	External Insulated Cladding	External wall insulation is the process of applying an insulating layer to the exterior of an existing building. Insulating helps to improve the thermal efficiency of the building by reducing heat loss, thus making the building warmer and more energy-efficient. External insulation is applied to the outer walls of a building, effectively "cladding" it with a layer of insulation material and allowing for a final finish to be applied to protect the insulation and improve the facade of the building.	The pool hall has external cladding in place already and the extension was constructed to 2010 Building Regs and is therefore already insulated. The changing area and lobby has a very limited area of exposed wall being mostly surrounded by the pool hall,	2	2	3	2	3	No opportunities	No viable and cost effective option on this site.
	Internal Wall Insulation	Internal wall insulation is a method used to improve the thermal performance of a building by adding insulation materials to the inside of the walls. This is typically applied to buildings with solid walls (those without cavities) or where external wall insulation is not possible due to aesthetic, practical, or planning restrictions.	Generally only applied where there is no cavity or external insulation options. Very disruptive to the running of the centre and there is already a good level of insulation installed.	1	2	2	3	2	No opportunities	No viable and cost effective option on this site.
	Double Glazing	Double glazing refers to the use of two panes of glass in a window, with a layer of air (or gas) trapped between them. This construction is designed to improve the thermal and acoustic insulation of a window. The gap between the two glass panes acts as a buffer, reducing the transfer of heat and sound between the inside and outside of the building.	All glazing on site is already double-glazed. Replacing with new DG is not a viable project due to the significant payback from a large capital outlay for a small improvement to the thermal efficiency.	1	2	2	2	2	No opportunities	No viable and cost effective option on this site.
	Triple Glazing	Triple glazing refers to the use of three panes of glass in the window. The additional pane and extra insulating gas or air layer trap more heat, reducing the amount of heat that escapes from a building. This makes triple glazing ideal for colder climates or homes that require very high energy efficiency.	Whilst triple glazing offers superior performance in terms of insulation, noise reduction, and condensation control, it comes with a higher upfront cost, longer payback period, and may not always provide a significant improvement over double glazing to warrant the additional cost.	1	1	2	2	3	No opportunities	The additional cost versus the thermal improvements are not financially viable.
	Roof Insulation	Roof insulation refers to the addition of insulating material to a roof, pitched or flat; a loft area or a suspended ceiling.	All roofs are believed to be up to recent building regs and therefore there are no opportunities to insulate.	Varies	3	3	2	3	No opportunities	No viable and cost effective option on this site.

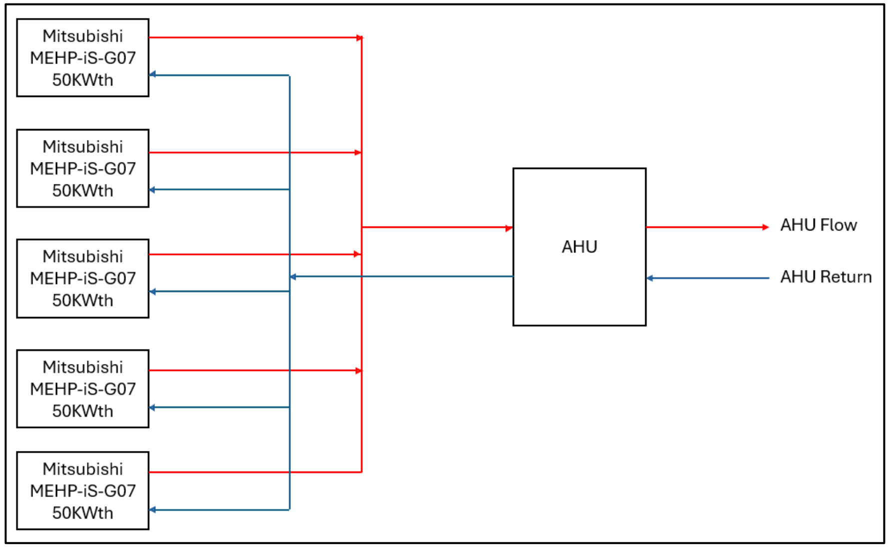
	Technology	Characteristics	Detail	Ease of Installation	Cost Effectiveness	Reliability	Maintenance Requirements	Carbon Impact	Overall Feasibility
Renewable Energy Generation	**Roof-mounted Solar PV**	Solar Panels convert sunlight into electricity. As they produce direct current (DC) electricity, they use inverters to convert the DC electricity into usable AC electricity. They are mounted on the roof at an optimal angle to capture sunlight throughout the day, the most efficient orientation is towards the South but they can be mounted on any roof facing direction. On a flat roof the panels are angled to optimize the sunlight exposure.	Determined feasible on the south-east & south-west facing roof of the extension building. This is subject to a structural survey of the roof structure and appropriate design & modelling.	2	**2**	**2**	**1**	**2**	**2**
	Ground-mounted Solar PV	Ground mounted arrays generate electricity in exactly the same way as roof-mounted but are placed on the ground. Mountings can fixed, tracking (they move with the sun) or frame mounted.		3	2	2	2	2	3
	Natural Gas CHP	Combined Heat & Power (CHP) generates both heat & electricity. Essentially a power generation unit it then captures the process heat which can be distributed into a heating system via a heat exchanger.	Not an option for decarbonisation, natural gas CHP will eventually be phased out - see Biomass for alternatives.					1	1
	Wind Turbine (Small Scale)	Wind turbines convert the kinetic energy of wind into mechanical energy, which can then be used to generate electricity. Can be both horizontal or vertical axis.	Not determined as feasible due to cost, space and planning requirements. Although could be revisted in the future, once roof mounted solar has been maximised.	1	2	2	1	3	1
	Biomass CHP	Works the same as a natural gas CHP however the fuel is Biomass. Biomass is any organic material used as a fuel, this can include wood pellets, crop materials, animal waste etc.	Deemed renewable however relies on a delivered fuel and storage space is required. Not seen as feasible when other technologies will generate electricity and ASHP have been chosen in terms of heat generation.	2	2	1	1	2	1
	Hydrogen CHP	Works the same as other CHP however is fuelled by hydrogen. Hydrogen comes in many 'colours' determining the carbon that has been emitted during it's generation, the most common are: Grey and black/brown hydrogen made from natural gas through steam methane reforming Blue hydrogen as above but with carbon capture Green hydrogen is made via the electrolysis of water using renewable electricity	Low/zero carbon hydrogen is still expensive and would have to be delivered. This is a fuel for the future that could be re-assessed in the years to come.	1	1	1	1	Varies based on Hydrogen generation method	1

Appendix 5: Current and Proposed Heating Schematics






Heating Flow
Mitsubishi MEHP-iS-G07 110KWth
Mitsubishi MEHP-iS-G07 110KWth
Mitsubishi MEHP-iS-G07 50KWth
Heat Exchanger
Pool Flow
Pool Return
Heating return


Mitsubishi MEHP-iS-G07 50KWth
Mitsubishi MEHP-iS-G07 50KWth
Mitsubishi MEHP-iS-G07 50KWth
Mitsubishi MEHP-iS-G07 50KWth
Mitsubishi MEHP-iS-G07 50KWth
AHU
AHU Flow
AHU Return

Appendix 6: Risk Register

						Inherent risk (without controls)				Residual risk rating (with controls)		
Risk ID	**Risk category**	**Date raised**	**Risk description** (A clear and concise statement describing the risk revent or situation.)	**Risk owner**	**Caused by and consequences**	**Likelihood** (The likelihood or chance that the risk event will occur)	**Impact** (The potential effect of the risk event if it were to occur)	**Risk rating**	**Control(s)** (The actions or measures put in place to mitigate or reduce the likelihood or impact of the risk)	**Residual likelihood** (The probability of the risk event occuring after control measures have been implemented)	**Residual impact** (The impact of the risk event after control measures have been implemented)	**Residual risk rating**
1	Permissions/approvals	Nov-24	There is a risk that a delay occurs in achieving the required Board approval for the project to proceed	Client	Should approval arise outside of the Finance & Resource committee meeting calendar - this could result in a delay to project approval	Moderate	Low	Moderate	The finance & Resource committee are aware of the timescales involved and the estimated dates that a successful grant offer could be made - meetings are frequent but an out of calendar meeting can be convened if needed	Low	Low	Low
2	Schedule	Nov-24	There is risk that programme could be delayed due to a number of reasons (mostly those already managed in other risks)	Client & Consultant	This could be caused by a number of reasons such as delays to approval, tendering, planning, DNO upgrades etc	Low	Moderate	Low	By building contingency into the programme and by managing all the other risks within the project.	Low	Low	Low
3	Cost	Nov-24	There is a risk that prices increase due to the lapse of time	Client & Consultant	Prices are from the HDPs generated in 2024 and therefore are impacted by inflation & demand - significant cost increases can result in project scope reduction or cancellation	Moderate	High	High	HDP costs have already been updated inline with latest costs, by our consultant. Contingency has been included in the overall project cost and a small funding pot is available to to apply to should this be required.	Low	Low	Low
4	Achieving Savings	Nov-24	There is a risk that savings (cost & carbon) are not achieved during the lifetime of the project	Client & Consultant	Electricity cost increases; inefficient running on the low carbon heating system - resulting in increased operational costs	Moderate	Moderate	Moderate	Other energy efficient works are included such as LED lighting & Solar PV which will reduce running costs elsewhere; solar PV will give a certain % of protection from price rises; proper system commissioning will take place; school support staff will be trained in correct use/management of the new systems	Low	Moderate	Low
5	Feasibility	Nov-24	There is a risk that detailed technical site surveys identify a technical issue with the proposed project	Client & Consultant	Unknown technical issues not identified at HDP stage	Low	Moderate	Low	The HDP's were completed by our consultant who have significant experience in the area of school decarbonisation and thorough surveys were completed at the time	Low	Moderate	Low
6	Resource	Nov-24	There is a risk of a lack of resource (internal & external) to support the project	Client, Consultant & Contractor	Tendering a contractor without the resource available & loss of internal staff to support the project	Low	Moderate	Low	The tendering process will ensure that an adequately resources contractor is appointed and that references are taken where required; the internal project team will include various staff across the Trust and ensure that adequate support is available even in the event of staff vacancies etc.	Low	Low	Low
7	Supply Chain	Nov-24	There is a risk that supply chain issues such as delviery times & cost increases arise	Client & Contractor	Cost increases within the supply chain due to demand for equipment and raw material costs; delivery times are extended due to demand	Moderate	Moderate	Moderate	Cost increases will be managed via contingency & the programme will be built to support a 16-20 week delivery period (along with additional time contingency)	Low	Low	Low
8	Electrical Supply	Nov-24	That DNO costs or delays result in a programme delay or overspend	Client	DNO costs are currently unknown as are lead times. This could mean that the programme is squeezed or that the final cost is too high.	Moderate	High	High	We will engage with the DNO as soon as possible to understand the capacity available and the estimated cost impact.	Moderate	Moderate	Moderate
9	Other	Nov-24	There is a risk that unknown asbestos is identified during the project resulting in a delay/cost increase	Client	Finding asbestos not already logged within the asbestos register and remidial costs being inhibitive - this only applies to Thomas Hinderwell	Low	High	High	It is not possible to control the identification of unknown asbestos however there is significant planning built into the programme and funding available for remediation of asbestos should it require removing. There is confidence in existing asbestos survey/register information.	High	Low	Moderate
10	Other	Nov-24	There is a risk that planning is required and/or rejected/results in delays	Client & Consultant	Due to the installation of a heat pump & solar PV a full planning application may be required - this could result in delays but is unlikely to be rejected.	Moderate	Moderate	Moderate	During the mobilisation phase the option can be taken, with North East Lincs Council, to use their Non-Domestic planning support services offering confirmation on whether planning is required and make use of pre-application advice	Low	Moderate	Low

Risk Rating	**Action**
Low	Proceed with manageable risk. No further governance required.
Moderate	Proceed with risk but residual risk should be noted through standard governance channels.
High	Consider alternative methods or additional supplemental measures. If you wish to proceed then decision should be taken to RM during a Delivery Call. Even where additional supplemental measures would not reduce the risk score, it can still be helpful to show pragmatic steps taken to manage the risk

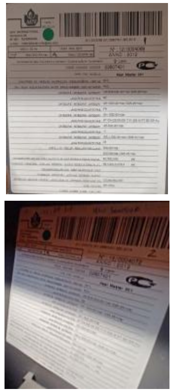
Appendix 7: Project Programme

Draft programme based on May 2025 start. Consultant/contractor appointment will enable a project specific programme to be built.

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26	Oct-26	Nov-26	Dec-26	Jan-27	Feb-27	Mar-27
Project Approved/Signed Off	■																						
Contractor Shortlist Defined		■																					
Contractor Appointed		■																					
Site Surveys		■																					
Detailed Designs		■	■	■	■	■																	
Electricity Capacity Calculations				■																			
DNO Application & Works				■	▨	▨	▨	▨	▨	▨	▨	▨											
Planning application				■	▨	▨	▨																
Out to Tender							■	■															
Tenders Complete									■														
Mobilisation										■	■												
Orders Placed												■											
Construction Phase												■	■	■	■	▨	▨						
Low Cost/No Cost Measures Implemented	■	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨										
Fabric Measures Implemented												■	■	■	▨	▨							
Electricity Reduction Measures (Solar PV, LED, etc) Implemented												■	■	■	▨	▨							
Removal of existing plant													■	■	■								
Installation of New Plant														■	■	■							
Heat distribution System flushing, insulation, commissioning, BMS works, testing															■	■	■						
Completed on Site																	■	■					
Final Commissioning																	■	■					
Practical Completion																			■	■	▨		

Appendix 8: End of Life Boiler Evidence

Location	Make	Model	Serial Number	Manufacturing Year	Anticipated replacement date	Method of Age ID	Quantity	Total Output Rating (kW)	Recommended total heat pump size (kWe)	Emitters + Pipework
Plant room 1	ACV	Heat Master 201	12/0004069 12/0004072	2012	Aug-27	Name plate	2	436	365(kWth) / 130(kWe)	Double steel panel radiators / twin pipe system

Boiler Photos	Name Plate	Existing Boiler Plant	Proposed Low Carbon Heating Replacement
		Situated in plant room 1. Each emitter/radiator is supplied with low-temperature hot water (LTHW) generated by two ACV Heat Master 201 gas-fired, condensing boilers (218 kW each), installed around 2012. The boilers are managed by a Trend IQE View 4 controller. The boilers also have an intergrated domestic hot water cylinder each with a 400l storage capacity tank. The ACV boilers state the year of manufacture on the rating plate.	We recommend replacing boilers with electric low-temperature air source heat pump (ASHP) air -to-water systems. These systems will have a combined rating of 130 kWe. An example of an appropriate solution for this includes the Mitsubishi MEHP-iS-G07 heat pump system. This is a versatile and efficient solution for various thermal load requirements. Range and Capacity: Single module thermal loads of 50KW & 110KW and can cascade from 110KW to 880KW when operating in a group. Temperature Range: Operates with a flow range of 25°C to 65°C. Refrigerant: Uses R32 refrigerant, which is more environmentally friendly. Efficiency: The seasonal coefficient of performance (SCOP) ranges from 3.2 to 3.4

Location	Make	Model	Serial Number	Manufacturing Year	Anticipated replacement date	Method of Age ID	Quantity	Total Output Rating (kW)	Recommended total heat pump size (kWe)	Emitters + Pipework
Outside compound	Nordair Niche	DF11VAV650	10946 / 1	2011	Jul-05	Email to Manufacturer	1	595	247(kWth) / 88(kWe)	Ductwork with extract grilles

Boiler Photos	Name Plate	Existing Boiler Plant	Proposed Low Carbon Heating Replacement
	 NORDAIR NICHE COMBINED HEATING AND VENTILATION COUNTRY AT, CH, CZ, DK, EE, ES, FI, GB, GR, HR, IE, IT, LT, LV, NO, PT, RO, SE, SI, SK, TR SERIAL No. 10946 / 1 MODEL No. DF11VAV650 H EX WEATHER PROTECTION IP 54 GAS TYPE Natural Gas (G20) CATEGORY I_{2H} FLUE TYPE A2 MAXIMUM HEAT INPUT GROSS 650.44 kW MAXIMUM HEAT OUTPUT NET 594.09 kW DESIGN HEAT OUTPUT NET 594.09 kW MINIMUM HEAT OUTPUT NET 29.70 kW PILOT HEAT INPUT GROSS 9.00 kW MAXIMUM GAS RATE 63.41m³/hr MINIMUM GAS SUPPLY PRESSURE 17 mbar MAXIMUM GAS SUPPLY PRESSURE 100 mbar START GAS PRESSURE 5.0 mbar MAIN GAS PRESSURE DIFFERENTIAL 11.7 mbar AIR FLOW RATE 11.00m³/sec EXTERNAL RESISTANCE 250 Pa AIR TEMPERATURE RISE 45 °C SUPPLY VOLTAGE 415 V 50 Hz No. OF WIRES 4 No. OF PHASE 3 POWER CONSUMPTION 11.0 kW MPCB RATING 415 V 32 AMP 240 V 4 AMP 24 V 2 AMP PIN 87BT41 This appliance is for outdoor installation only and must be installed in accordance with the rules in force. Consult instructions before installation and use of appliance.	Situated outside of plant room 1. This Nordair Niche gas-fired Air handling unit (AHU) provides space heating for the pool hall and surrounding changing areas. It has a total output of 595 kW and is managed by a Trend IQE View 4 controller. The age of the unit was confirmed by contacting Nortek with the rating plate details including serial no. They confirmed the unit was delivered to site on 21/11/2011.	We recommend replacing the gas-fired AHU with electric air source heat pump (ASHP) air -to-water system. These systems will have a combined rating of 88 kWe. An example of an appropriate solution for this includes the Mitsubishi MEHP-iS-G07 heat pump system. This is a versatile and efficient solution for various thermal load requirements. **Range and Capacity:** Single module thermal loads of 50KW & 110KW and can cascade from 110KW to 880KW when operating in a group. **Temperature Range:** Operates with a flow range of 25°C to 65°C. **Refrigerant**: Uses R32 refrigerant, which is more environmentally friendly. **Efficiency:** The seasonal coefficient of performance (SCOP) ranges from 3.2 to 3.4