Net Zero Carbon Emissions Trajectory for Oadby & Wigston Borough Council

Report V4.

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APSE (Association for Public Service Excellence) is a not for profit local government body working with over 300 councils throughout the UK. Promoting excellence in public services, APSE is the foremost specialist in local authority front line services, hosting a network for front line service providers in areas such as waste and refuse collection, parks and environmental services, leisure, school meals, cleaning, housing and building maintenance.

APSE Energy is APSE's local authority energy collaboration. The vision for the collaboration is to form an "effective collaboration of a large number of local authorities to enable and facilitate the local municipalisation of energy services. By this we mean the public and community, as well as private, ownership and managerial control of local energy generation, supply networks and delivery of energy efficiency works. Local authorities working together in this way would have great influence and would be able to deliver economies of scale in green energy to promote economic growth and combat fuel poverty.

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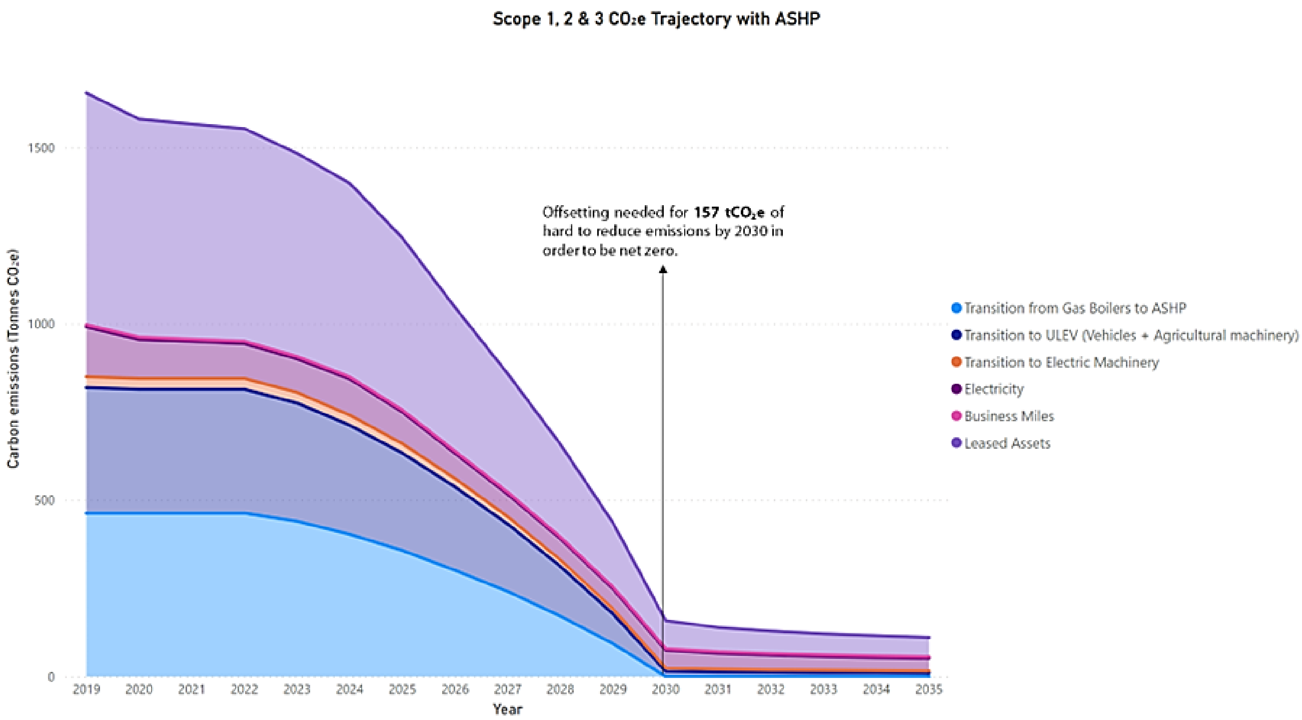
Executive Summary

This report shows calculations for the carbon emissions baseline of Oadby & Wigston Borough Council and an estimated projection of emissions after interventions are made with a net zero carbon target of 2030.

The trajectory below shows a projection of the Scope 1, 2 and known Scope 3 carbon emissions for the net zero target of 2030. The total emissions from all Scope 3 sources are not known to date.

Figure 1: Scope 1, 2 & 3 CO_2e trajectory under ASHP scenario

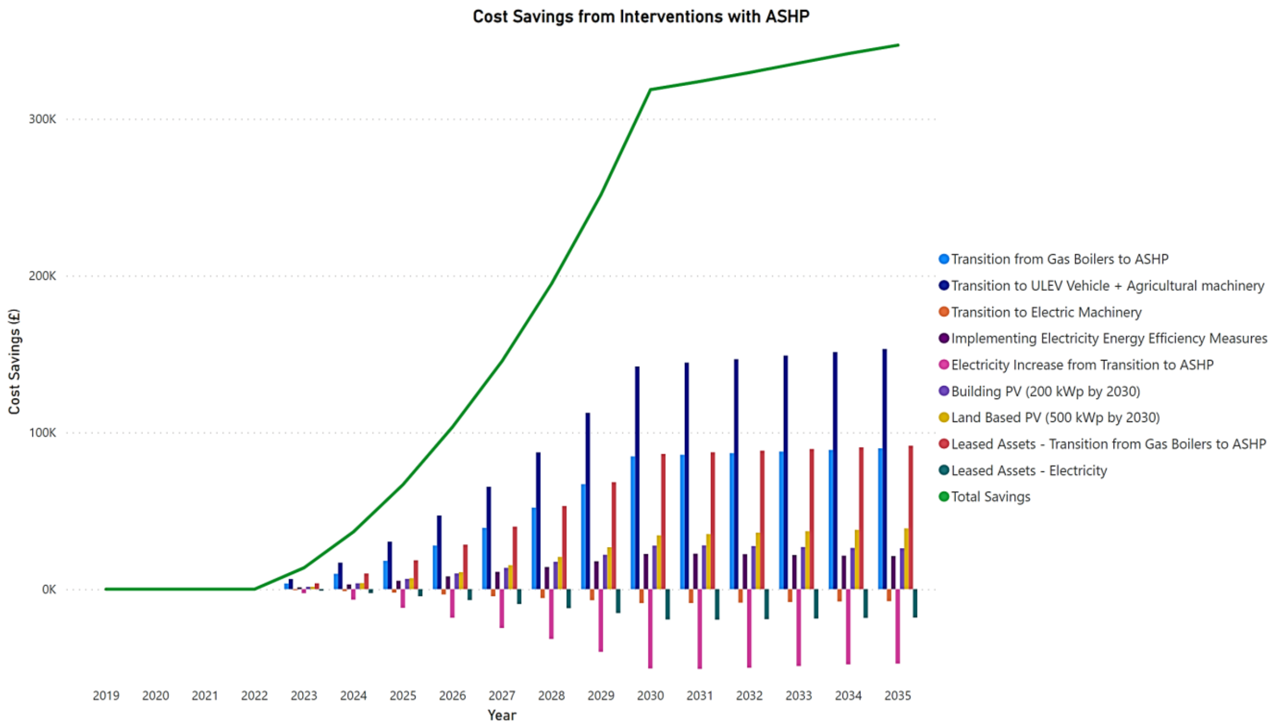


This trajectory represents an overall saving of 1,497 tCO_2e (91%) when comparing 2019 to 2030.

It is estimated that there will be 157 tCO_2e from hard-to-reduce sources that will be unavoidable by 2030 that will need to be offset, and it is assumed that this can be offset through land-based PV and a tree planting scheme.

Carrying out the recommended initiatives will result in financial savings over the term, as shown in the chart below:

Figure 2: Cost savings from interventions under ASHP scenario



It is estimated that a financial budget of approximately £13.3 million is required to reach net zero carbon by 2030 for corporate assets by being more energy efficient in buildings; installing air source heat pumps (ASHP); generating power; replacing council owned vehicles; and developing a tree planting scheme. However, implementing these initiatives will financially benefit the Council with savings of £318,600 in 2030.

It is estimated that an additional budget of £3.2 million would be required to decarbonise leased assets.

Disclaimer: Cost estimates provided in this report are approximations and are not guaranteed. The estimates are based on information provided by the Council and assumptions which have been stated, where possible. Financial planning should therefore not be solely based on these estimates as actual costs would vary subject to detailed feasibility studies of all council owned and leased assets.

The calculations included in this report do not consider planned spending by the Council over the time period in question. For example, we have not factored in revenue spending the Council may have already set aside for building refurbishment, new boilers or replacement vehicles over the next few years.

1 Oadby & Wigston Borough Council Carbon Emissions

1.1 Introduction to Baseline Carbon Footprint

This section of the report provides the findings of the carbon footprint calculations for Oadby & Wigston Borough Council which can be used as a benchmark to record current emissions and to track performance against future emissions. The carbon footprint has been undertaken in accordance with best practise guidance by the Greenhouse Gas Protocol[1] and calculated using 2019 conversion factors for the carbon dioxide equivalent (CO_2e is explained further in Section 1.3) published by the Department for Business, Energy & Industrial Strategy (BEIS)[2].

The carbon footprint is categorised into scopes, which cover:

Scope 1 (direct) emissions are from activities owned or controlled by the Council. Examples of Scope 1 emissions include emissions from combustion in council owned or controlled boilers, furnaces and vehicles.

Scope 2 (indirect) emissions are associated with purchased electricity, heat, steam and cooling. These indirect emissions are a consequence of the Council's energy use, but occur at sources that the Council do not own or control. Examples include grid supplied electricity and heat provided through a heat network.

Scope 3 (other indirect) emissions are a consequence of the Council's actions that occur at sources the Council do not own or control and are not classed as Scope 2 emissions. Examples of Scope 3 emissions include business travel by means not owned or controlled by the Council (grey fleet), disposing of the Council's own waste and purchased goods in the supply chain, etc.

1.2 Carbon Reporting Boundaries

The organisational boundaries determine what emissions are the responsibility of the Council or others. This can be based on who owns, operates, or exerts control over certain assets and can be based on financial or operational control. The buildings categorised under Scope 1 & 2 within this reporting are those where energy is purchased and consumed by the Council. The vehicles categorised under Scope 1 are vehicles that the Council own, lease and operate purely for the Council's own operations.

Scope 3 emissions are classified under 15 different categories as detailed under Appendix C. As Scope 3 emissions are under the influence of the Council, but not under its direct control, it can be difficult to obtain the necessary data to calculate the associated carbon emissions from some Scope 3 sources. One of the largest contributors to Scope 3 carbon emissions is purchased goods and services.

[1] https://ghgprotocol.org/guidance-0
[2] https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

Emissions from assets the Council owns and leases to another entity, but does not operate, is included in Scope 3. An example of this is a leisure centre where the Council owns the building, but a separate leisure operator occupies and runs the building and pays the energy bills.

The financial control model is used in this reporting. To put it simply, if the Council pays for the energy bills then it is classified under Scope 1 and 2, but if the Council owns an asset and a third party pays the energy bills then this is classified under Scope 3.

A full list of the reported emissions is under Section 1.4. This represents a reasonable data set for a Council, as it is not uncommon for councils to only have data available for electricity and gas.

There are sources that are missing from the reporting. The largest contributor is likely to be from purchased goods and services, which is generally very difficult to gather data and calculate emissions about. This category includes all upstream (i.e., cradle-to-gate) emissions from the production of products purchased or acquired by the Council in the reporting year. Products include both goods (tangible products) and services (intangible products).

Cradle-to-gate emissions include all emissions that occur in the life cycle of purchased products, up to the point of receipt by the Council. Relevant purchases to the Council may include capital goods, such as office supplies, office furniture, computers, telephones, travel services, IT support, outsourced administrative functions, consulting services, janitorial, landscaping services, maintenance, repairs and operations.

The Council should set up procedures to record all emission sources related to its operations for future reporting.

1.3 Carbon Emissions

Appendix A shows a summary for emissions and separate tabs showing a breakdown for each source in 2019/20.

Emissions are calculated as carbon dioxide equivalent (CO_2e), which is a term used to combine the seven most threatening gases that have the highest Global Warming Potential. This includes carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and nitrogen trifluoride.

The carbon footprint has been calculated using the best data that was available to the Council during the reporting year and it is the Council's responsibility to confirm the accuracy.

1.4 Emissions for 2019/20

Table 1: Scope 1, 2 & 3 carbon emissions by source for 2019/20

2019/20			
Emissions Source	**Scope**	**% Split**	**tCO2e**
Gas	1	25%	410
Fuel Oil	1	1%	23
Vehicle - Council owned	1	18%	300
Electricity	2	9%	143
Gas - WTT	3	3%	53
Fuel Oil - WTT	3	0.3%	4.3
Vehicle - Council owned - WTT	3	4%	71
Electricity - T&D	3	1%	12
Electricity - WTT	3	1%	22
Waste	3	0.04%	0.6
Business Travel by car	3	0.4%	6
Leased Assets	3	37%	606
Total		**100%**	**1,651**

Figure 3: Carbon emissions by source for 2019/20

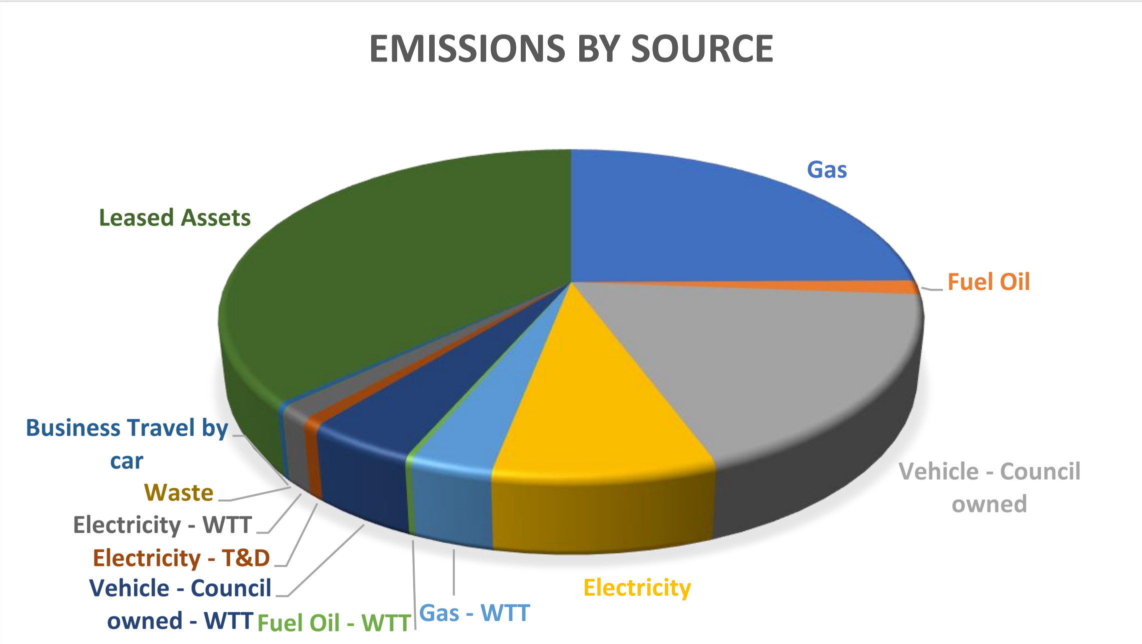
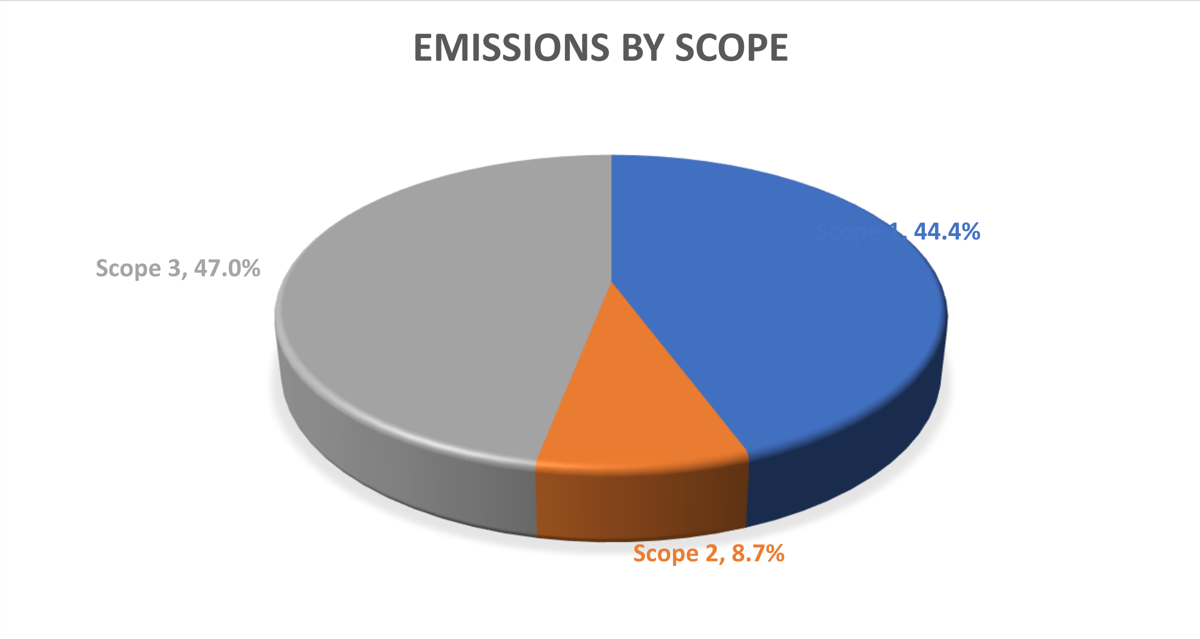


Table 2: Carbon emissions by scope for 2019/20

2019/20		
Emissions Source	**% Split**	**tCO2e**
Scope 1	44.4%	733
Scope 2	8.7%	143
Scope 3	47.0%	775
Total	**100%**	**1,651**

Figure 4: Carbon emissions by scope for 2019/20



2 Notes and Observations

Scope 1

Mains Gas

Data for gas was good, but the kWh data was not available for two sites.

Council Owned Vehicles

The Council has recorded the mileage travelled by each vehicle and the miles per gallon (MPG). These figures have been used to convert the fuel to litres. The volume of fuel, in litres, has been recorded for selected vehicles.

Carbon emissions from vehicles can be calculated using the mileage or the volume of fuel (in litres). Calculating the emissions is more accurate when using the volume of fuel as a refuse truck, for example, will spend a lot of the time stationary but will be consuming energy from lifting and crushing waste. However, it is more accurate to use the actual volume of fuel rather than calculating this from the mileage and MPG.

For 13 of the vehicles, it was not possible to calculate the carbon emissions as not enough data was provided and these vehicles have been separated from the main table in Appendix A.

In future the Council should record the volume of fuel used in each vehicle.

Fuel Oil

The data provided for fuel oil was for the period of 05/03/19 to 17/04/20, which is 409 days. The volume of fuel was adjusted on a prorated basis to account for 365 days.

Scope 2

Electricity

The start date and end date for the supply period has not been included, so it is assumed that the electricity data covers 365 days.

Electricity bills may not cover a full 365 days, particularly when billed on a quarterly basis. The Council should record the start and end period of the electricity usage to determine if the usage covers a full year.

Scope 3

Business Travel by Staff Owned Car

The data supplied for this section was of good quality showing the mileage and engine size for the petrol and diesel vehicles used for business travel. In selected cases the fuel type was not shown so an average fuel type was assumed for the carbon conversion factors.

Waste

Waste data has been supplied for main Council offices and the depot only. In the future the Council should develop methods to record all waste streams from all sources.

Leased Assets

There are three properties that data is available for which fall under the Leased Assets category. These are assets that the Council will own, but a third party will occupy and manage the property including paying the gas and electricity bills.

These three buildings account for 37% of the total emissions.

Well to Tank

Fuels have indirect Scope 3 emissions associated with the production, extraction, refining and transport of the fuel before their use known as Well-to-tank (WTT). WTT emissions have been recorded for:

- Electricity;
- Gas;
- Transmission and Distribution;
- Council Owned Vehicles.

Transmission and Distribution
Transmission and distribution (T&D) factors are used to report the Scope 3 emissions associated with grid losses which is the energy loss that occurs in getting the electricity from the power plant to the organisations that purchase it.

Further Notes and Observations
Data from the Council shows that they are responsible for 127 electricity meters, which provides a reasonable representation of how many assets the Council operate. A review should be carried out of each asset to determine if the Council are responsible for paying the electricity and gas usage and taking ownership for the associated carbon emissions. It is not uncommon for assets to be sold, leased or decommissioned yet the Council continue to pay for the utilities. Likewise, the Council should check to confirm if they are responsible for more than 127 properties.

3 Recommendations for gathering data going forward

3.1 Scope 1 and 2 Emissions

The Council should develop a procedure for gathering and storing its own data as it is made available. The benefit of this is that the carbon reporting process is streamlined and progress towards targets can be tracked.

3.2 Scope 3 Emissions

Scope 3 emissions can account for 70-80% of a council's total footprint (Carbon Trust), given the use of contractors for waste collection, construction, social services and other services.

Appendix C shows the 15 different categories of Scope 3 emissions and what data should be gathered to report on emissions in future years. Where applicable, the Council should develop policies/procedures to gather the data from third parties. This should be incorporated into the procurement process and contracts with suppliers.

It is discretionary for an organisation to report on Scope 3 emissions. It should be explained and documented in subsequent carbon reports if the Council is unable to obtain data for carbon sources as it is deemed financially impractical or not significant. The reporting principles should be based on:

- Relevance;
- Completeness;
- Consistency;
- Transparency;
- Accuracy.

Noteworthy Scope 3 sources that are missing from this carbon reporting include:

- The supply chain of purchased goods and services;
- Supply and waste water;
- Further details of waste from operational buildings;
- Employee commuting;
- Working from home.

Purchased goods and services will likely represent a high level of emissions down the supply chain. However, obtaining this data from third parties may prove difficult and the Council should assess what relevant goods and services could be recorded in subsequent years and policies should be set in place to request this data from suppliers.

The volumes of water that are supplied and returned to sewer can be recorded from the water bills. It is recommended to enter into a consolidated water contract so that all supplies are on a group contract for both supply and wastewater. Conditions of the contract could be that Automatic Meter Readers (AMR) are installed which will improve the accuracy of billing and can also be configured to identify leaks quickly.

Policies should be put in place to start recording waste data from all sites. This could be through contractual changes, i.e. waste contractor weighing and recording waste type, or the Council can measure its own waste. There are tracking sheets from WRAP[3] to monitor waste streams and these could be used in the short term until the waste contractor can record it.

<u>Metering and Energy Management Software</u>

A half hourly meter (also known as HH or 00) is a non-domestic electricity meter that sends consumption data to the energy supplier every half hour via telecommunications. They are compulsory for non-domestic premises that have a maximum demand of 100kW or higher during any half hour period of the day. They are not compulsory in smaller buildings which are billed on the Non-Half Hourly (NHH) basis.

NHH meters can be voluntarily upgraded to Automatic Meter Readers (AMR) or Smart Meters which are similar to HH meters. The benefit is that the supplier bills on the actual usage and the end user can monitor its energy usage on a half hourly basis rather than a monthly basis.

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[3] https://wrap.org.uk/

Sub-meters can also be installed to distribution boards and larger consuming equipment to monitor usage and performance. For example, installing a gas submeter, electricity generation meter and a heat meter to a CHP will support in calculating the performance and efficiency of the system and installing an electricity submeter to lighting circuits will help identify if lights are left on out of hours.

The cost to install AMR to the main billing meter ranges depending on the provider but could cost in the region of £200 per meter and will vary depending on the type and age of the existing meter. There is also an annual charge of around £50 to access the data. Some energy suppliers offer 'free' AMR but the cost of the energy bill standing charge is normally increased by around £80 to cover the cost and allow access to the data.

Using energy management software will provide several benefits such as:

- The ability to electronically upload all invoice data, HH/AMR data and manual meter readings;
- Provide the ability to setup energy excess alarms to identify when energy is being used beyond expected parameters;
- Validate energy bills to identify billing errors;
- Instantaneous access to energy data for:
    - Trend analysis and comparison with previous performance;
    - Comparison with targets or benchmarks;
    - Ranking of sites according to performance;
    - Carbon reports;
    - Monitor usage against weather.

The cost for energy management software can vary significantly but a standard energy management software used by councils is in the region of £4,000 per year.

Remote access to the building controls through a Building Management Systems (BMS) can improve building temperatures and reduce energy usage. Using Trend IQVISION BMS Supervisor will improve the monitoring and management capabilities of Trend controllers and have improved energy management functions, alarms, centralised data logging and more functions for monitoring sub-meters which can all be used for highlighting and investigating energy use within buildings.

IQVISION would generally be better for monitoring the energy usage of submeters in individual buildings and energy management software would be better for monitoring the energy usage of the whole estate.

There are a range of other systems available. Trend is mentioned simply because it is commonly found on site during our audits at several councils.

4 Pathway Methodology

4.1 Energy Efficiency

Appendix B shows generic measures that could be taken to reduce energy usage from the 2019/20 baseline emissions. **This is a desktop assessment based on the consumption data and typical saving initiatives and is not based on site survey information. Estimated energy savings and forecast capital costs shown are for representative purposes to give an illustrative outcome and should not be used for budgeting purposes.**

The trajectory and savings detailed in Appendix B can be used to track performance of reducing emissions against the 2019/20 baseline year and should be treated as a live document and updated when better information is available following site surveys, or after projects have been delivered.

The Council should be able to achieve significant carbon and cost savings by reviewing its maintenance policies to specify highly efficient plant and services, and low-emission vehicles, rather than replacing like-for-like. Changing policies to specify materials with low embodied carbon should also reduce Scope 3 emissions by considering the carbon life cycle cost in terms of the supply chain, operation and decommissioning.

It is recommended that a detailed audit and feasibility study is carried out for all assets to determine the site-specific initiatives. This will provide an indication of the realistic interventions that could be provided and the likely cost savings, capital cost and carbon savings. The trajectory should be treated as a live document and updated once more accurate information is available following site surveys.

For buildings it is recommended that the principles of the energy hierarchy are followed. The aim is to reduce operational carbon emissions by as much as financially and technologically possible, and offset the emissions that are difficult to reduce. These are the principles of the energy saving hierarchy:

Lean – first use less energy, reduce end user energy use;

Clean – then be energy efficient;

Green – and then use renewable energy systems and carbon offsetting.

An example of this is to insulate a building so that the heat demand is reduced. This will have a knock-on effect on the size of the heating plant meaning that it may be possible to reduce the size of the heating plant which would reduce the capital cost for equipment. Solar panels would then be considered to generate renewable power. The principles are that the cleanest and cheapest unit of energy is the one that is not used. It is not necessarily the right approach to install solar panels on an old building first when the priority should be to reducing the heat loss of the building, installing a low carbon heating source and improving the controls. However, the approach for each building is bespoke and it may not be cost effective to insulate buildings for several reasons such as:

- The building is listed;

- There are architectural features that would be impacted if insulating externally;
- The costs are high and there is a lengthy payback. The Chartered Institute of Building Services Engineers (CIBSE) suggested that a measure should be considered if the simple payback does not exceed 15 years;
- The building was constructed with good levels of insulation that is in good condition.

The following assumptions have been made which can be updated once more information is available:

- Future CO_2 emissions and tariff rates have been taken from the Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions published by BEIS[4]. These emissions factors include transmission and distribution losses, including significant losses due to power station inefficiency meaning that the emissions factors differ slightly to those calculated in Table 1;
- BEIS have not published future CO_2 emission factors for natural gas. Although it is likely that the carbon emissions factor of gas will decrease as non-fossil fuel gases are injected into the grid, such as hydrogen, the applied emissions factor of gas in this pathway was constant for each year;
- The energy costs are calculated using the forecast retail fuel price which includes the Climate Change Levy but excludes standing charges that are not directly impacted by consumption fluctuations;
- The future emission factors and energy cost rates were published in June 2021 meaning that they do not consider the current volatility in the energy markets due to the war in the Ukraine;
- The intervention capital cost is calculated by multiplying the typical payback of the intervention by the annual energy cost savings, with the exception of heat pumps which is explained later;
- Not all interventions are applicable to each site, e.g. replacement lighting is the only intervention assumed for car parks and street lighting; no savings are projected on certain assets such as door entry or CCTV. Additionally, the data supplied by the Council contains several properties which appear to be residential. As the Council pays the energy bills it is assumed that these are communal areas such as hallways/stairways/lobbies hence the only energy saving intervention applied is LED lighting;
- The pathway is based on current technology available today and assumes that all interventions could be delivered by 2030.

[4] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

4.2 Interventions for Reducing Gas usage (Heat)

Generic interventions for heating (gas usage) include:

Table 3: Heat-based interventions

Intervention	Saving on Heat Demand	Payback in Years	Detail
More efficient plant	20%	8	Could include more efficient boilers
Controls	15%	5	Could include a new or optimised BMS for larger sites, and controllers and Thermostatic Radiator Valves (TRVs) for smaller sites
Insulation	15%	10	Could include building fabric insulation, draught proofing, pool cover and pipework insulation
Other	15%	5	Could include more efficient heat emitters, heat recovery and distribution improvements

It should be noted that savings from these interventions have been calculated concurrently rather than independently, i.e. each intervention reduces the heat demand following on from the previous intervention. For example:

- 100kWh less 20% saving from more efficient plant = 80kWh >
- 80kWh less 15% saving from controls = 68kWh >
- 68kWh less 15% saving from insulation = 58kWh >
- 58kWh less 15% saving from 'other' = 49kWh
- Total reduction = 51%

4.2.1 Heat Pumps

Using heat pumps is a good initiative for heating because the carbon factor of electricity will reduce as the grid is decarbonised; in addition to their efficiency and Coefficient of Performance (COP). For a heat pump, a COP value of 3 means that 1 kW of electric energy would generate 3 kW of heat. Effectively producing an increase in energy output of 200%.

Replacing gas boilers with heat pumps can be very expensive. This is because the existing boilers distribute heat at around 80°C and heat pumps distribute heat at around 50°C. It is most likely that a heat pump installation would require design, high levels of insulation, low levels of air infiltration, controls, an external location for plant and possible upgrade of emitters and pipework. In most cases, it is assumed that the cost to retrofit an existing site with a heat pump and the associated infrastructure would be disproportionate compared to the benefits unless financial incentives are used such as the Renewable Heat Incentive or grant funding as with the Public Sector Decarbonisation Scheme.

It is very difficult to estimate the capital cost for heat pumps. A Ground Source Heat Pump (GSHP) is more efficient than an Air Source Heat Pump (ASHP) but is generally much more expensive as it involves significant ground works to bury the slinkies. The costs are also heavily affected by the heat emitters as it is likely that the radiators and pipework will need to be replaced at a high cost, plus the cost to increase the electrical supply can be very high, but these elements are not normally known without a detailed investigation. Water Source Heat Pumps (WSHP) are also an alternative if there is a body of water nearby. The trajectory is based on an ASHP, although GSHP or WSHP may be possible following a detailed feasibility study.

It is likely that changes in technology will mean that options for more low carbon heating systems will be available by 2030.

The estimated capital cost of an ASHP for each building has been calculated based on industry experience of delivering similar sized projects for each building based on its energy usage and/or end-use, i.e. the heat pump cost for a pavilion was based on the cost of delivering a similar project at a similar sized pavilion.

A detailed feasibility study is required for each building to review the viability of low-carbon heating.

4.2.2 Distribution Network Operator and Electrical Capacity

Heat pumps will also increase the building's electricity demand. This could be offset by reducing the electricity usage through other methods, such as LED lighting, but in most cases the overall electricity consumption is likely to increase. An investigation is required to review the buildings Maximum Demand, Maximum Import Capacity, and new electrical load to determine if a larger electrical incoming supply is required. The Distribution Network Operator (DNO) should also be contacted to understand any restrictions on the grid in the local area.

Detailed calculations are required to determine if the size of the electricity cables entering the building need to be increased. The DNO is responsible for the local electricity network and an application will need to be made if the electrical capacity needs to be increased. Following the application, the DNO will then inform the Council of the works involved and the cost. The cost will depend on the amount of work required, the size that the incoming supply is being increased by and the distance that new cables need to be laid. If there is enough spare capacity then the works will not be needed.

It is very difficult to estimate the cost of the DNO works as this is not known until the application has been assessed. A cost estimate has been provided to increase the electrical capacity of each site based on experience of previous projects.

4.3 Interventions for Reducing Electricity Usage

Generic interventions for electricity include:

Table 4: Energy saving interventions

Intervention	Saving on Electricity Usage	Payback in Years	Proportion of building services	Apportioned saving across whole building	Detail
LED Lighting and Control	60%	6	33%	20%	Replace existing luminaires with LED & automatic control
Controls and HVAC	15%	5	41%	6%	Controlling building services with a BMS
Office Equipment	15%	5	15%	2%	Replacing aging equipment with more efficient equipment
Other	15%	5	11%	2%	Could include variable speed drives, motors, hand dryers

Building information sourced from the Chartered Institute of Building Services Engineers (CIBSE).

Savings from these interventions have been calculated independently from the total electricity usage and their estimated proportion to building services, e.g., lighting is assumed to account for 33% of all electricity usage in a building and a potential saving of 60% could be achieved from installing LED lighting and control which leads to an apportioned whole building saving of 20%.

A change in policies to upgrade existing building services to the most efficient option through planned maintenance, and upgrading fossil fuel vehicles to low emission vehicles when they are due to be replaced, will impact the action plan significantly.

4.4 Electric Vehicle Charge Points

The capital cost of projects includes a sum for installing EV charge points at selected buildings. The number of charge points per building, or suitable buildings to install charge points, are unknown at this stage and a detailed feasibility study is required to calculate this. At this stage it is assumed that 5no. charge points can be installed at 30no. buildings at a cost of £1,200 each.

The cost does not include any additional costs for upgrading the electrical infrastructure as this is included in the heat pump costs.

We have also not included any increases to electricity usage as it is unknown what the charging capacity is likely to be i.e., how many vehicles will be charging each day.

4.5 Project Phasing

Projects have been programmed to start in 2023 and end by 2030, with the delivery of projects ramping up each year. This is shown in the table below:

Table 5: Proposed project completion schedule

	2023	2024	2025	2026	2027	2028	2029	2030
Percentage of Projects Delivered Per Year	5%	8%	10%	12%	13%	15%	17%	20%

5 Achieving Net Zero Target of Council Emissions

A "net zero" target refers to reaching net zero carbon emissions by the nominated year of 2030, as provisionally chosen by the Council, but differs from zero carbon, which requires no carbon to be emitted at all.

Net-zero refers to balancing the amount of emitted greenhouse gases with the equivalent emissions that are either offset or sequestered through rewilding, tree planting or carbon capture and storage. It is much more beneficial to reduce carbon emissions before offsetting techniques are adopted for hard-to-reduce emissions.

The term "carbon neutral" is often used as meaning the same as 'net zero carbon', but its meaning is open to interpretation and there are different definitions of what carbon neutral means. The interpretation of APSE Energy is that carbon neutral means purchasing carbon reduction credits equivalent to emissions released, without the need for emissions reductions to have taken place. This could also be achieved through switching to a green energy tariff although this would only Scope 1 (mainly gas and oil) and 2 (electricity) but not include Scope 3.

This trajectory includes all known Scope 1, 2 & 3 emissions and is modelled so that emissions are reduced as much as technically and financially possible while the resultant hard to reduce emissions are then offset. Therefore, the term 'net zero carbon' is used.

5.1 Power Generation

5.1.1 Solar Panels on Buildings

The model assumes that 200 kWp of solar photovoltaic (PV) could be installed by 2030 on buildings. It is assumed that 200 kWp is viable as the Council has provided a dataset with ample properties listed. However, a detailed feasibility study across the estate is required to review each building's suitability and determine each site's specific system size.

NOTE: Information provided by the Council lists 127 entries for electricity usage and 15 entries for gas usage, excluding leased assets. It is assumed that at least 30 of these entries would be viable options for mounting roof-based PV systems culminating in a total supply of at least 200 kWp.

5.1.2 Solar Panels on Land

The trajectory assumes that 500 kWp land-based PV could be installed which would count towards carbon offsetting, this could be done in an open space such as grassland or a car park canopy. This is considered a carbon offset as it is assumed that the system will connect directly to the electricity grid rather than connect directly to Council owned buildings through a private wire.

The amount of available land for PV is unknown at this stage. It is recommended to carry out a detailed feasibility study to determine the amount of generation that could be possible via land-based PV.

5.2 Fuel Usage in Vehicles

5.2.1 Fuel Usage for Vehicles

Ultra-Low Emission Vehicles (ULEV) are already commercially available to replace most passenger and delivery vehicles in the Council's fleet. The trajectory is modelled so that such vehicles will be upgraded to low emission alternatives by 2030. This can be achieved by changing policies so that ULEV vehicles are purchased/leased instead of replacing vehicles like-for-like. As electric vehicles are more efficient compared to fossil-fuelled options, a multiplication factor was calculated by comparing the fuel efficiency of fossil-fuelled vehicles to the energy efficiency of a comparative electric vehicle (EV) on a case-by-case basis. This factor was then applied to the estimate the resultant reduction in energy usage when such vehicles are replaced by EVs.

On the other hand, the market for ULEV alternatives for agricultural machinery (i.e., tractors and diggers) is still in its infancy. Therefore, to reduce emissions in this sector, the fuel utilised would be transitioned to biodiesel which has lower associated emissions per litre than diesel. Although the market price of biodiesel is currently higher than diesel, it is expected that the cost will be driven down as its usage becomes more widespread. Moreover, compared to wholly replacing such machinery with electric alternatives, this pathway would require less expenditure combined with the fact that electric options for such purposes are yet to reach a commercially satisfactory technology readiness level.

The phasing for transitioning all vehicles is per the schedule presented in Table 5.

Furthermore, effective journey management and route optimisation for refuse collection vehicles (RCVs) and public cleaning vans could afford lower mileage which would further reduce transportation-related emissions of the Council.

5.2.2 Fuel Usage for Council Owned Machinery

The Council supplied data on total volume of fuel oil consumed in its depot, which was prorated to tally with the baseline period. However, since the specific end-use was not stated, it was assumed that this was utilised in machinery for purposes of grounds maintenance such as grass trimmers, lawn mowers, etc.

Based on this idea, carbon emissions and financial savings were calculated by estimating the energy content of the fuel oil in kWh and transitioning to electrical alternatives in accordance with the project scheduling timeline. Total energy consumption for the electrical equivalents by 2030 is assumed to be equal to energy content of fuel oil consumed in the baseline year. Capital costs for the transition to electrical machinery have not been estimated as details of the existing equipment has not been provided.

5.3 Business Miles

Transportation for business-related activities in vehicles not operated or owned by the Council contributed to 6 tCO_2e (0.4%) to total emissions in the baseline year. A reduction in emissions associated with business mileage/travel could be stimulated by several factors such as corporate policies (i.e. encouraging ride sharing, usage of public transport, hybrid working) and natural transitions in the market such as the spread of low emission vehicles, evolving public transport links, and more remote meetings via video conferencing.

However, for more accurate carbon reporting and forecasting the Council should also gather data on all modes of travel utilised in meeting the requirements of the business – refer to Appendix C – Data that should be gathered to report on Scope 3 emissions. Further guidance can be provided on streamlining the data gathering process, if required.

It has been assumed that emissions from business milage will reduce by 5% annually up to 2030.

5.4 Leased Assets

Leased Assets account for 37% of the total emissions and 606 tCO_2e.

For leased assets the calculations for the emissions trajectory have been completed in the same way as for corporate assets detailed in Section 4 Pathway Methodology.

6 Trajectory to 2035

Future emissions data was taken from the Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions.

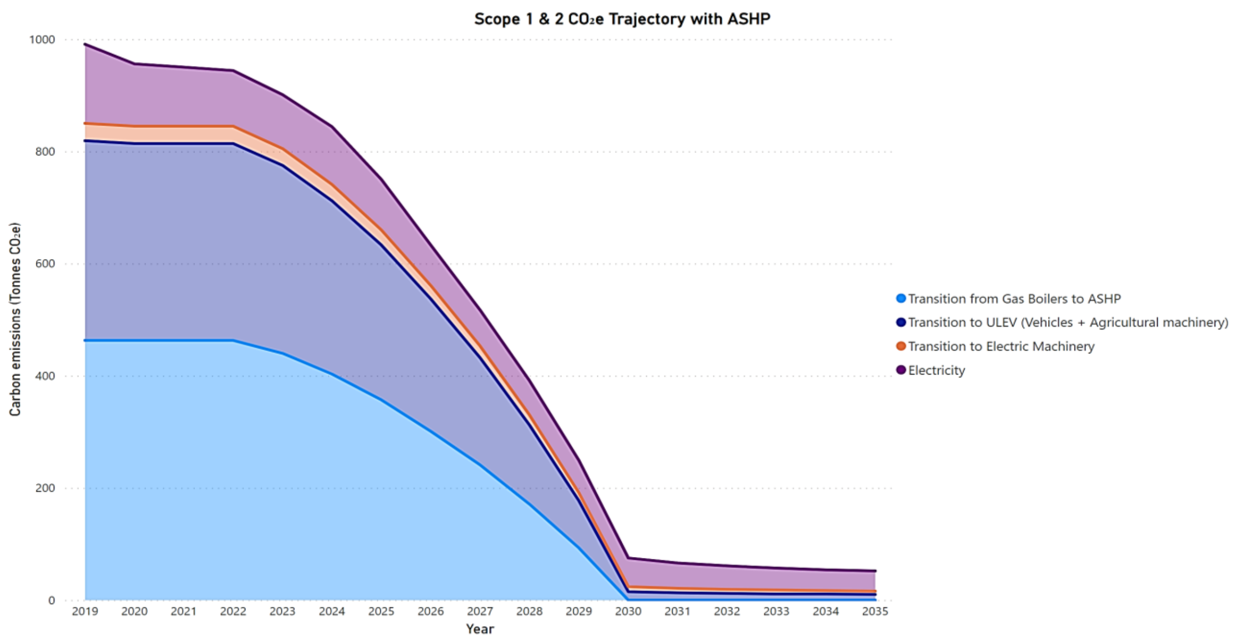
A breakdown of the year-on-year carbon savings can be found in Appendix B.

For comparative purposes the carbon trajectory and financial metrics were estimated under the following scenarios:

- 'Business as Usual' - Do nothing. This scenario assumes that the energy usage is the same in each year, but the carbon emissions reduce mostly as a result of decarbonisation of the electricity grid;
- 'Gas Boilers' – Improve efficiencies by delivering all interventions across Scope 1, 2 and 3 but retain the gas boilers;
- 'Transition to ASHP' – Improve efficiencies by delivering all interventions across Scope 1, 2 and 3 and replace all boilers with ASHPs.

Additionally, carbon emission trajectories for a net-zero target of 2030 for Scope 1 & 2 and for Scope 1, 2 & 3 have also been visualised separately to aid comparison between direct emissions from the Council's operations (Scope 1 & 2) and emissions associated with their value chain (Scope 3).

Figure 5: Scope 1 & 2 CO_2e trajectory under ASHP scenario



Note: Carbon emission factors include Well-to-Tank (WTT) conversion factors of energy carriers and Transmission and Distribution (T&D) factors, where applicable.

Figure 5 shows the Scope 1 & 2 carbon savings when installing heat pumps and removing gas boilers by 2030. This is a carbon saving of 97% compared to the baseline year.

Figure 6: Scope 1, 2 & 3 CO2e trajectory under ASHP scenario

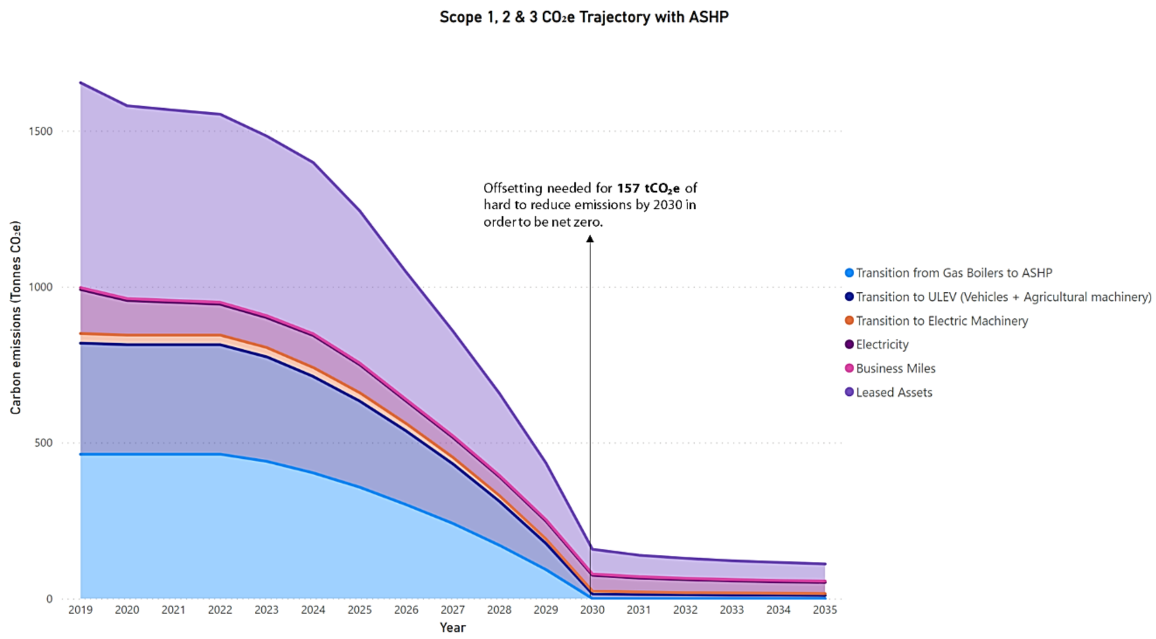
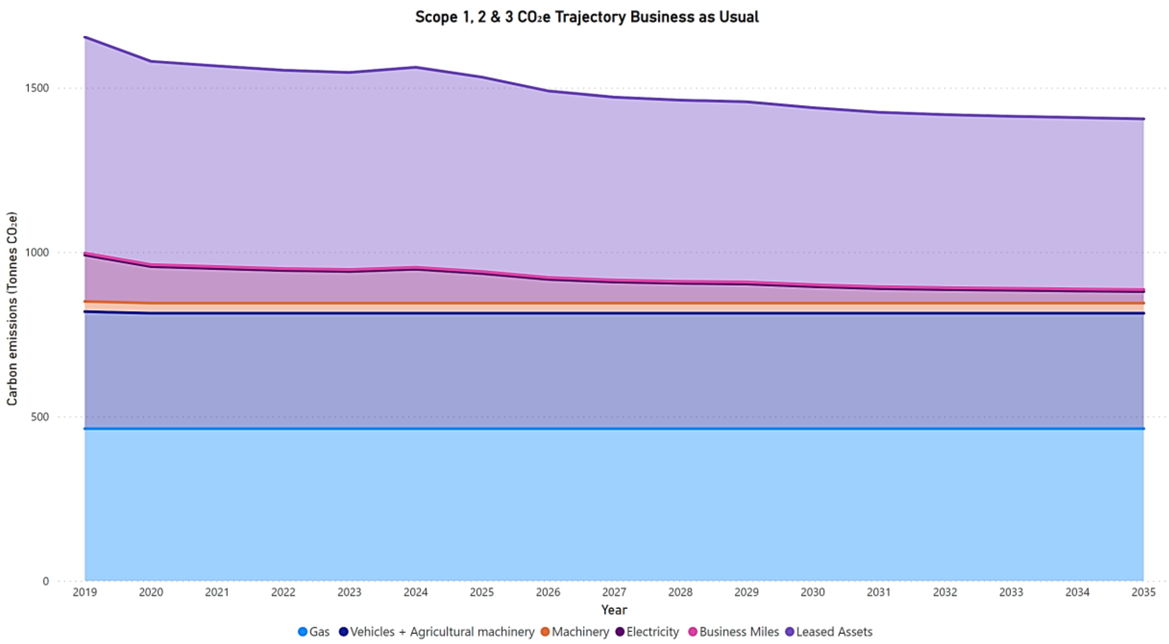


Figure 6 visualises the tCO_2e trajectory for Scope 1, 2 and 3 emissions. There are 157 tCO_2e that are unavoidable by 2030 if gas boilers are replaced with ASHPs. This is the amount of carbon that will need to be offset to balance the emissions that cannot directly be removed based on current technology and within a reasonable budget.

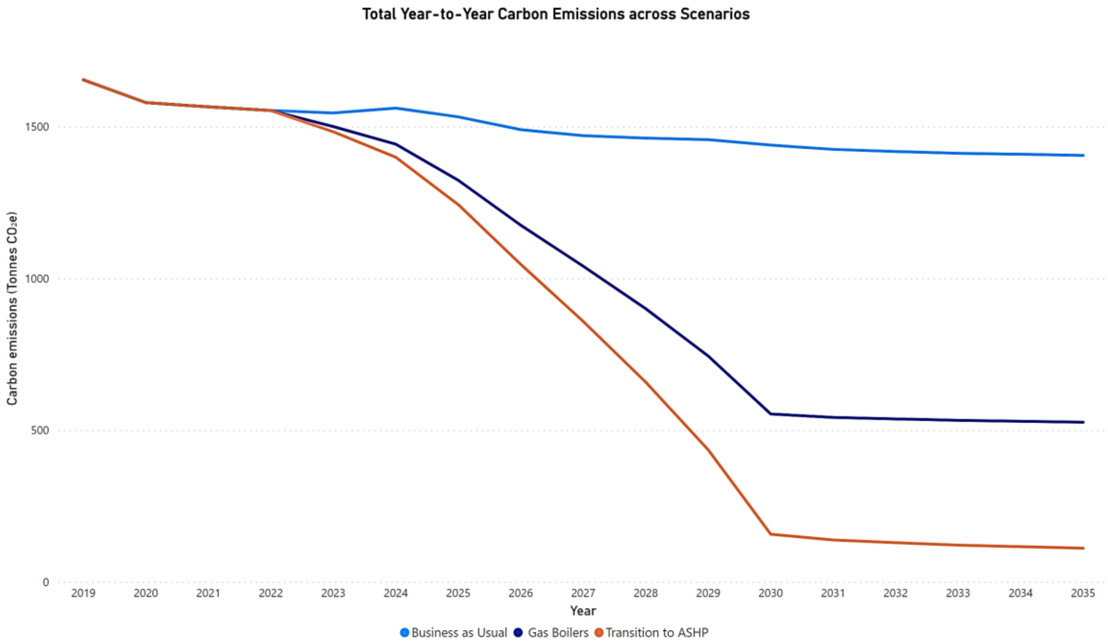
Figure 7: Scope 1, 2 & 3 CO_2e trajectory under Business-as-Usual scenario



The data visualisation above shows the trajectory if no interventions were delivered and the amount of energy used by the Council remains constant across the term. There is a decrease in electricity carbon emissions as the grid decarbonises, but emissions from other sources barely change. By doing nothing, the carbon emissions in 2030 will be 1,439 tCO_2e which is a reduction of 13% from the 2019 baseline.

6.1 Boiler vs Heat Pumps

Figure 8: Comparing carbon emissions under the different scenarios



The graph shows a notable reduction in emissions if energy efficiency recommendations and all interventions are implemented with even further savings if gas boilers are replaced with heat pumps.

Therefore, it is recommended that all boilers be replaced with heat pumps, where feasible.

6.2 Offsetting when Installing ASHP

A carbon offset is a reduction in emissions of CO_2e made to compensate for emissions produced elsewhere. There are several ways of offsetting carbon emissions, such as carbon capture and storage; however, this is not currently deemed financially or technically feasible for the Council. More typical options available to the Council to directly offset emissions include renewable energy generation projects and rewilding/tree planting. However, the effectiveness of tree planting to quickly offset emissions can be questioned as it can take many decades for trees to reach maturity.

It is assumed that solar PV could be placed on land with a generation capacity of approximately 500 kWp generating 475 MWh of electricity that feeds directly into the electricity grid. This could be installed in open spaces or as a canopy over car parks. If the PV system is connected directly to a building it is not considered an offset as the generated electricity would be consumed by the building.

A 500 kWp system would have a capital cost of approximately £450,000, offset 43 tCO_2e in 2030 and an additional 168 tCO_2e in the five years (2031-2035) following the net-zero target year. However, the amount of carbon offset in 2035 is 30 tCO_2e, demonstrating that the carbon offset benefits of a 'solar farm' decrease as the grid decarbonises.

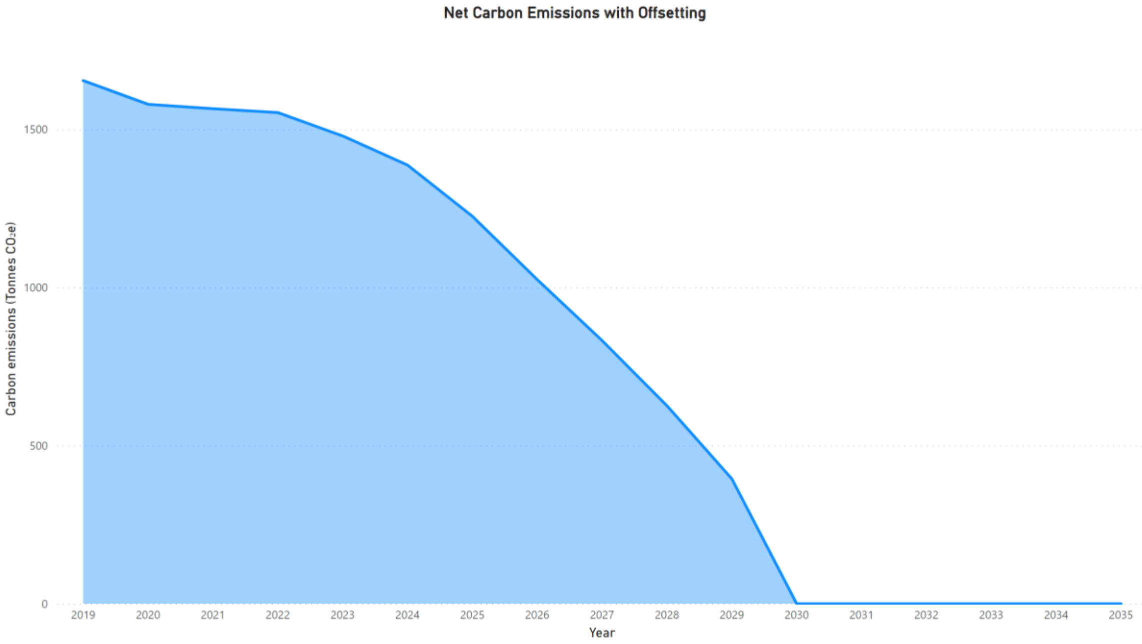
The installation of 500 kWp PV would leave 114 tCO_2e of unavoidable emissions by 2030 that the Council needs to offset to attain net-zero status. Carbon offsetting through tree planting schemes could allow the Council to be carbon neutral by the target year following recommendations to reduce environmental impacts. The Council can enter into agreements to purchase carbon units (credits) from a number of verified Woodland Carbon Unit (WCU) or Pending Issuance Unit (PIU) providers/project developers listed on the UK Land Carbon Registry, which could then be used to compensate for unavoidable emissions in carbon reporting.

The cost of offsetting 1 tonne of CO_2 in British woodlands was referenced from The Woodland Trust – a verified project developer. Based on this pricing information (£25/tCO_2), it would cost the Council £2,850 to balance the remainder of its emissions and be net zero carbon by the 2030 reporting year. Despite this, carbon emissions would need also need to be offset in years following the Council's net-zero target year of 2030, which would incur additional charges. Conversely, the Council could opt to grow its own carbon units on its estate and have the project validated in accordance with the Woodland Carbon Code (WCC) standards. The PIUs from the scheme are then converted to WCUs as the trees grow and sequester carbon. The Council could be eligible to obtain grants to support its tree planting scheme from available agroforestry schemes.

A detailed feasibility study is required to identify the most suitable WCU/PIU project developers to suit the Council's needs; and a detailed feasibility is required if the Council opts to grow its carbon units to understand the land requirement, tree species, availability of grants, and potential for carbon sequestration by the programme.

The following graph shows the pathway for net zero carbon which includes reducing carbon initiatives and installing ASHP combined with offsetting measures. The graph shows that the Council will be net zero in 2030 if it offsets the unavoidable 157 tCO_2e via the suggested pathways. The amount of carbon to be offset in subsequent years continues to fall as the carbon factor of the electricity grid decreases with grid decarbonisation (refer to Appendix B).

Figure 9: CO_2e emissions with offsetting measures under the ASHP scenario



6.3 Forecast Capital Cost with ASHP

Investing in energy efficiency projects and power generation will, in most cases, have a positive financial benefit with a good return on investment (ROI). The Council should set its own guidelines on a cap for ROI to measure the viability of projects.

Grid-supplied electricity and gas rates are taken from BEIS modelling published in June 2021[5]. Market conditions have changed drastically since this time for several reasons and largely due to the war in Ukraine. It is therefore likely that the forecast energy rates provided are outdated, but this was still the best source to use at the time of writing.

The future grid export rates are based on the current price and increased by 2.5% annually.

[5] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Table 6: Forecast capital cost and financial savings from initiatives under ASHP scenario

Intervention	Capital cost of intervention	Accumulative cost saving up to 2030	Annual saving of intervention in 2030	tCO_2e Savings in 2030 vs 2019
Transition from Gas Boilers to ASHP and heat-based interventions*	£4,693,400	£115,500	£34,091	432
Transition to ULEV Vehicle + Agricultural machinery	£4,458,333	£507,500	£142,060	342
Transition to Electric Machinery	Unknown	-£33,500	-£8,916	22
Electricity Saving from energy efficiency	£129,200	£82,800	£22,451	104
Building PV (200 kWp by 2030)	£180,000	£102,200	£27,727	17
Land Based PV (500 kWp by 2030)	£450,000	£120,000	£34,278	43
Energy Efficiency (Leased Assets)*	£3,177,127	£236,300	£66,905	579
Electric Vehicle Charge Point	£180,000	N/A	N/A	N/A
Tree Planting	£2,850	N/A	N/A	114
Total	**£13,270,909**	**£1,130,800**	**£318,600**	**1,652**

*Represents the cumulative figures from implementing energy saving recommendations and heat-based interventions, in addition to transitioning gas boilers to ASHPs for Leased Assets.

This shows that the forecast capital cost to achieve the 2030 net zero goal is approximately £13.3million and the total annual savings achieved in the year 2030 would be the equivalent of £318,600.

The table above includes costs that are likely to be the responsibility of the Council and does not include Scope 3 categories. However the £13.3 million does include a budget of £3.2 million which would be required to decarbonise leased assets. Depending on the contract with the leisure operator, it is possible that this full cost may not be the responsibility of the Council.

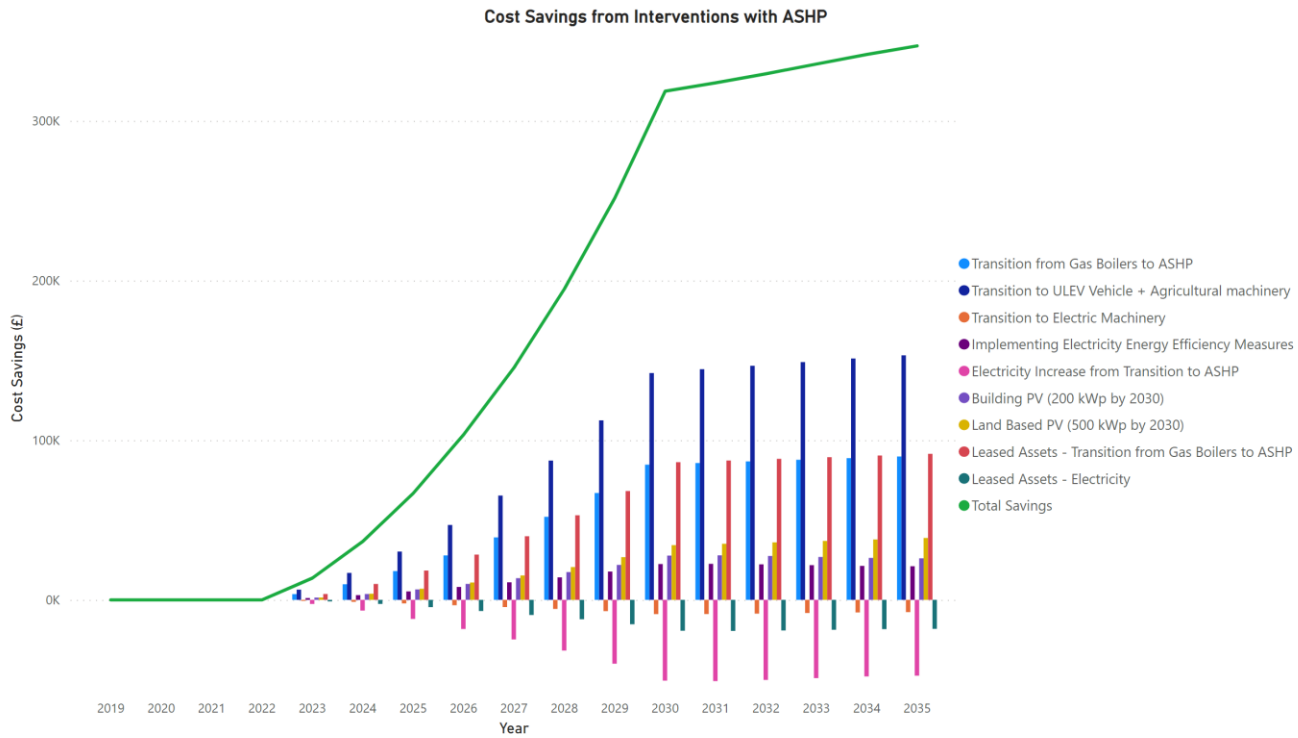
Inflation on the capital cost has not been considered in the forecast cost. It is difficult to estimate future costs of interventions as prices will increase with inflation, but the cost could also come down due to government subsidies and supply and demand particularly with heat pumps.

The calculations included in this report do not consider planned spending by the Council over the time period in question. For example, we have not factored in revenue spending the Council may have already set aside for building refurbishment, new boilers or replacement vehicles over the next few years.

6.4 Cost Savings with ASHP

The graph below shows the total savings if all initiatives/recommendations are implemented by 2030.

Figure 10: Year-to-year cost savings from interventions under ASHP scenario



The graph considers savings made through efficiency savings (insulation, controls, etc.) and installing heat pumps. It should be noted that it will generally be more expensive to run a heat pump compared to a gas boiler if no other interventions are included as the cost of electricity is typically 4 times more expensive than gas up to 2030. However, the price difference between electricity and gas is expected to close as gas is made more expensive as an incentive to move away from gas boilers.

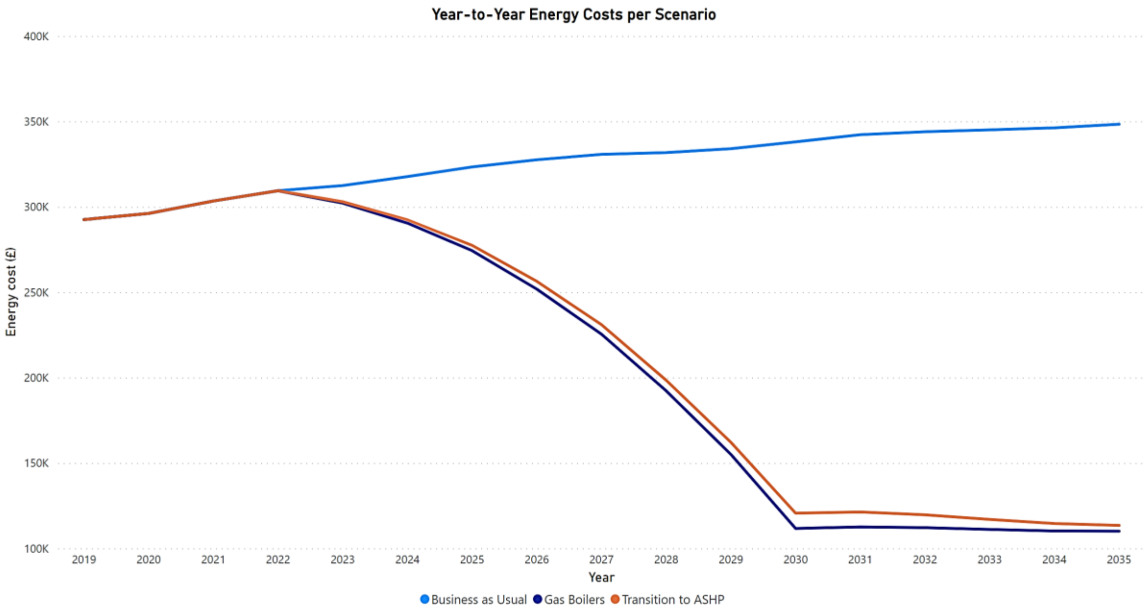
Although the 500 kWp solar farm is larger than the 200 kWp system on buildings, the financial savings are not proportional as the [current] export rate for a solar farm is much less than the savings achieved by having PV on a building (and using the generated electricity within that building) which reduces the amount of electricity purchased from the grid.

The specific payback period of transitioning fossil-fuelled vehicles to ULEV alternatives was not calculated due to the volatility in future energy prices (electricity and biodiesel) and the cost of ULEV vehicles, which cannot be accurately predicted. Additionally, a detailed study is required for each vehicle in terms of end-use and current operational schedule to suggest suitable alternatives to meet individual requirements. However, based on current assumptions, the cumulative savings from switching to ULEV would be equivalent to £507,500 by 2030.

Annual cost comparison of CO_2e scenarios between 2019 to 2035

The graph below shows the cost of energy bills for Scope 1 and 2 sources by comparing the operation of gas boilers with heat pumps as well as other interventions, and with business as usual.

Figure 11: Comparing scope 1 & 2 associated year-to-year energy costs under the different scenarios



The graph shows that the cost of energy using gas boilers is comparable with the ASHP, if all other efficiency projects are delivered. There is also an overall energy cost saving if all interventions are delivered. This is because the energy usage is decreased through energy efficiency measures such as insulation, LED lighting and solar panels. It should be noted that it is possible that the overall cost may increase if the Council only installed ASHP and do not reduce energy usage as the cost of electricity is around 4 times more expensive than gas.

7 Practicalities, affordability and comparison

7.1 Practicalities

The technologies noted in this plan are all existing, tried and test technologies. This type of equipment is currently installed and operating in many buildings and it is no longer considered 'new' technology so the risk of investing in it is minimal.

There may of course be barriers to installing it within specific buildings. This is a desk top study and there is a requirement to carry out onsite detailed surveys for each building to identify any barriers and plan a solution as a next step.

Equally the estimates made for carbon savings, electricity loads and other matters are based on data provided by the Council and surveys will help to provide more accurate estimates.

Technologies such as heat pumps and solar panels are in high demand and supply chains are impacted as a result. Equally there are issues with the number of companies and skilled operatives to install and maintain some of the technologies. This is out of the control of the Council and might have an impact on scheduling of work and the duration of projects.

These factors reinforce the benefits of having a plan in place to address the whole issue of decarbonising the Council's assets as part of a wider asset management plan. The Council will realise the importance of such plans – both as an internal policy requirement but more importantly in the context of this report, as a tool for accessing external funds such as the Public Sector Decarbonisation Scheme (PSDS).

7.2 Affordability

Allocating a budget to invest to decarbonise the Council's assets is a political decision and this report is one way of ensuring that decision is an informed one.

The cost of solar panels has dropped substantially over the past decade as rollout has increased dramatically. There is an expectation that the cost of heat pumps will follow suit but estimating by how much is impossible.

No doubt new technologies will be developed over the coming years but again it is impossible to second guess the details. These are likely to be expensive as they are introduced so may not be readily affordable for the foreseeable future in. This is exactly the position for some new technologies now. Over time prices should fall.

This report has not taken account of future planned spending on the Council's assets. A figure of £13.2m has been estimated as the cost but there will have been significant funds spent over the time period in these assets anyway. For example, replacement vehicles will have been planned for over the coming decade and those budgets could be used to take forward this agenda such as purchasing low emission vehicles. We suggest the appendices to his report are updated with such budgets.

As noted above government is focussed on heat pumps as a preferred technology and there may be financial support available in future (in addition to PSDS) but this cannot be relied upon. This focus should help to prompt a market reaction to produce more heat pumps and lead to a reduction in prices.

All of the above points highlight the importance of maintaining an accurate and up to date action plan alongside detailed asset data.

7.3 Comparison

Just over three quarters of local authorities have declared a climate emergency and the vast majority of them have identified a date by which they want to be net zero carbon. This applies to their own council operations. A smaller number have identified a date by which they want their wider district to net zero carbon. Often the declaration was made and a date identified prior to work being carried out to inform the decision to declare an emergency or date.

Oadby and Wigston Borough Council are in a positive position in this regard. A climate emergency has not been declared nor a date set by the Council so they can use the information in this report to do so if they wish although there is no legal requirement to set a date.

It is difficult to compare other than generically one authority's approach with others due to differences in scale, historic investment, asset ownership and condition, political views, geography and other factors. Nottingham are considered to be at the vanguard and have a significant team in place and many years of treating the agenda as a political priority. On the other hand, Clackmannanshire Council is one of the smallest in the UK and is taking forward a partnership project with a neighbouring council and university to address climate change. In other words, there is a wide range of activity taking place.

Factors to consider when looking at the Council's approach are as follows:

- Informing/training all in the authority (officers and members) about the importance of this agenda in their daily deliver of services, project work and investment decisions;
- Avoiding the position where a single person or team is considered the sole area of responsibility/knowledge for this agenda;
- Establishing an appropriate process for collating, analysing and reporting relevant data on performance and assets;
- Prioritising activity to address decarbonisation – address the biggest emitters and where most benefit can be gained first;
- Understanding which actions should be funded by revenue funding, reserves, PWLB or other funding (such as PSDS);
- Planning well in advance for external funding.

8 Conclusion

It is recommended to report annually on the progress of reducing carbon emissions for Scope 1, 2 & 3.

Emissions from the Council's own operations should be calculated using the methodology in this report and policies and procedures should be put in place to record the raw data needed to calculate emissions as it is made available rather than trying to retrieve the data in bulk retrospectively.

Further investigations are recommended to calculate Scope 3 emissions such as purchased goods and services, waste, and employee commuting and what initiatives could be applied to reduce emissions. Overall emissions will increase when adding in additional sources as data quality improves.

The trajectory and savings detailed in Appendix B and the wider programme can be used as a benchmark to track the performance of reducing emissions against the 2019/20 baseline year.

The Paris Climate Agreement aims to keep global temperature increases well below 2°C and pursuing 1.5°C. This calls for organisations to set a 'carbon budget' which is a term used to indicate the maximum amount of carbon an organisation can produce over a period of time to stay within the Paris Agreement. This often requires setting a science-based target and carbon budget.

The minimum reduction required for targets in line with well-below 2°C scenarios is 2.5% in annual linear terms over 15 years. Organisations are strongly encouraged to adopt targets with a 4.2% annual linear reduction to be aligned with limiting warming to 1.5°C, which is a reduction of 63% over 15 years. This carbon trajectory should reduce emissions by 79% between 2019 and 2030.

The buildings in this carbon trajectory report were not subject to an energy audit as this report is a desktop study performed without detailed knowledge of the building estate and is based on rule of thumb and engineering and industry experience. A detailed energy audit should be provided for each building to provide a clear action plan of what interventions can be provided, their capital cost, funding opportunities and the cost/carbon savings.

Exclusions due to insufficient data

Business mileage (travel) incurred in all modes of travel (i.e. road, rail, air, water) not owned and operated by the Council including hotel stays.

Employee commuting to and from work in vehicles not owned or operated by the Council could contribute significantly to a council's carbon emissions, especially in situations where remote or hybrid working (teleworking) is not common. Additionally, in home working cases, the emissions resulting from electricity and heat usage from the remote location and any work-related activities would also need to be accounted for. However, as the electricity grid decarbonises, it is expected that associated emissions from remote work will also reduce. Moreover, instituting remote work could reduce operational costs for electricity and gas usage in Council offices.

Vehicles

A detailed feasibility study is required to more accurately convert the carbon savings of transitioning from diesel vehicles to low emission vehicles. This is particularly prominent for refuse collection vehicles as a large portion of the fuel energy used is for lifting and crushing waste rather than travelling long distances.

The capital costs include a sum for EV charge points. The cost does not include any additional costs for upgrading the electrical infrastructure as this is included in the heat pump costs. Planning for future electricity demand is important so that upgrading a grid connection is a one-off event even though installation of heat pumps and EV chargers in the same building may be separated by a number of years.

We have also not included any increases to electricity usage as it is unknown what the charging capacity is likely to be, i.e. how many vehicles will be charging each day. If a lot of vehicles are charged at council buildings, then this will increase the electricity consumption and associated emissions.

Water Supply and Wastewater

The total volume of water supplied and wastewater effluent by the Council has not been provided. Nevertheless, simple measures can be taken to reduce water usage and cost such as installing low flow appliances and fixing leaks. However, such data can be included in the carbon reporting and forecasting if made available in the future.

It is recommended that the Council enter a consolidated water contract so that all water utilities are on a group contract for both supply and wastewater. Conditions of the contract could be that Automatic Meter Readers (AMR) are installed which will improve the accuracy of billing and can also be configured to identify leaks quickly.

Supply Chain

The supply chain for purchased goods and services is likely to make up a significant proportion of Scope 3 emissions. It is recommended that the Council starts to set up the processes and procedures to require carbon data from relevant suppliers that make up the bulk of the Council's purchases.

Reference should be made to Appendix C, which illustrates the 15 categories under the umbrella of Scope 3 emissions. Proper tracking and data gathering of the associated emission sources would give the Council a holistic understanding of all emissions associated with activities across their value chain.

Glossary

Term	Definition
Carbon dioxide equivalent (CO_2e)	The carbon dioxide equivalent (CO_2e) allows the different greenhouse gases to be compared on a like-for-like basis relative to one unit of CO_2 and includes the seven greenhouse gases with the greatest global warming potential (GWP).
Carbon footprint	A carbon footprint measures the total greenhouse gas emissions caused directly and indirectly by a person, organisation, event or product. A carbon footprint is measured in tonnes of carbon dioxide equivalent (tCO_2e).
Council Vehicles	Vehicles that are owned or controlled by the Council. This does not include employee-owned vehicles that are used for business purposes.
Electricity	Electricity used at sites owned/controlled by the Council. This is reported as a Scope 2, indirect emission. The conversion factors used are for the electricity supplied by the grid that the Council purchase - they do not include the emissions associated with the transmission and distribution of electricity.
Employee Vehicles	Travel for business purposes in assets not owned or directly operated by the Council. This includes mileage for business purposes in cars owned by employees, public transport, hire cars etc.
Energy carrier	Energy carriers are transmitters of energy including electricity, solid, liquid, and gaseous fuels. They occupy intermediate steps in the energy-supply chain between primary sources and end-use applications.
[Natural] Gas	Primary fuel sources combusted at a site or in an asset owned or controlled by the Council.
Pending Issuance Unit	A Pending Issuance Unit (PIU) is effectively a 'promise to deliver' a WCU in future based on predicted sequestration. It is not 'guaranteed', and cannot be used to report against UK-based emissions until verified. However, it allows companies to plan to compensate for future UK-based emissions or make credible CSR statements supporting woodland creation. $1\ \text{PIU} = 1\ \text{tonne of Carbon Dioxide equivalent that will be sequestered in future}$
Transmission and Distribution	Transmission and distribution (T&D) factors are used to report the Scope 3 emissions associated with grid losses (the energy loss that occurs in getting the electricity from the power plant to the premises).
Wastewater	Water returned into the sewage system through mains drains.
Water Supply	Water delivered through the mains supply network.
Well-to-tank	Well-to-tank (WTT) conversion factors are used to account for the upstream Scope 3 emissions associated with extraction, refining and

	transportation of the raw fuel sources to an organisation's site (or asset), prior to combustion.
Woodland Carbon Code	Woodland Carbon Code (WCC), a trademark of Scottish Forestry, is the standard that ensures projects are independently validated/verified and represented on the UK Land Carbon Registry.
Woodland Carbon Unit	A Woodland Carbon Unit (WCU) is a tonne of CO_2e which has been sequestered in a WCC-verified woodland. It has been independently verified, is guaranteed to be there, and can be used by companies to report against UK-based emissions or to use in claims of Net Zero emissions. $$1\ WCU = 1\ tonne\ of\ carbon\ dioxide\ sequestered$$

Appendix A – Carbon Footprint Calculations

(Separate Spreadsheet)

Appendix B – Carbon Trajectory Report

(Separate Spreadsheet)

Appendix C – Data that should be gathered to report on Scope 3 emissions

The reporting of Scope 3 emissions is discretionary. The table below provides further guidance on the information required to calculate emissions from Scope 3.

Item	Category	Details Required
1	Purchased goods and services	This category includes all upstream (i.e. cradle-to-gate) emissions from the production of products purchased or acquired by the Council in the reporting year. Products include both goods (tangible products) and services (intangible products). This category includes emissions from all purchased goods and services not otherwise included in the other categories of upstream scope 3 emissions (i.e. category 2 through category 8 below). Cradle-to-gate emissions include all emissions that occur in the life cycle of purchased products, up to the point of receipt by the Council. Cradle-to-gate emissions may include: • Extraction of raw materials • Agricultural activities • Manufacturing, production, and processing • Generation of electricity consumed by upstream activities • Disposal/treatment of waste generated by upstream activities • Land use and land-use change • Transportation of materials and products between suppliers • Any other activities prior to acquisition by the reporting company Relevant purchases to the Council may include capital goods, such as office supplies, office furniture, computers, telephones, travel services, IT support, outsourced administrative functions, consulting services, janitorial, landscaping services, maintenance, repairs and operations.

		For accurate carbon reporting emissions, the Council should request cradle-to-gate emission factors for materials used by suppliers to produce purchased goods such as Environmental Product Declarations (EPDs). It is likely that many suppliers will not be able to provide all the emission data. If an EPD cannot be provided, supplementary information required includes the volume of product (kg) and the carbon emission factor (kg CO_2e). A policy should be developed so that suppliers in the supply chain are required to provide this data as part of the contract, where the volume of goods is noteworthy.
2	Capital goods	Capital goods are final products that have an extended life and are used by the Council to manufacture a product, provide a service, or sell, store, and deliver merchandise. Capital goods are treated as fixed assets or as plant, property, and equipment (PP&E). Examples of capital goods include equipment, machinery, buildings, facilities, and vehicles. The required information is the same as Category 1 above. A policy should be developed so that suppliers in the supply chain are required to provide this data as part of the contract.
3	Fuel- and energy related activities (not included in Scope 1 or Scope 2)	Transmission and distribution (T&D) losses have been included and calculated from the data provided in Scope 2.
4	Upstream transportatio n and distribution	Category 4 includes emissions from: • Transportation and distribution of products purchased in the reporting year, between suppliers and its own operations in vehicles not owned or operated by the Council. • Third-party transportation and distribution services purchased by the Council in the reporting year (either directly or through an intermediary), including inbound logistics, outbound logistics (e.g. of sold products), and third-party transportation and distribution between the Council's own facilities. The Council requires data on: • Quantities of fuel (e.g., diesel, petrol, jet fuel, biofuels) consumed

		• Amount spent on fuels • Distance travelled • Vehicle type This may include managed assets - Vehicles that are used by the Council but are not owned by the organisation and generally do not appear on the organisation's balance sheet, for example, maintenance contractor vehicles, outsourced refuse and recycling trucks, road sweepers, grounds maintenance mowers etc. A policy should be developed so that suppliers using their own vehicles are required to provide this data as part of the contract.
5	Waste generated in operations	This includes emissions from third-party disposal and treatment of waste generated in the Councils owned or controlled operations in the reporting year. This category includes emissions from disposal of both solid waste and wastewater. The Council should request volume and emissions data from the waste treatment company applicable to **its own waste stream**. If this cannot be provided, the emissions can be calculated by requesting the volume of waste, type and disposal method: Example of data required: Total weight (kg) of waste type and disposal method e.g. • 5,000kg municipal waste to landfill • 500kg organic garden waste to composting • 1,000kg metal recycled • 1,000kg plastic recycled • 1,000kg paper recycled Data is required for the volume of supply and wastewater in cubic metres (m^3) from water bills. Local authorities have an important role in waste prevention and sustainable waste management through awareness-raising campaigns, providing separate collection for recycling and food waste, and implementing waste-to-energy schemes. It is therefore voluntary on whether the Council choose to include the emissions from waste associated with the whole borough, or just the Council's own operation.

6	Business travel	Travel for assets not owned or directly operated by the Council. This includes mileage for business purposes in cars owned by employees, public transport, hire cars etc. Require details for: <u>Vehicle</u> Fuel type, size of vehicle and distance for: • Car • Motorbike • Taxis • Bus • Rail <u>Flights</u> • Airport travelled to/from • Number of passengers • Class type • Distance <u>Ferry</u> • Foot or car passenger • Distance
7	Employee commuting	This category includes emissions from the transportation of employees between their homes and their worksites. Emissions from employee commuting may arise from: • Car • Bus • Rail • Other modes of transportation Staff would be required to provide method of transport and distance travelled. It may be difficult and time consuming to collect accurate data.
8	Upstream leased assets	This category is applicable from the operation of assets that are leased by the Council. If the Council procures the energy then this should be considered as Scope 1 and 2. If the landlord is responsible for the Scope 1 and 2 emissions, the Council should include the reporting under Scope 3. An example may include an office that the Council lease from a

		private landlord. All energy bills may be included as part of the lease and the energy contract is under the name of the landlord. The Council should therefore request the energy data from the landlord and include this under Scope 3. Data required include the Scope 1 and 2 data from the leased asset.
9	Downstream transportatio n and distribution	This category includes emissions that occur in the reporting year from transportation and distribution of sold products in vehicles and facilities not owned or controlled by the Council in the reporting year. It is assumed that this category is not applicable to the Council as it does not manufacture and sell products.
10	Processing of sold products	It is assumed that this category is not applicable to the Council as it does not manufacture and sell products.
11	Use of sold products	It is assumed that this category is not applicable to the Council as it does not manufacture and sell products.
12	End-of-life treatment of sold products	It is assumed that this category is not applicable to the Council as it does not manufacture and sell products.
13	Downstream leased assets	This category is applicable where the Council is the landlord to a lessee. If the Council procures the energy on behalf of a lessee then this should be considered as Scope 1 and 2. An example of this is where the Council may lease a premises to a lessee and include all energy costs as part of the lease. The energy contract is under the name of the Council and is therefore reported under Scope 1 and 2. If the lessee is responsible for the Scope 1 and 2 emissions, the council should include the reporting under Scope 3. An example of this is a shop that the Council own and the occupant pays for the energy bills and the contract is under their name. The Council should request the energy data from the shop occupier and report this under Scope 3. Data required include the Scope 1 and 2 data from the leased asset.

14	Franchises	It is assumed that this category is not applicable to the Council as it does not operate any franchises.
15	Investments	This category includes scope 3 emissions associated with the Council's investments in the reporting year, not already included in scope 1 or scope 2. This category is applicable to investors (i.e. organisations that make an investment with the objective of making a profit) and organisations that provide financial services. This category also applies to investors that are not profit driven (e.g. multilateral development banks). Investments are categorised as a downstream scope 3 category because providing capital or financing is a service provided by the organisation. Category 15 is designed primarily for private financial institutions (e.g., commercial banks), but is also relevant to public financial institutions (e.g., multilateral development banks, export credit agencies) and other entities with investments not included in scope 1 and scope 2. The Councils scope 3 emissions from investments are the scope 1 and scope 2 emissions of investees. For purposes of greenhouse gas accounting, this standard divides financial investments into four types: • Equity investments • Debt investments • Project finance • Managed investments and client services An example of the information required is the Scope 1 and 2 emissions from the bank where an investment is in place. This is based on the Council's proportional share of investment in the investee. If the Council has £1million invested in the bank and the banks total investments amount to £100million, the Council should report on 1% of the banks Scope 1 and 2 emissions. It is assumed that this information will be difficult to collate from third parties and that the total emissions will be proportionally small compared to other emission sources and these emissions could be excluded from the reporting.