Classification: OFFICIAL

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Appendix 1

Derby City Council Building Energy Strategy 2023 – 2035

September 2022

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Approving Body	Corporate Leadership Team
Accountable Service Director	
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Derby City Council

Contents

1. Executive Summary

The Climate Change Act 2008 set in legislation the UK's approach to tackling and responding to climate change. It introduced the UK's long-term legally binding 2050 target to reduce greenhouse gas emissions by at least 80% relative to 1990 levels.

In June 2019, parliament passed legislation requiring the government to reduce the UK's net emissions of greenhouse gases by 100% relative to 1990 levels by 2050. Doing so would make the UK a 'net zero' emitter. The government has released a ten-point plan on how these targets will be achieved. Point 7 of the plan is aimed at Greener Buildings which is the focus of this strategy.

The new carbon budget, covering the period 2033-2037, sets targets for the UK reduce its greenhouse gas emissions by almost 80% by 2035 compared to 1990 levels; placing the UK as one of the most ambitious countries in the world in cleaning up its economy to tackle climate change. Emissions from electricity and gas account for over 50% of Derby City Councils carbon emissions.

In line with government objectives Derby City Council declared a climate emergency in 2019 and has set an ambitious target of reaching net zero by 2035. To be 'net zero' means to reduce greenhouse gas emissions and/or to ensure that any ongoing emissions are balanced by removals. The 'net' in net zero is important because it will be very difficult to reduce all emissions to zero in the timescale needed. The removals can be achieved through carbon offsetting.

The Energy Strategy action plan is working towards net zero. The Action plan is a working document. The Energy Strategy sets out the councils' strategic objectives which translates into the four strategic focus areas of approach:

- **Reduce Energy Consumption**; reduce energy demand, recover energy where possible and ensure it is used in a non-wasteful manner.
- **Improve Energy Efficiency**; consider energy efficiency at all asset levels, invest in energy saving technologies.
- **Install Renewables**; buy renewable energy going forward and invest in renewable installations.
- **Carbon Off-setting**; the remaining carbon will be targeted by carbon offsetting.

This Strategy sets out how Derby City Council will move forward to achieve this target. The governments Heat & Buildings Strategy released in September 2021 sets out how the UK will achieve net zero. The report focuses on a whole building approach as well as heat decarbonisation.

The UK is set to make a transition from gas for heating and hot water to electrified heating, heat pumps and potentially hydrogen powered boilers. Derby City Councils Energy Consumption has reduced in the last 4 years by 22%. Covid has had an impact on this figure but year on year since 2017 there has been a reduction in carbon emissions per m^2. In total there has been a Carbon Dioxide Equivalent (CO_2e) reduction of 44%. This includes carbon dioxide and all other greenhouse gasses.

Key Actions – In line with Gov targets to: Replace gas boilers with heat pumps, Install solar panels to increase self-generation, purchase greener electricity from renewable source, consider carbon offsetting.

Replacing gas Boilers with heat pumps is faced with challenges. To get the best outcome from these energy saving modifications it is important to consider the envelope of a building and its insulation. This will have a huge impact on heating the building and ties in with the energy hierarchy. A further consideration is the load of the electricity supply to a building as installing a heat pump increases electricity consumption. Finding an experienced contractor is also a challenge as this is a relatively new technology. It is a technology that is continually improving.

Solar panels are a renewable energy option. This requires a feasibility study into the location of the building and the suitability of solar PV. Considering the direction of the roof, the strength of the roof and any trees etc that may shade the panels.

A contractor shortage is a further challenge to reaching net zero. There are not many contractors with adequate experience to install heat pumps. This is something the government is trying to improve with its ten-point plan.

Buying greener energy from energy suppliers is an option. This is something that Derby City Council will explore when the current energy contract expires.

The definition of carbon offsetting is the action or process of compensating for carbon dioxide emissions arising from industrial or other human activity, by participating in schemes designed to make equivalent reductions of carbon dioxide in the atmosphere. This option is a last resort once the other areas of the energy hierarchy have been exhausted.

2. Introduction

Climate Change is at the forefront of government decisions and as such is becoming a priority for business organisations. Government targets and changes in legislation are driving a climate change agenda.

The Government is implementing a range of policies at a national level designed to transition the UK to a low carbon economy. With fossil fuel reserves declining, the UK is increasingly looking to renewable and low carbon sources of energy. This is crucial to meet an ever-growing demand. As a result, energy costs and environmental taxes are rising, and security of supply is becoming increasingly vulnerable.

To ensure Environmental Sustainability the Government has led a low carbon agenda since the turn of the century. In the UK, successive Governments have introduced legislation designed to drive the transition from a carbon intensive energy regime towards a low carbon economy.

This includes the Climate Change Act 2008, the Energy Act 2011, and the Energy Bill 2012. More recently a net-zero Green House Gas (GHG) target for 2050 will deliver on the commitment that the UK made by signing the Paris Agreement. Around 70% of the world economy is now covered by net zero targets.

Government targets have become more ambitious and are now striving for net zero. Net zero means achieving a balance between the greenhouse gases that are put into the atmosphere and those that are taken out. The energy market needs to ensure a balance between energy security, managing energy equity and environmental sustainability. Reducing emissions has become more of a focus now the planet is facing rising temperatures and witnessing more extreme weather conditions

The UK is a leader in paving the way to a net zero economy. Over the last 30 years the UK governments have cut emissions by 44% whilst growing our economy by 78%. In 2012, 40% of our electricity came from coal. That figure is now less than 2%. [1]

The Net Zero Strategy Build Back Greener includes a specific section on Heat and Buildings. This will potentially help to fund parts of this strategy. [2]

All of these targets place additional public pressures on the council for responsible procurement. This includes energy and the pressure to procure or produce non-polluting low or no carbon energy. The reputation of the council is greatly affected by such decisions.

This strategy will set out how Derby City Council will work towards the net zero 2035 target. This Strategy document has been developed to target and focus on the energy consumption of the Council's corporate property portfolio and its resulting carbon emissions. The Council must manage the increasing risks of the energy market including energy security, pricing and sustainability.

3.Legal Requirements & Government Targets

The Council recognises that delivery of its services:

- consumes energy resources which has a financial impact on its budgets
- has a negative environmental impact from the emissions of Carbon Dioxide and other greenhouse gasses
- must manage the increasing risks and costs associated with fuel price inflation, security of fuel supplies and energy related legislation

The Council acknowledges that in line with the duties under the Local Government Act it seeks to secure continuous improvement with regards to the efficiency and effectiveness of its energy management strategy and structures.

There are several statutory requirements and legislation that the Council is required to adhere to, notably:

- The Energy Performance of Buildings Regulations (EU) requires that Display Energy Certificates (DEC) must be displayed in buildings accessed by the public and that Energy Performance Certificates (EPC) must be produced for buildings put up for sale, let or newly constructed.

- Building Regulations (The Building Act 1984) require that all new buildings and material alterations of existing buildings incorporate energy conservation features such that the building meets Target CO_2 Emissions Rate.

In June 2019, parliament passed legislation requiring the government to reduce the UK's net emissions of greenhouse gases by 100% relative to 1990 levels by 2050.[3] Doing so would make the UK a 'net zero' emitter. The sixth carbon budget covering 2033-2037 has been set in law to reduce greenhouse gas emissions by almost 80% by 2035 compared with 1990 levels. The government has released a ten-point plan on how these targets will be achieved. The points set out are as follows:[4]

1 - Advancing Offshore Wind

2 - Driving the Growth of Low Carbon Hydrogen

3 - Delivering New and Advanced Nuclear Power

4 - Accelerating the Shift to Zero Emission Vehicles

5 - Green Public Transport, Cycling and Walking

6 - Jet Zero and Green Ships

7 - Greener Buildings

8 - Investing in Carbon Capture, Usage and Storage

9 - Protecting Our Natural Environment

10- Green Finance and Innovation

The main point which relates directly to and influences Derby City Councils energy strategy is Point Seven. The Councils energy strategy will work towards targets set out in this report.

Point Seven – Greener Buildings

The Heat & Buildings Strategy outlines a transition that focuses on reducing bills and improving comfort through energy efficiency, whilst building the markets required to transition to low-carbon heat. [4] The government's strategy also focuses on a whole building approach and will consider the heating system in the context of what is most appropriate for the whole building. [5]

It also sets out that by 2032 Ensure that the public sector has reduced its direct emissions by 50% compared to a 2017 baseline.

4. Derby City Council Background

Derby City Council declared a climate emergency in 2019 and in 2021 set an ambitious target of reaching net zero by 2035. The Energy Strategy is in line with the Councils Plan, linking in with the key focus area Green City, protecting and enhancing our environment. This focus area sets out the target to reduce carbon emissions and to reach net zero.

The Energy Strategy covers Derby City Councils corporate estate which is comprised of 136 sites and accounts for over 54% of Derby City Councils overall carbon emissions. This report does not consider street lighting or traffic signals. Schools are also excluded in the first phase due to resources. Schools will be included once the resources become available.

Greenhouse gas emissions are categorised into three groups or 'Scopes'.

- Scope 1 covers direct emissions which are from owned or controlled sources.
- Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling.
- Scope 3 includes all other indirect emissions that occur because of a company's operations.

This report covers Scope 1 & 2 emissions only. This includes energy for lighting and powering equipment, as well as the fuel used to heat, cool, and provide hot water for each building. Any site that is leased out or managed by a third party falls into the scope 3 emissions category. Property and Consultancy Services will oversee and steer energy saving projects on scope 3 buildings that are run by a third party.

A focus on our buildings and workplaces will be key to our carbon reduction ambition which will in turn result in financial savings. Rising energy and carbon costs over the coming years will create significant, risks and opportunities in Derby.

4.2 Context

Derby City Council's corporate estate incorporates 255,164m² of floor space and provides a variety of services for staff and the community.

The carbon emissions from the property portfolio account for 54% of the council's overall carbon emissions. It is also important to note that 55% of emissions from the corporate sites come from the top 22 consuming sites. Data used is from 2019/20 pre pandemic to give a more accurate indication of usage. Each year data will be analysed to identify trends.

There is a wide mix of building types, age profiles and service installations, which present different opportunities for achieving emission reductions. This report will look at how these reductions can be achieved.

Despite the varying styles of building and the equipment installed, all of these buildings are all heavily reliant upon grid supplied electricity and piped natural gas to maintain day to day operations.

There are significant changes under way with the UK electricity grid. There is a significant shift in power production, with all coal fired power stations due to be decommissioned by 2025. They are being replaced by new clean energy capacity, in the form of wind and solar powered generation.

In Quarter 1 2021, renewables' share of generation in the UK was 41.6 per cent; this is the third highest and higher than fossil fuels' share for four quarters out of the five most recent.

By contrast the carbon intensity of piped gas supplies has remained relatively constant and is not expected to fall in the short term.

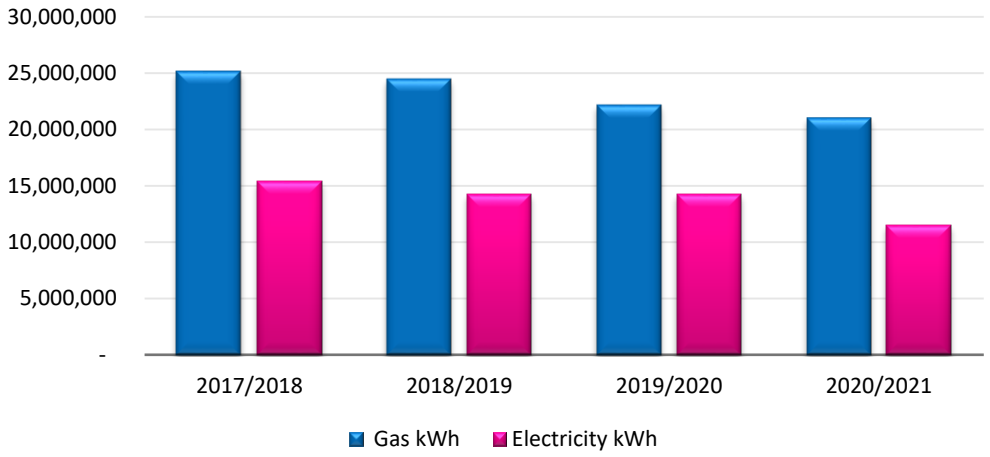
At national level, UK government have stated ambitions to move the UK economy to a Net Zero position by 2050 and are promoting and supporting a range of initiatives to achieve this. This included the electrification of heat and the decarbonising of the electricity supply.

4.3. Current Position

In the financial year 2019/20 Derby City Council used over 36 million kWh of energy over the corporate estate which consists of 136 sites, this excludes schools and street lighting and traffic signals. The 136 sites equate to a floor area of 255,164m². This costs over £3 million emitting over 8 thousand tonnes of CO_2. This equated to the corporate property assets consuming 143 kWh of energy per m^2 and 31Kg of CO_2e per m^2.

Figure 4.1

Energy Consumption for gas and electricity for the corporate estate between 2017 and 2021



Consumption year on year has decreased for gas and electricity. Much of this is likely due to Covid and the buildings being vacant in 20/21. A full energy profile needs to be conducted for each site to fully understand and manage its energy usage. Between the financial years 17/18 and 20/21 there has been a 22% decrease in consumption and 44% reduction in carbon emissions. There was a 29% reduction in electricity consumption and 18% reduction in gas consumption.

Energy profiling will provide data to be able to understand the energy usage of each site. As a post-Covid hybrid working system is established, more people will be working from DCC sites on a more regular basis.

Figure 4.2 reveals the actual gas usage alongside the predicted usage. The predicted usage is calculated considering the outside temperature. This means on a colder day it is expected that there will be an increase in consumption. The predicted usage is based on a baseline external temperature of 15.5ºC. The predicted gas usage is very similar to actual usage which demonstrates good energy efficiency overall.

Figure 4.2 – Weather Corrected Data from April 2019 to March 2020

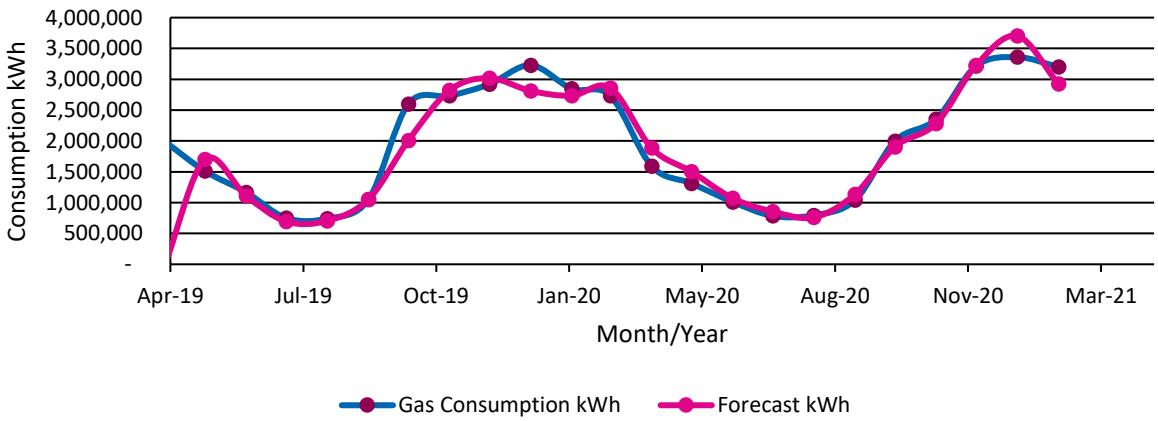
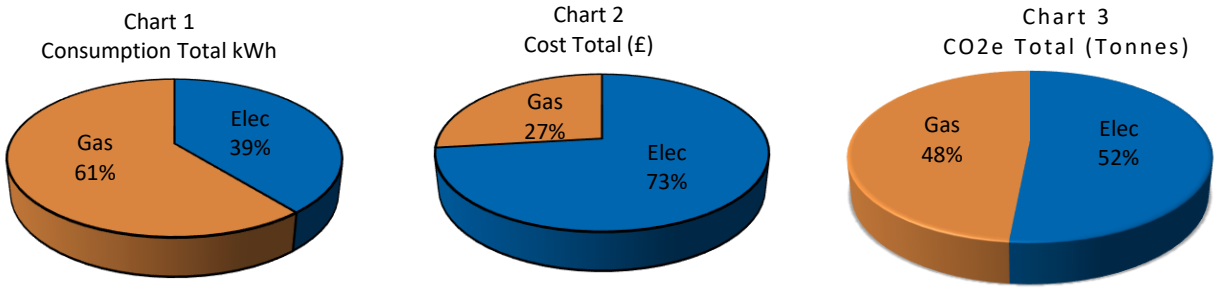


Table 4.1 - Proportions of Gas & Electricity Consumption & Emissions 2019/20

	Chart 1 Consumption Total kWh	Chart 2 Cost Total (£)	Chart 3 CO_2e Total (Tonnes)
Elec	14,231,021	2,207,510	4,322
Gas	22,161,050	811,130	4,067
Total	36,392,071	3,018,641	8,389

CO_2e Emissions factor Electricity 0.2773 Gas 0.18385 source: www.gov.uk, 2019



The proportions of gas and electricity consumption and emissions reveal that there is more carbon released from our electricity consumption than gas consumption per kWh. The conversion factor for electricity is predicted to reduce as more renewable power is generated for grid electricity.

Chart 3 shows that 48% of emissions come from gas consumption. This is used for hot water and heating across our corporate sites. **This will be one of the main areas of focus to reduce our carbon emissions. It is important to note that 55% of emissions come from the top 22 consuming sites.**

4.4. Achievements so far

- Constructed hydro-electric power station on the River Derwent providing 50% of the Council house electricity and exporting surplus onto the grid.
- There are 8 PV installations generating on average around 150kWh of energy overall. Financially this saved around £17,000 and 48 tonnes of CO2 in 2019/20.
- Installed external LED lighting at Moorways Sports Complex (Stadium track).
- Conducting feasibility study on Kedleston Road for a site wide air source heat pump system. This will be used to facilitate a holistic approach to energy reduction.
- Organised 22 energy audits to be conducted to determine energy saving measures to reduce carbon emissions and to make financial savings.
- Automatic Meter Readers (AMR) have been installed across 80% of the portfolio for gas and electricity meters.
- Improved the management of energy and gas consumption data

5. Base line data for top consuming sites

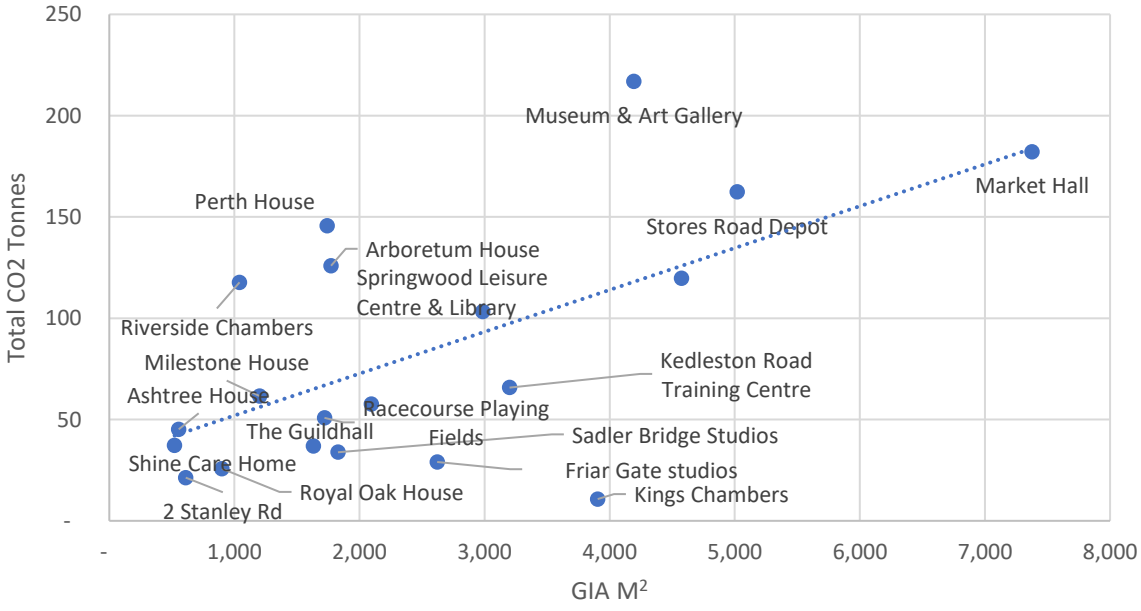
Below is the baseline data for the 22 top consuming sites. The energy usage per m^2 indicate the efficiency of the sites. The full table of site consumption data and emissions data is in Appendix 1. The data below is for the top consuming sites as not all audit reports have been completed.

Table 5.1- Base line data for top 22 sites

	Total kWh 19/20	GIA	kWh M^2	CO_2 Emissions Tonnes	Total CO_2 per M^2
Electric	6,380,866	80,363	77	1,938	0.0241
Gas	11,273,053	80,363	133	2,069	0.0257
Total	17,653,919	80,363	210	4,007	0.0499

The first step is to target the 22 top consuming sites that account for 55% of overall emissions of the corporate estate. Figure 5.1 illustrates the CO_2 emissions per annum in tonnes by gross internal area. The sites that fall on the top left of the blue trend line are those that are producing more carbon per m^2. Several sites have been excluded from the chart including The Council House, Derby Arena and Markeaton Crematorium. These sites are larger sites consuming more energy which is what is expected.

Figure 5.1 – CO_2 Emissions per M^2



6. The Energy Management Strategy

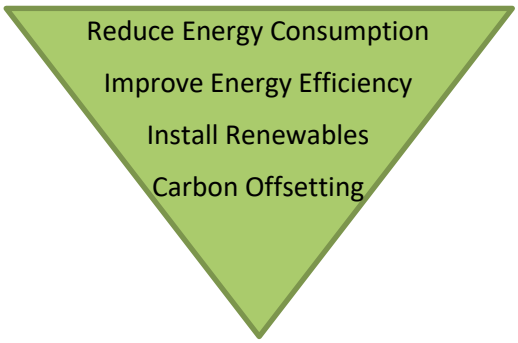
This strategy will set out how Derby City Council will work towards the net zero 2035 target. This Strategy document has been developed to target and focus on the energy consumption of the Council's corporate property portfolio and its resulting carbon emissions. The Council must manage the increasing risks of the energy market including energy security, pricing and sustainability.

6.1 Objectives

The approach to achieving the councils net zero-carbon target will be in line with the Energy Hierarchy. This will mean that reducing our consumption will be our priority. This will be achieved by no and low-cost measures along with technical improvements to improve energy efficiency. Renewable energy will be implemented where it is feasible and once, we have reduced the energy consumption of the site.

Heat decarbonisation is the priority. This needs to be achieved using a whole building approach in line with government guidelines. Our buildings need to aim for a 50-75kWh per square meter. This target will mean that long term there will be enough renewable energy to power the UK each year.

Figure 6.1 – Energy Hierarchy



The Energy Management Strategy sets out four key Strategic Focus Areas to deliver a sustained reduction in the consumption of energy resources and carbon emissions. Energy management is crucial and includes continual monitoring along with technical and behavioural change improvements to ensure that energy usage is kept to a minimum.

6.2 Key Strategic Objectives

The Councils Strategic Objective translates into the four strategic focus areas of approach:

- **Reduce Energy Consumption**; reduce energy demand, recover energy where possible and ensure it is used in a non-wasteful manner.
- **Improve Energy Efficiency**; consider energy efficiency at all asset levels, invest in energy saving technologies.
- **Install Renewables**; buy renewable energy going forward and invest in renewable installations.
- **Carbon Off-setting**; the remaining carbon will be targeted by carbon offsetting.

7. Reduce Energy Consumption

It is essential to reduce the demand for energy. The first step to do this is through simple no and low-cost measures. Making sure lights and appliances are off when not in use. Ensuring that boiler timers match the occupancy of the building along with making sure the timers are set correctly.

7.1 Metering and Monitoring

The first step in achieving effective energy management is to ensure that accurate data is available. Data is key to being able to set targets and to know if they have been achieved. The most effective way to monitor data is through half hourly readings.

Half Hourly information allows for detailed data profiling. This reveals the baseline data for a site as well as identifying any spikes or trends in energy usage. It is recommended that all larger consuming sites have half hourly meters fitted.

Profiling each site and monitoring energy consumption is crucial and something that needs doing on a regular basis. Setting alarms on Systems Link is one way to be alerted to an increase in consumption. Resources are needed to ensure that data is analysed, and changes made accordingly.

The top consuming sites will need to have HH meters fitted where they aren't already in place for the electricity consumption.

7.2 Creating Awareness

It is essential to make everyone on site aware of ways to reduce energy and to educate employees and anyone visiting the sites. Posters, emails, meetings are all great ways to get people involved.

A communication plan needs to be developed and to establish who will work on this and monitor progress. Once people are educated on why and how energy is to be reduced the more likely people are to engage.

All staff have a duty to assist with the Council's commitment to the Building Energy Management Strategy and to seek the assistance of the Energy Management Team for advice, support and guidance as appropriate.

All staff are responsible for ensuring that the energy consumed whilst carrying out the planning and delivery of their service is minimised in support of the Council's Strategic Objective.

8. Improve Energy Efficiency

The options that are set out below will primarily be aimed at the top 22 consuming sites which account for 55% of overall emissions. Energy audits conducted on these sites provide estimated savings.

The strategic approach is to look at a whole building approach in line with the Building and Energy Management government guidelines. There will need to be feasibility studies conducted to move these energy savings measures forward. The technologies that are identified below have been recommended in the energy audits that have been conducted.

8.1 PAS 2038

PAS2038 is an energy efficiency standard that has been released in response to an urgent requirement to improve the energy efficiency of buildings in the UK, in line with Climate Change Act. Towards that end, the Department for Business, Energy and Industrial Strategy (BEIS) sponsored BSI to produce PAS 2038:2021, a new specification that sets out requirements on retrofitting non-domestic buildings for improved energy efficiency.

8.1.1 What does PAS 2038:2021 cover?

It covers all buildings except those used as private dwellings (i.e. houses, bungalows, flats, or apartments) including multi-residential buildings in which occupants share some communal facilities, e.g. hotels, guest houses, hostels, and students' and nurses' accommodation.

8.1.2 Why use PAS 2038:2021?

The PAS defines technically robust and responsible "whole-building" retrofit processes in line with the Heat & Buildings Strategy which is section 7 of the 10-point plan released by the government.

Its requirements cover the[6]:

- Management of the retrofit process, from inception to completion
- Assessment of buildings for retrofit of energy efficiency and related measures
- Identification and evaluation of improvement options (energy efficiency measures)
- Preparation of medium-term improvement plans
- design and specification of energy efficiency measures (whether individual Measures or packages of multiple measures)
- Installation of measures
- Testing, commissioning, and handover of installed measures
- Fine tuning of the performance of retrofitted buildings
- Evaluation of retrofit projects

PAS 2038 will support the following:

- improved functionality, usability, and durability of buildings.
- improved comfort, well-being, health and safety (including fire safety) and productivity.
- enabling buildings to use low- or zero-carbon energy supplies.
- improved energy efficiency, leading to reduced fuel use, fuel costs, and pollution.
- reduced environmental impacts of buildings.
- protection and enhancement of the architectural and cultural heritage of building stock.
- avoidance of unintended consequences related to any of the above.
- minimization of the “performance gap” that occurs when reductions in fuel use, fuel cost, and carbon dioxide emissions are not as large as intended or predicted.

It is essential that this standard is used throughout the council and not only on projects aimed at energy efficiency. Any building works need to follow this standard if the council is to effectively reduce its emissions.

8.2 Key Technologies for top consuming sites

The technologies below are divided into electricity and gas reducing measures. Each of these will be considered for the top consuming sites initially. The remaining sites will be targeted once these works are complete.

8.3 Electricity reduction measures

8.3.2 Lighting Upgrades – LED’s and automated switching

LED’s are the most efficient electric light source and widely used in providing artificial light to new buildings.

When coupled with movement & natural light sensors LED’S offer the most efficient lighting method. There is the option to replace only the tubes, but this will be decided by a site-by-site basis. Dimming technology with lux level sensors help to further reduce energy consumption.

8.3.3 Photo Electric Controls

Due to the large amount of light available at several sites, it is recommended that photoelectric sensors are installed in areas with large windows. This will reduce the amount of energy used in those areas. In many areas’ electricity is being used to light areas that are already sufficiently lit by natural light. Using daylight sensors or photocells can reduce electricity use by up to 40%.

8.4 Gas reduction measures

Gas reduction measures will be approached holistically. By taking a whole building approach this will reduce the energy demand at each site. The reports that have been carried out recommend all the measures necessary to ensure the site reaches its potential.

8.4.2 Thermostatic Radiator Valves

There are many sites across the portfolio that do not have thermostatic radiator valves (TRV's). These allow for localised control for the room temperature opposed to via the boiler, this allows for much more control at zone level. This allows for a zone temperature to be set based on occupancy and its use.

8.4.3 Glazing Upgrade

Improved glazing can massively improve the efficiency of the building. The glazing itself and the insulation around the windows is key to improving energy efficiency. This will improve the EPC rating of the building.

8.4.4 Air Permeability & Thermal Imaging

An air permeability test is the recognised method used to determine the total air lost through leaks in a building's envelope. Reducing the air permeability within a building allows less energy to escape from areas such as gaps around doors and windows.

Heat loss can also be identified through a thermal imaging camera in the colder months. This will show where heat is leaking form the building. To tackle this issue appropriate specifications are to be developed to deal with construction gaps, which form air leakage and heat loss.

8.4.5 Insulation

Several sites will benefit from wall and loft insulation. Introducing insulation in line with 2010 regulations and increasing the U-Value of the walls to 0.26W/m2-k can reduce energy bills by around 4%. Dependent on the building and cost verse saving the wall insulation will be cavity wall or external wall insulation.

8.5 Gas and Electricity Reduction Measure

8.5.1 BMS Systems

A Building Management System (BMS) is a computer-based system installed to control and monitor a building's electrical and gas fired equipment such as boilers, ventilation, lighting, fire systems, and security systems.

A BMS is an excellent way to lower energy usage in a cost-effective way. It will also ensure optimum comfort for users, tenants, and residents of the buildings. A BMS system allows remote management of heating, ventilation, and air conditioning (HVAC) so that maintenance staff do not have to spend time visiting each building or room to shut down, switch on or adjust temperature levels or air conditioning.

An effective BMS system with adequate architecture can provide significant energy savings (up to 40%), as well as enabling real time measurement of building energy usage to provide up to the minute data. This data can be utilised to ensure that the building is running to its optimum performance. A full investigation will be carried out to identify which systems need to be invested in and to establish at what point the BMS will be installed if at all.

9. Install Renewables

9.2 Solar Panels

Solar PV provides the easiest method of generating power on site and presents a significant opportunity to create self-generation capacity. This can offer energy to power the electricity used at each site as well as to power any heat pumps that are installed.

Feasibility studies will also look at the possibility of solar battery storage for any sites using energy overnight such as leisure centres.

9.3 Air Source Heat Pumps

An air source heat pump is an energy-efficient device that extracts heat from the outside air. The heat pump is usually located outside the property and connected to the heating system in place of a gas boiler

An air source heat pump, sometimes referred to as an air-to-water source heat pump, transfers heat from the outside air to water, which heats the building via radiators or underfloor heating. It can also heat water stored in a hot water cylinder for hot water. Heat from the air is absorbed into a fluid. This fluid then passes through a heat exchanger into the heat pump, which raises the temperature and then transfers that heat to water.

Air-to-air heat pumps transfer heat from the outside air to air inside the building, increasing the temperature of the air in each room. This warm air enters the building through a series of fan coil units, or ‘blowers’. Air-to-air heat pumps are sometimes referred to as air conditioning. Air conditioning if often thought of as a way of cooling buildings, it can also be used for heating. An air-to-air heat pump does not heat water delivered to the taps, so an alternative will be needed for heating water. [7]

To enable this to be an efficient method of heating a building the structure of the building must be thermally efficient.

. This installation also requires a storage cylinder to store the water that will be used to be heated and circulated to the radiators.

10. Additional measures to lower emissions

10.1 Ensure that all new builds achieve net zero carbon.

To ensure that new builds complete the Climate Change Impact Assessment tool and consult with the Property and Consultancy Services team prior to any works commencing.

10.2 Buy 100% renewable electricity

To reach net zero with scope 2 emissions the council will need to buy 100% renewable energy. It is important that we reduce our consumption to 70-75 kWh per m^2 for there to be enough renewable electricity to power the UK.

DCC needs to ensure it procures energy from a company that truly supports renewable generation. The energy market is complex and not all renewable electricity tariffs are based on the direct generation or purchase of renewable energy

10.3 Office space optimisation after COVID

Consideration needs to be made to how much office space is now required. Working from home has been proven a success and staff that are able to continue their work from home have embraced the challenge and have proven that this is possible.

A hybrid working strategy should be considered that allows employees to choose when they go into the office and an easy-to-use system that allows employees to book a desk.

10.4 Hydrogen as fuel

Derby City Council will also be monitoring the governments progress with its hydrogen strategy. Trials are underway to see if hydrogen blended with natural gas is a realistic and safe alternative. This would mean that new boilers that are already in place could easily be converted and consume less natural gas.

10.5 Carbon Offsetting

When all the above actions have been implemented the top consuming sites will not be net zero. No local authority operating public services could ever become truly zero carbon. This is where carbon offsetting comes into play.

It is a fundamental principle of legitimate offsetting that all work possible to reduce emissions has first been exhausted to reduce emissions, before the issue of offsetting arises. The hierarchy for emissions is calculate, avoid, reduce, offset – with offsetting being the last resort.

Derby City Council will need to decide the type of off-setting it will use.

11. Predicted Savings for Top Consuming Sites

The predicted energy savings from implementing the technologies suggested above are shown in the tables below. The electricity savings are predominantly from LED lighting installations. Behavioural change will also play a big part in reducing energy consumption. The LED upgrades will make a 7% reduction. This reduction considers increases in heating emissions due to heat losses from inefficient lighting. The sites which do not have gas will make electricity savings when heat pumps are installed. Graph 1 highlights the total of the potential savings. The full break down of estimated savings are in Table 1 in Appendix 2.

The gas/heating saving opportunities are highlighted in the second table. Please note Kings Chambers and Friar Gate Studios do not have a gas supply. Savings identified would affect electricity consumption.

Table - 11.1 Total Predicted kWh Savings for Electricity

LED LIGHTING			PHOTO ELECTRIC CONTROLS			SOLAR PANELS		
Estimated Annual Savings			Estimated Annual Savings			Estimated Annual Savings		
kWh	£	KG CO2e	kWh	£	KG CO2e	kWh	£	KG CO2e
193,068	42,402	37,335	26,591	10,007	5,142	82,195	14,384	15,895

Table 11.2 Total Predicted kWh Savings for Heating Reduction

GLAZING UPGRADE			EXTERNAL WALL INSULATION			CAVITY WALL INSULATION			AIR PERMEABILITY			AIR SOURCE HEAT PUMP		
Estimated Annual Savings			Estimated Annual Savings			Estimated Annual Savings			Estimated Annual Savings			Estimated Annual Savings		
kWh	£	KG CO2e	kWh	£	KG CO2e	kWh	£	KG CO2e	kWh	£	KG CO2e	kWh	£	KG CO2e
260,636	14,357	46,914	204,875	9,398	36,878	123,631	9,170	22,254	1,697,937	74,597	296,113	8,096,080	128,138	1,428,807

CO_2e Emissions factor Electricity 0.19338 Gas 0.18 source: www.gov.uk, 2022

Table 11.3 Gas consumption that will need carbon offsetting on the top consuming sites

	Annual Gas Consumption (kWh)	Predicted Gas Savings (kWh)	Predicted Gas Consumption (kWh)	% Consumption needing carbon offsetting
Museum & Art Gallery	412,674	394,366	18,308	4.44
Council House	2,538,834	2,420,386	118,448	4.67
Riverside Chambers	415,353	373,166	42,187	10.16
Marble Hall	382,164	339,986	42,178	11.04
Springwood Leisure Centre	537,813	206,444	331,369	61.61
Milestone House	273,957	250,341	23,616	8.62
Kings Chambers	0	0	0	N/A
Friar Gate Studios	0	0	0	N/A
Sadler Bridge Studios	59,164	57,669	1,495	2.53
Kedleston Road	269,474	265,623	3,851	1.43
Shine Care Home	142,138	110,644	31,494	22.16
Guildhall	147,111	140,518	6,593	4.48
Royal Oak House	78,180	70,922	7,258	9.28
Ashtree House	250,959	249,900	1,059	0.42
2 Stanley Road	86,864	86,514	350	0.40
Stores Road Depot	237,980	140,334	97,646	41.03
Derby Arena	1,064,545	586,291	478,254	44.93
Crematorium Markeaton Lane	2,451,959	2,393,275	58,684	2.39
Arboretum House	439,434	124,839	314,595	71.59
Perth House	499,094	55,664	443,430	88.85
Racecourse Playing Fields	160,175	0	160,175	100.00

Table 11.3 details each site and what will need carbon offsetting after the suggested improvements that have been detailed above have been made. The need for offsetting is likely to reduce as new technologies are developed that are suited these buildings.

To decarbonise the heating systems with the suggested changes would make a 79% reduction.

Several sites have been identified as suitable, feasibility studies need to be conducted to get accurate pricing and energy savings.

12. Monitoring and Evaluation

12.1 Effectiveness

Projects carried out will be monitored through energy consumption data. Continuous monitoring will ensure that projects are saving the energy predicted. Month on month, year on year comparisons will enable financial and carbon savings to be calculated.

12.2 Efficiency

The predicted payback time for any invest to save project will be monitored. This is to ensure that the investment is making the predicted savings on time and in budget. A project will be considered a success when it is making financial and carbon savings.

13. Resources Required

To achieve the four key strategy objectives, energy reduction, energy efficiency and renewable installation the following resources will be essential.

- Educating site managers and staff on site on how to reduce energy and recommending energy saving technological improvements.
- Revenue funding available for feasibility studies
- Project Managers for technical installations
- Funding for energy improvements (funding amounts will be determined through feasibility studies).
- Funding for installation of HH meters where needed

The business case for these resources will be developed to move this strategy forward.

14. Challenges to consider

14.1 Property Rationalisation

The decisions made by Derby City Council on the direction of sites is critical to which sites will receive investment to improve energy efficiency. Decisions made me drastically effect the sites which are chosen for energy improvements.

14.2 Contractor Shortage

While the government is promising extra funding for energy saving projects, it is failing to deliver on the critical ingredient, the workforce. There is a very large shortage on the skill sets required to meet net zero.

This means there are not enough staff to complete and maintain services but also there is a concern that the specifications and the ability to design a system may be compromised. It is essential when installing heat pumps for the system to be sized correctly.

It will be vital that Derby City Council work with competent contractors. The Energy Team will also work with climate change colleagues internally to utilise existing skills to reduce dependency on contractors and consultants.

14.3 District Network Operator Restrictions

Western Power are working on the local grid to ensure that it can meet demand. However, there are two main concerns. The first being that if there is a sudden uptake with heat pumps there could be a significant increase in electricity demand that the grid may not be able to handle.

Secondly renewable installations require an application to Western Power and there may be a delayed connection due to a lack of staff and grid capacity. This is something that Western Power are working on, but it is a consideration for the Energy Strategy.

15. Action Plan

The action plan forms part of the Climate change Action Plan. It is a working document that sets out details of how the energy strategy will be implemented. These targets will develop and change as feasibility studies are conducted and once energy data is profiled for each site.

There will be quarterly and monthly updates to report on energy consumption and savings made. This Energy Strategy is not a standalone document; it will be integrated with other DCC strategies and policies.

One of the main documents that the action plan will incorporate is the D2N2 Energy Strategy 2019-2030 – D2N2 Clean Industrial Revolution. The targets that will be considered are:

T2. At least a 60% reduction against 1990 carbon emissions per capita and a 15% reduction in per capita energy demand.

T3. 15% of buildings using low carbon heating and all current building stock be Energy performance Certificate level C or above where possible

T5. 100% low carbon energy supply with 60% renewable energy generation output and increase of 180MW in electricity storage

16. References

[1] COP26-Explained.pdf (ukcop26.org)
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[5] Heat and buildings strategy (publishing.service.gov.uk)
[6] PAS 2038:2021 | BSI (bsigroup.com)
[7] In-depth guide to heat pumps - Energy Saving Trust