East Lindsey District Council

Carbon Reduction Plan

August 2020

Context

Growing acknowledgement of the latest science and recommendations from the Committee on Climate Change have resulted in unprecedented recognition of the global climate emergency and the need to act urgently in order to reduce carbon emissions to limit further global warming and associated environmental impacts. Global initiatives are now focused on limiting warming to well below 2^{o}C, aligning to the pledges outlined in the Paris Agreement. Despite this, warming continues, with the impacts being felt both nationally and internationally. Across the UK, continued warming is projected to make winters warmer and summers hotter and drier. Sea levels will also continue to rise and threaten many coastal communities across the country. Many industrial and farming processes will also be affected by a continuation of rising temperatures, exacerbating impacts that warming will have on communities across the UK.

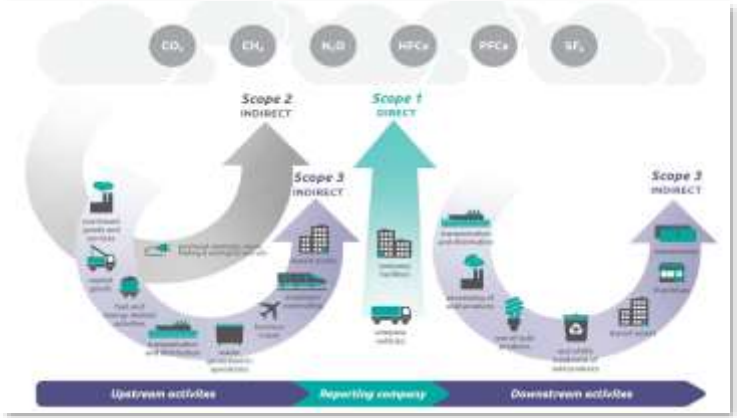
In 2019, the UK Government became the first major economy in the world to pass laws to end its contribution to global warming by 2050 by setting a target of achieving net zero emissions by 2050. Local authorities have a crucial role to play in developing effective pathways towards reducing their emissions, which. If successfully achieved, will help to reduce climate impacts at both the local and national scale as well as delivering public health co-benefits resulting from cleaner air and leading a more active lifestyle .

East Lindsey District Council recognises the significant role it can play in helping to accelerate the national transition towards developing a low carbon economy and has included a strategic aim within its new corporate strategy to *adapt to meet the challenge of a changing natural environment*. This report has been commissioned by the Council to help achieve their carbon reduction targets.

Contents

Executive summary

- This Carbon Reduction Plan forms a key step in East Lindsey District Council's (ELDC) response to the climate crisis and sets out a number of strategic actions that ELDC should work towards in order to achieve their carbon reduction target. ELDC previously developed a Carbon Reduction Plan in 2009, which has now been updated to reflect the Council's new climate commitments.
- To lead by example and encourage the District as a whole to undertake similar steps, ELDC is committing to an ambitious target of reducing its carbon emissions to net zero by 2040, with a minimum emissions reduction of 45% by 2027.
- Achieving the target will reduce emissions from 2,583 tCO_2e in 2019 to 1,421 tCO_2e/year in 2027, before progressing to net zero by 2040**.** Moving towards this ambition will solidify ELDC's recognition of the wider climate crisis we are all facing, whilst showing the Council's local leadership role in climate change action.
- This action plan suggests a number of projects that, alongside the expected decarbonisation of the national electricity grid, will contribute to the Council achieving its carbon reduction target.



Overview of the World Resource Institutes GHG Protocol accounting methodology

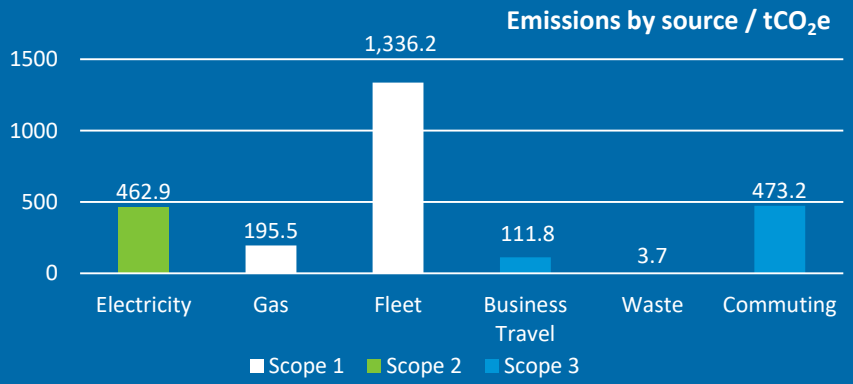
Emissions included within the carbon footprint and targeted with projects:

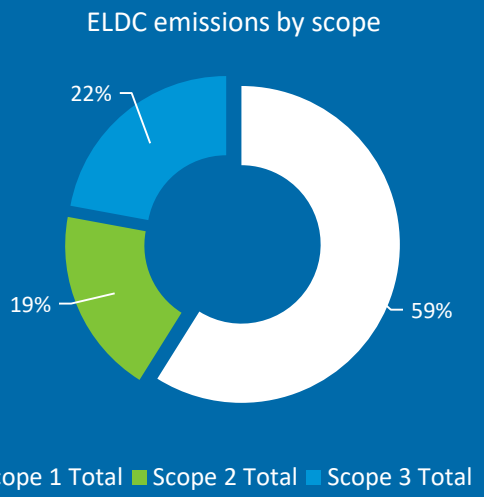
Scope 1	• Gas consumption for space and water heating in buildings	• Council vehicle fleet fuel consumption
Scope 2	• Electricity consumption in buildings	
Scope 3	• Emissions from employee commuting • Business travel in non-Council fleet vehicles	• Third-party disposal and treatment of waste generated in Council-controlled operations

Carbon footprint overview

East Lindsey District Council's carbon footprint for the calendar year 2019 was calculated to be **2,583 tCO_2e.** Six emissions categories make up this total carbon footprint:

1. **Fuel consumption** in the Council's fleet (1,336 tCO_2e)
2. **Gas consumption** in buildings (196 tCO_2e)
3. **Electricity consumption** in buildings (463 tCO_2e)
4. **Employee commuting** (473 tCO_2e)
5. **Business travel** (112 tCO_2e)
6. **Waste emissions** (4 tCO_2e)





- The carbon reduction target set by the Council contains all of the stated emission categories here, including selected scope 3 emissions (business travel, waste and commuting) from sources outside of the Council's direct operational control.
- These Scope 3 emissions make up 22% of the total footprint. The Council will therefore have to integrate carbon management in its interactions with contractors, employees and operators to achieve its decarbonisation targets, as well as focusing on the assets under their operational control.

Carbon reduction opportunities overview

To achieve the first emissions reduction target of 45% by 2027 the Council needs to reduce scope 1, 2 and selected scope 3 emissions by approximately 194 tCO_2e /year. The Council will then have to decarbonise at a rate of 109 tCO_2e /year between 2027 and 2040 in order to achieve net-zero by 2040. The following target areas have been identified across the Council, with relevant reduction opportunities identified for each. These projects will assist ELDC on the pathway towards the goal:

Public lighting

Upgrading street and promenade lighting under ELDC's control to LED and introducing advanced controls

Fleet electrification

Replacing existing internal combustion engine vehicle fleet with battery powered electric vehicles

Fleet management

Roll out of regular driver training and comprehensive telematics

Council buildings

Roll out of energy efficiency and renewable energy measures

Council offices

Centralised or remote control and monitoring of HVAC* systems

Commuting and travel

Encouraging low carbon transport modes and mileage management strategies

The projects identified in this plan have the potential to reduce ELDC emissions from 2,583 tCO_2e/year to just 15 tCO_2e/year by 2040.

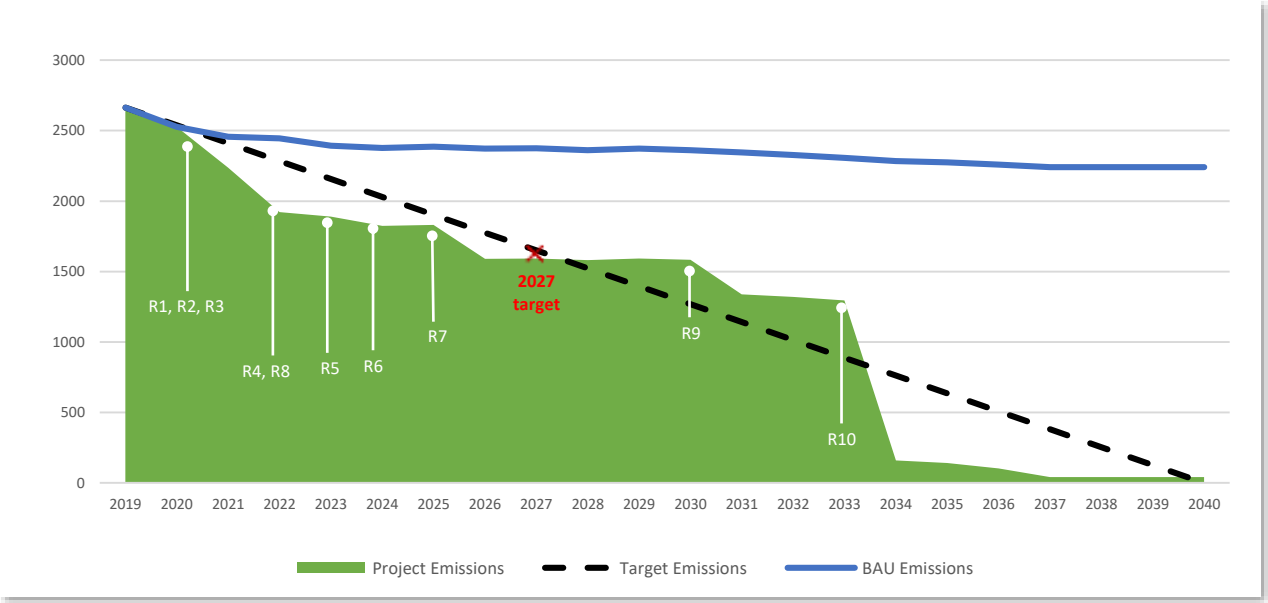
The total estimated cost to implement the above projects is approximately £301,100, not including any costs associated with improvements required to decarbonise the refuse Heavy Goods Vehicle (HGV) fleet or replacing Tedder Hall with a more energy efficient office site. The project proposals in this plan have been based on high level and remotely accessed information and benchmarks. All projects will require full feasibility assessments to be undertaken to establish a detailed cost-benefit analysis.

* Heating Ventilation Air Conditioning (HVAC)

Overview of the Carbon Reduction Pathway

Projection of total ELDC business as usual emissions, the effect of proposed projects and the 'net-zero by 2040' target

NB. projected UK grid electricity decarbonisation is included within the BAU pathway



R1 – Energy Management
R2 – Mileage Management
R3 – Driver Training
R4 – Remote HVAC* Systems
R5 – Fan and Pump Upgrades
R6 – LEDs
R7 – Vehicle Fleet Electrification
R8 – Tedder Hall & Skegness Town Hall to be replaced
R9 – Space Heating Electrification
R10 – Refuse Fleet Electrification

* Heating Ventilation Air Conditioning (HVAC)

Greenhouse Gas Removals

Meeting ELDCs net-zero 2040 target will need more than just extensive cuts to emissions. It will also require the active removal and storage of Greenhouse Gases (GHGs) from the atmosphere in a process known as GHG removal. GHG removals are a carbon offset mechanism for cancelling out GHG emissions through anthropogenic methods. These include methods such as growing forests, enhancing mineral weathering and direct capture of CO2 from the air.

ELDC has committed to a **net-zero** target, which requires any residual emissions to be addressed using greenhouse gas (GHG) removals only. This is in contrast to a **carbon neutral** target under which avoided emissions carbon offsets (e.g. investing in renewable energy projects) are also permissible.

The exact level of GHG removals required by ELDC is still not clear and guidance is expected to progress between now and 2030. (The World Resource Institute and the Carbon Trust are developing a new accounting standard for GHG removal, which is due for public comment in 2021). It is recommended that the Council agree on several principles around which a specific GHG removal strategy can be built as the sector develops. Any strategy should include the principles of:

a. **Reductions before removal.** GHG removal should only be explored after efforts to achieve reductions within an organisation's emissions boundary have been fully explored.
b. **Additionality.** The reductions achieved should be additional to what would have happened in the absence of the project.

Next steps

Building on the analysis and suggestions provided throughout this action plan, it is now important for ELDC to conduct a further, more detailed feasibility assessment of individual project opportunities. This will ensure that the Council is able to quantify appropriately and take forward more confidently the provisional opportunities identified here. Considering the current emissions ‘hot spots’ (certain Council-owned buildings and fleet), ELDC should prioritise and coordinate efforts towards these emissions sources in the first instance, using the contents of this Carbon Reduction Plan for further iterations of project development.

The Council should use the initial quantifications provided (energy, carbon and cost-saving potential) as a building block for the development of further detailed business cases going forward. The information shown in this plan should be clearly communicated - along with explanation of the limitations to what has been done - and shared with key decision makers across the organisation.

Putting in place an early immediate action plan to build on the findings of this Carbon Reduction Plan will help to ensure carbon reduction remains a key part of the Council’s agenda going forward, also allowing the necessary budgets and organisational/governance structures to be developed accordingly.

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Section 1: Council target

East Lindsey District Council has set a target of reducing its carbon emissions to net zero by 2040, with a minimum emissions reduction of 45% by 2027. This target covers a range of emissions sources that are under both direct and indirect control of the Council (Table 1).

The ambition of East Lindsey District Council's carbon reduction target demonstrates the Council's intention to act against the causes and impacts associated with climate change. The Council must now work towards reducing its carbon footprint in order to achieve its targets, building and accelerating on the emissions reductions that have previously been achieved across the organisation. This plan therefore details initial actions and key mechanisms required in order to work towards reducing emissions by at least 45% by 2027. It builds on the Carbon Reduction Plan developed by ELDC back in 2009 and reflects the Council's newly declared climate commitments, progress and latest developments.

The first step in developing this action plan is establishing an up-to-date carbon baseline, particularly as some of this data has not been collected previously for ELDC. This baseline provides the reference from which to start a full analysis of the current emissions, their magnitude and who is responsible for them.

Scope 1	• Natural gas • Vehicle fleet
Scope 2	• Electricity
Scope 3	• Operational waste • Business travel • Employee commuting

Table 1: Footprint boundary for East Lindsey District Council's net zero target

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Section 2: Carbon footprint overview

East Lindsey District Council has set a target of reducing its carbon emissions by at least 45% by 2027, as well as endeavouring to become net-zero carbon by 2040. These targets cover emissions sources that are under direct and indirect control of the Council (Table 1, previous page).

This section provides an inventory of ELDC greenhouse gas emissions for the calendar year 2019 – the 'baseline' against which future progress will be evaluated.

Scope

ELDC's footprint has been calculated according to the World Resources Institute (WRI) Greenhouse Gas (GHG) Protocol, and aligns to the following accounting definitions:

- Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity
- Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity

The GHG Protocol further categorises these direct and indirect organisational emissions into three broad scopes (Figure 1):

- **Scope 1:** All direct GHG emissions
- **Scope 2:** Indirect GHG emissions from consumption of purchased electricity, heat or steam
- **Scope 3:** Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities not covered in Scope 2 (e.g. transmission and distribution losses) , outsourced activities, waste disposal, etc.

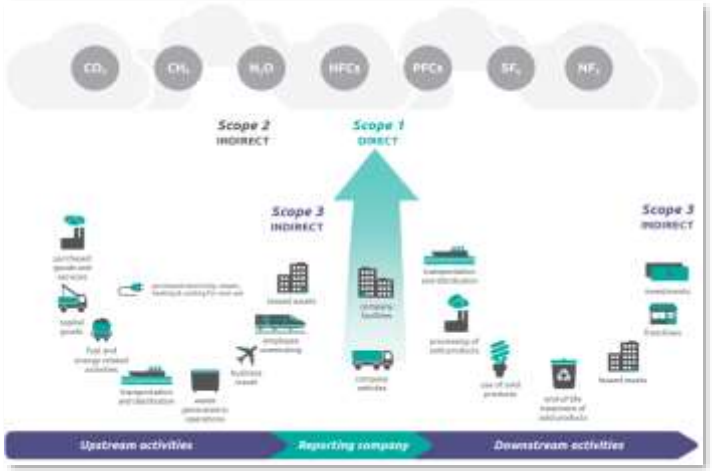


Figure 1: Overview of the World Resource Institute's GHG Protocol accounting methodology

Section 2: Carbon footprint methodology

In carbon footprinting a common unit of carbon dioxide equivalent (CO_2e) is used, which allows the impact of each of the seven main greenhouse gasses to be expressed in terms of the amount of CO_2 that would create the same amount of warming.

A carbon footprint is calculated by multiplying activity data (e.g. litres of vehicle fuel, kWh of electricity/gas) by an associated emissions factor:

- Where possible, real activity data should be collected throughout the reporting period for use in the footprint calculation.
- Emissions factors are updated annually and published by the UK Government's Department for Business, Energy and Industrial Strategy (BEIS).

If activity data is not available, various benchmarks and proxies can be used:

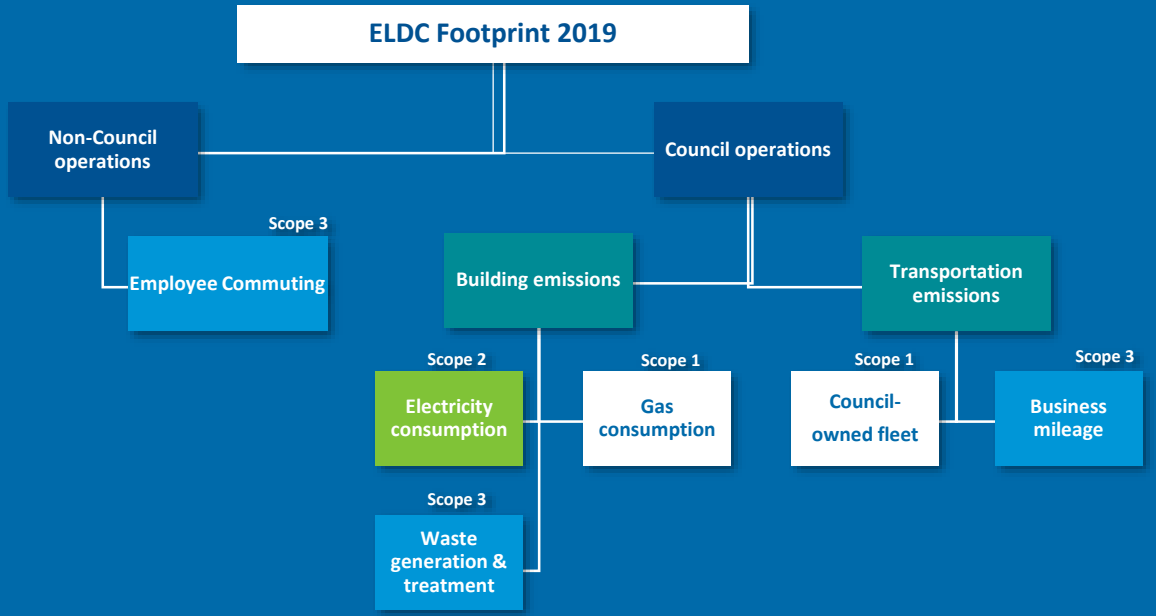
- Benchmarks can be used to approximate activity data. For example, typical electricity consumption per m^2 floor area of a building.
- When input data is scarce, proxy factors can be used in place of the BEIS factors to approximate emissions from the available input data (e.g. contract value).

Emissions are calculated by multiplying activity data by an emissions factor:

Input/ activity data	x	Carbon factor	=	Carbon emissions ($kgCO_2e$)
• kWh (utilities) • Litres or km (fuel)		• BEIS factor ($kgCO_2e$/unit)		
• £ (contract value) • m^2 (floor area)		• Proxy factor e.g. ($kgCO_2e$/£ spent)		

General calculation methodology to calculate carbon emissions

Section 2: Scope of carbon footprint



An explanation of excluded emissions is included in Appendix 1

Scope 1 emissions [S1]:

- Gas consumption, typically space and water heating in buildings
- Council vehicle fleet fuel consumption

Scope 2 elements [S2]:

- Electricity consumption throughout ELDC

Scope 3 elements [S3]:

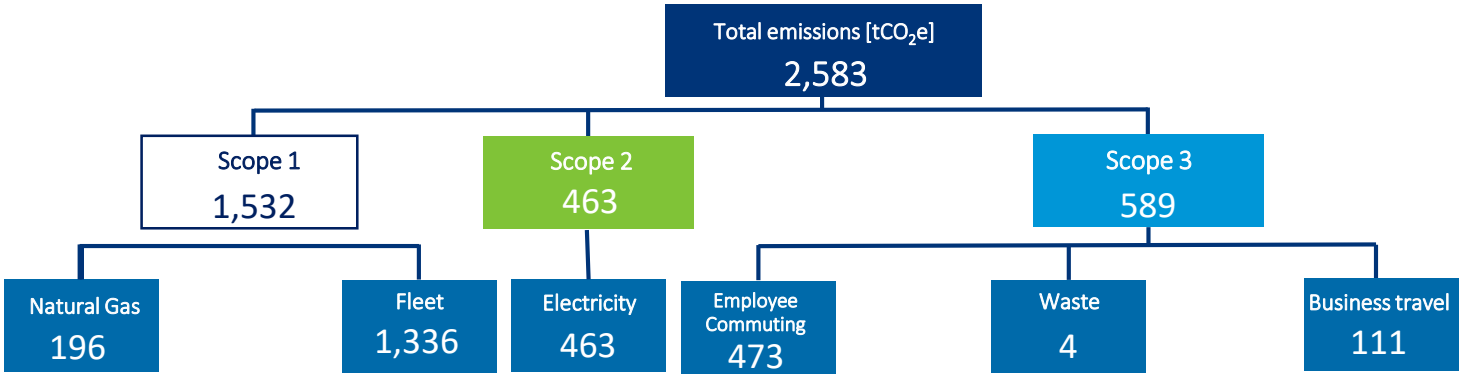
- Business travel in non-Council fleet vehicles
- Third-party disposal and treatment of waste generated in Council-controlled operations
- Employee commuting based emissions

Section 2: East Lindsey District Council Footprint 2019

In the 2019 calendar year, **2,583 tCO_2e** were emitted from the Council's own operations and associated activities.

- **Scope 1:** gas (primarily for heating buildings) and transport fuel consumption in the Council's own fleet;
- **Scope 2:** electricity consumption within ELDC buildings used by ELDC staff;
- **Scope 3:** waste generation, business travel (arising from ELDC-operated buildings, journeys completed by ELDC staff and councillors on behalf of ELDC activities) and employee commuting.

The Council will need to reduce its footprint to at least 1,421 tCO_2e by 2027 to achieve the interim 45% carbon reduction target, representing an average annual reduction of 194 tCO_2e / year until 2027. The council will then have to decarbonise at a rate of 109 tCO_2e /year between 2027 and 2040 in order to achieve net-zero by 2040.



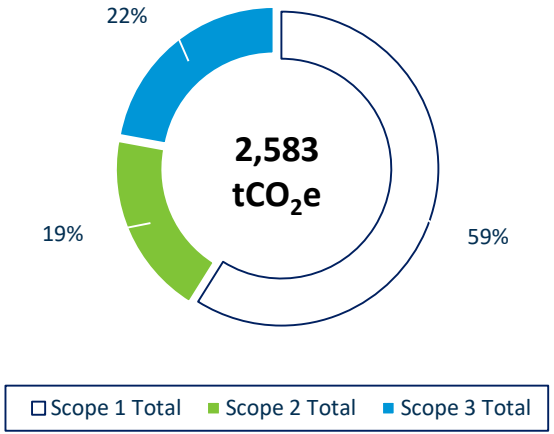
* Emissions figures have been rounded to the nearest whole number

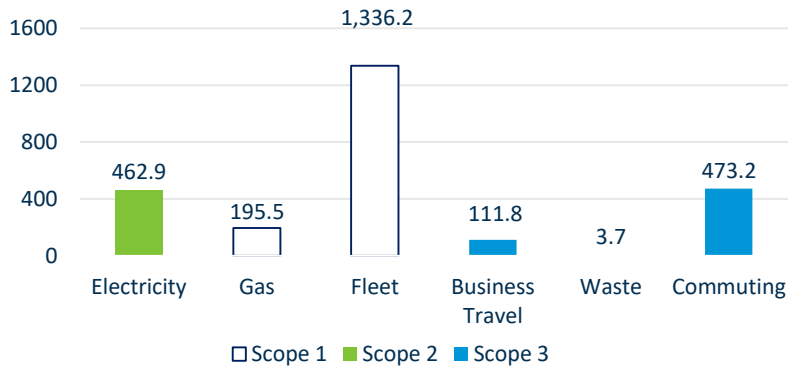
Section 2: East Lindsey District Council Footprint 2019

ELDC's footprint is primarily made up from three emissions categories (so-called emission hotspots):

- **51.7%** of emissions are associated with fuel consumption in the Council's vehicle fleet
- **25.4%** of emissions are from electricity and gas consumption in the Council's buildings
- **22.6%** of emissions come from business travel and commuting

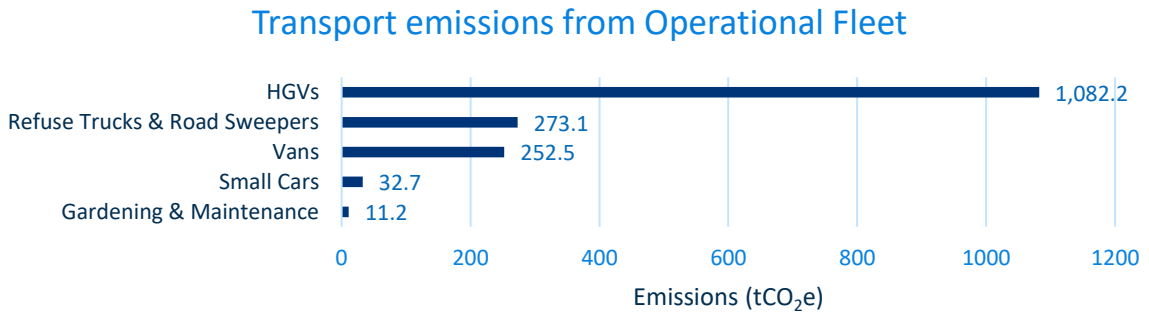
These emissions hotspots should be at the forefront of the Council's carbon reduction efforts and are the focus of the recommendations made in this report.





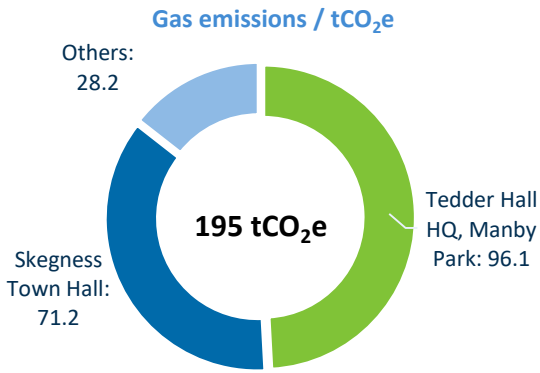
Hotspot 1: Transport Emissions from Operational Fleet

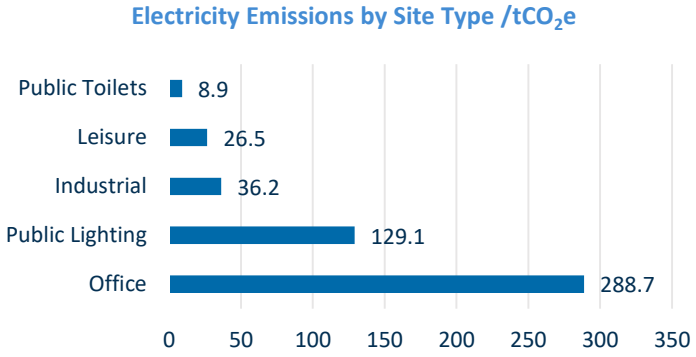
- The greatest opportunities for reducing fleet emissions come from electrification.
- East Lindsey District Council's fleet consists of approx. 101 vehicles.
- The furthest a light fleet vehicle (van or car) drives in a year is approx. 38,270 miles, assuming operation 200 days of the year, yielding a daily average of 191 miles per operational day. This is within the range of a typical electric vehicle.
- 98% of all fleet emissions arise from the use of diesel, compared to 2% from petrol. Although diesel vehicles are more efficient from a $kgCO_2$/mile perspective, they release more harmful particulate matter and more NO_X and SO_X gases – major contributors to local air pollution.
- Heavier vehicles (HGVs and refuse trucks) are currently much harder to decarbonise. In the near term, a better understanding of telematics and age and efficiency of vehicle should be considered. It may then be easier to convert fuel (to CNG for example) than to electrify.



Hotspot 2: Buildings Emissions from Gas and Electricity

- Tedder Hall HQ and Skegness Town Hall contribute approximately 86% of the Council's total gas-related carbon emissions.
- The total figure displayed in the pie chart below (195 tCO_2e) **excludes** upstream scope 3 elements related to the extraction, refining and transportation of natural gas.
- Options for mitigating emissions from gas heating include substitution with district heating systems and electric heat pumps, as well as improving building fabric materials to improve heating efficiency.
- Electricity emissions are likely to decrease year on year as more renewables are integrated into the UK national electricity grid and more coal power plants are decommissioned.
- ELDC's main offices account for the majority of electricity emissions (51%).
- Energy efficiency measures, such as replacing filament and fluorescent lightbulbs with LEDs, can aid ELDC in reducing their electricity footprint.

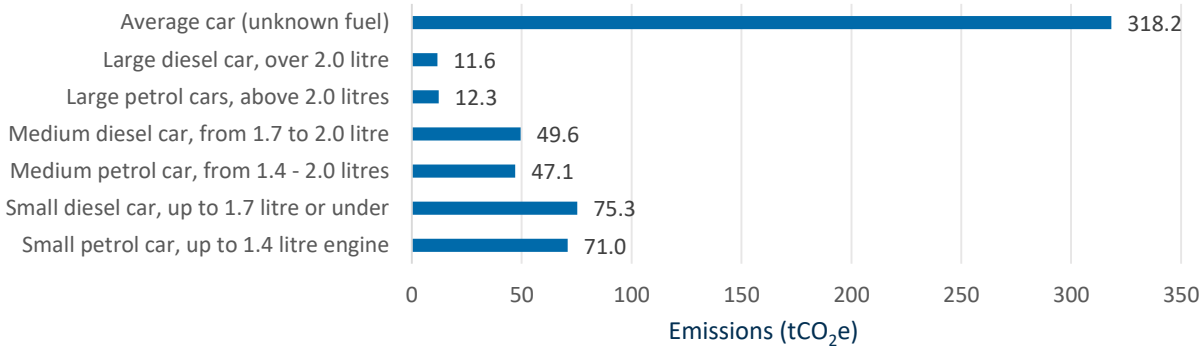




Hotspot 3: Commuting and Business Travel

- Car emissions from commuting and business travel account for a sizeable portion (22%) of ELDC's total emissions. There is clear agreement across industry, government and the public that future travel / commuter networks must emit fewer emissions and help the UK meet net-zero targets
- Strategies for reducing travel emissions include reducing the number of journeys people make, for instance by making optimal use of technology-based solutions such as video-conference calls. The coronavirus pandemic has accelerated new ways of working for organisations, from which we can learn. Flexible working practices, such as working from home where possible, offer a solution to mitigating the carbon emissions associated with commuting.
- Utilising less carbon intensive modes of travelling, such as public transport, cycling or using low-emission private vehicles, is another potential solution. These solutions can save the Council and/or its employees money, reduce congestion and improve people's health.

Emissions from Commuting & Business Travel



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Section 3: ELDC Carbon Reduction Short-term Opportunities - Summary

Projects have been phased according to the estimated cost per tonne of carbon dioxide equivalent abated (CAPEX £/tCO_2e), with the most cost efficient projects deployed first (CAPEX refers to the capital expenditure required to upgrade individual technologies/buildings).

IMPORTANT NOTE: The costs, technologies and emissions provided in this report are estimates and the order (CAPEX / tCO_2e) may be subject to change when actual quotes are received from contractors as individual technologies mature and projects progress. All suggestions are subject to further feasibility/design studies and procurement processes.

Emissions source	Recommendation	Estimated CAPEX GBP	Annual emissions saving tCO_2e	Cost efficiency £/tCO_2e	Annual cost saving GBP	Payback period years
Council offices	Improve standard of energy management & staff awareness	£0	16	£0	£3,400	instant
Commuting & travel	Mileage management	£0	56	£0	£0	instant
Vehicle fleet	Driver training & performance management	£20,200	148	£136	£46,300	0.4
Council offices	Centralised/remote control and monitoring of HVAC systems	£10,000	40	£248	£8,000	1.3
Council offices, foreshore leisure infrastructure	Fan & pump upgrades	£5,400	18	£307	£1,800	3.0
Public toilets	Upgrade public toilet lighting to LED	£3,100	8	£403	£4,300	0.7
Public lighting	Upgrade promenade lighting to LED	£6,900	11	£604	£6,900	1.2
Council offices	Full LED lighting roll out across council offices	£35,300	40	£873	£10,600	3.3
Vehicle fleet	Electrification of car & van fleet	£200,000*	230	£957	£69,100	2.9
All	**Total**	**£301,100**	**568**	**n/a**	**£149,300**	**2.0**

* Revenue figure if leased (CAPEX if purchased outright est. £1.6m). Year 1 cost estimate includes EV charging infrastructure and cost difference between leasing EVs and conventional fuel vehicles. Future year costs expected to decrease as the EV market develops.

Additional ELDC Carbon Reduction Opportunities – longer-term

The opportunities listed below are likely to require significant capital investment and some are subject to planning application and/or suitable technologies becoming available on the market. These recommendations have been set out separately from those on the previous pages as it is understood they are likely to be viewed by ELDC as longer term opportunities/investments, some of which may not be practically implementable immediately, i.e. not within the next 1-3 years.

It should be noted, however, that these measures are estimated to reduce the Council's footprint by over 50%.

Electrification of vehicle fleet and space heating systems recommendations assume that electricity is procured on renewable electricity tariffs until the UK electricity grid mix fully decarbonises.

The emissions savings provided in this report are estimates and may be subject to change if/when individual projects progress and are subject to further feasibility studies and procurement processes.

Emissions source	Recommendation	Estimated CAPEX GBP	Annual emissions saving* tCO_2e	£/tCO_2e	Annual cost saving GBP	Payback period years
Council offices	Replace Tedder Hall with new Head Office site	TBC	265	TBC	TBC	TBC
Vehicle fleet	Electrification of refuse fleet	TBC	1,097	TBC	TBC	TBC
Council offices, leisure facilities	Electrification of all space heating	TBC	233	TBC	TBC	TBC
All	**Total**	**TBC**	**1,595**	**TBC**	**TBC**	**TBC**

Council offices carbon reduction opportunities (1)

ELDC operates a number of 'office' sites (offices, town halls, business centres), which account for ~70% of the emissions associated with the Council's natural gas and electricity consumption. The largest contributor to this footprint by far is Tedder Hall, which accounts for ~58% of office-based emissions. It is understood that a proposed new-build office site will eventually become ELDC's head office, however, there remains uncertainty around the future use of Tedder Hall. It is also understood that the second largest contributor to office-based emissions, Skegness Town Hall, will not be used by ELDC as an office in the longer term. With these considerations in mind, it is not recommended that any significant investment is made at ELDC's office sites until future considerations are taken into account. However there are a number of low cost or "no regret" actions that should be considered at these sites, alongside the larger capital investment decisions that have been highlighted later in this report. These primarily concern the treatment of the energy consumption at all sites as a controllable resource (by implementing management procedures such as those outlined below); upgrading controls for heating, ventilation and air conditioning (HVAC) so that these multiple systems can be controlled and monitored remotely; upgrading fans and pumps within these systems; and upgrading fluorescent lighting to LED.

Manage energy usage

- Appointment of senior staff member at each site with responsibility for energy, and energy champions appointed
- **16 tCO_2e**/year saving
- 67,750 kWh/year saving
- £3,400/year cost saving
- Internal time only cost

HVAC control upgrades

- Centralised/remote control of HVAC systems across 9 sites
- **40 tCO_2e**/year saving
- 194,600 kWh/year saving
- £8,000/year cost saving
- £10,000 nominal cost

Fan & pump upgrades

- Replacement of ageing fans and pumps with more efficient models
- **18 tCO_2e**/year saving
- 18,600 kWh/year saving
- £1,800/year cost saving
- £5,400 nominal cost

LED lighting upgrade

- Upgrade 85% of existing fittings to LED units (remainder already LED)
- **40 tCO_2e**/year saving
- 142,800 kWh/year saving
- £10,600/year cost saving
- £35,300 nominal cost

The costs, technologies and emissions provided are estimates and the figures may be subject to change when actual quotes are received from contractors, as individual technologies mature and projects progress. *Further assumptions and information can be found in Appendix 3.*

Council offices carbon reduction opportunities (2)

As described earlier in this section, the largest contributor to the Council's 'office' carbon footprint by far is Tedder Hall, which accounts for ~58% of office-based emissions. It is understood that a proposed new-build office site will eventually become ELDC's head office. Therefore, we have modelled the impact of replacing Tedder Hall with a Building Regulations Part L2A compliant new-build office building. While actual in-use building consumption may vary, this provides a useful high level theoretical comparison against measured consumption at Tedder Hall.

Replace Tedder Hall with new head office

- **265 tCO_2e/** year 1 estimated saving
- 985,330 kWh/year saving
- 10% reduction in total Council footprint

Further assumptions and info can be found in Appendix 3.

Should the construction of the new Head Office go ahead this offers a one-off opportunity for ELDC to lock in significant and permanent carbon savings, therefore, ensuring that the building is designed to be as low carbon as possible is vitally important in ELDC's journey towards net-zero. Any increase in capital costs as a result of lower carbon design will be recouped in lifetime operational costs and avoided emissions. Achieving optimal low/zero carbon performance in a new build by design from the outset is much more practical and cost-effective - even if it means slightly higher initial capital costs - than attempting to retrofit in years to come, once the building is built and in use.

Electrification of space heating carbon reduction opportunities (3)

Electrification of the gas-fired space heating systems within Council offices and Council-operated leisure facilities represents a significant carbon reduction opportunity. While replacing (in some cases) relatively efficient gas-fired heating systems with air source heat pumps (ASHPs) is not expected to result in significant energy or cost savings, this could potentially reduce ELDC's carbon footprint by ~9%.

ASHPs can often be connected to existing infrastructure to reduce installation costs; however, a detailed evaluation of each site will be required to assess the feasibility of connecting with existing hot water pipework, radiators, ducting and so on.

A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with these measures.

N.B. Should electrification of space heating systems be implemented, the predicted savings stated elsewhere in this report from fan/pump upgrades and BEMS/heating control optimisation may need to be discounted to avoid double-counting of emissions reductions. This has been accounted for in the Carbon Reduction Pathway in this plan.

Electrification of space heating

- Replacement of gas-fired heating systems with Air Source Heat Pumps (ASHPs)
- **233 tCO_2e**/year saving
- 9% reduction in total Council footprint

Further assumptions and information can be found in Appendix 3.

Public lighting carbon reduction opportunities (4)

ELDC has responsibility for over 500 MWh per annum of public lighting across the District. Some of this, e.g. footway lighting, has already been upgraded to LED however some less efficient lighting remains. ~50,000 kWh of energy consumption relates to promenade lighting columns at Mablethorpe, which are assumed to be low pressure sodium units. No information has been received regarding their state of repair (or column upgrade needs). Based on electricity consumption data, public toilet lighting is responsible for ~36,000 kWh of electricity consumption per annum and is understood to be a mix of low and high frequency fluorescent luminaires. Energy savings of 60-80% are assumed achievable by upgrading promenade and public toilet lighting to appropriate LED alternatives. Once LEDs are installed, additional savings will also be possible through implementing "control" savings such as dimming and/or trimming. Beyond energy and carbon savings, ELDC would also benefit from reduced maintenance and lamp replacement lifecycle costs thanks to the significant additional burn hours that LED alternatives bring over traditional lighting.

Illustrative energy and cost savings for full LED upgrades are detailed below. Maintenance savings and potential savings through centralised management or trimming have not been included. A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with these measures.

Promenade lighting upgrades

- LED upgrade of existing low pressure sodium lamps
- **11 tCO_2e/**year 1 estimated saving
- £6,900 estimated capital cost (£3k/kW installed)
- 40,400 kWh/year saving
- £5,800/year cost saving

Further assumptions and information can be found in Appendix 3.

Public toilet lighting upgrades

- LED upgrade of existing fluorescent luminaires
- **8 tCO_2e/**year 1 estimated saving
- £3,100 estimated capital cost (£1.8k/kW installed)
- 27,200 kWh/year saving
- £4,300/year cost saving

Further assumptions and information can be found in Appendix 3.

Fleet management carbon reduction opportunities (5)

There are a number of driver training and performance monitoring actions that could be taken to reduce ELDC's recorded fuel use and related carbon emissions. Improvements in the performance monitoring of waste fleet drivers have been made recently (e.g. assigning drivers their own vehicle. More could still be done, however, to monitor and promote efficient driving across the waste fleet, e.g. KPIs, driver league tables, inclusion of fuel efficiency in driver performance reviews. Based on experience of supporting clients to implement driver monitoring, we have conservatively estimated that ELDC could achieve a 5% reduction in waste fleet emissions by improved monitoring and management of driver performance.

Driving style has a big impact on all fleet fuel efficiency and driver training can reduce fuel consumption and emissions, as well as maintenance costs and risks of accidents. Typically training can save around 5-10%**. Sustaining these savings over the longer term is challenging, so we have assumed that all drivers of fleet vehicles attend the training twice between 2021 and 2030. We have estimated that ELDC could achieve a 7% reduction in fleet emissions by ensuring that all drivers attend driver training.

A detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with these measures.

Driver performance management: waste fleet

- Performance management of waste fleet drivers
- **55 tCO_2e**/year saving
- 20,900 litres diesel/year saving
- £1,300/year cost saving
- Internal time only cost

Driver training: all fleet

- Driver training for all fleet vehicle drivers
- **94 tCO_2e**/year saving
- 35,750 litres diesel/year saving
- £45,000/year cost saving
- £20,200 nominal cost

Further assumptions and information can be found in Appendix 3.

**Department of Transport, 2016, Efficient Driving https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/509972/efficient-driving-rapid-evidence-assessment.pdf

Fleet electrification carbon reduction opportunities (6)

The current fleet operated by ELDC consists of ~90 vehicles, the majority of which are diesel fuelled. In order to reach a zero emission transport system a transition from a fossil fuel powered fleet to a fleet powered by low emission energy sources such as electricity, hydrogen or other zero carbon fuels is essential. This transition to a low carbon transport system is likely to be achieved predominantly through the use of battery powered Electric Vehicles (EVs), however the Council will remain open to exploring alternative future technologies (such as hydrogen fuel cell vehicles) as appropriate.

Electrification of this fleet would lead to significant carbon reduction. To quantify this opportunity, it is has been assumed that all diesel vans and company cars (total of 65 vehicles) will be replaced by comparable EVs from 2021, while mileage will remain constant. Rollout of electric or other zero carbon fuelled HGVs should follow once the technology becomes readily available for HGVs. The Council is open to other forms of low or zero carbon transport that may be more appropriate given the region's geography, such as hydrogen fuel cell vehicles, or biofuels.

Currently, the majority of the fleet is owned by the Council (not operated on a lease basis). The estimated capital costs below show two procurement alternatives 1) outright ownership and 2) leased. The cost of EV charging points and supporting infrastructure is included in the costs. When considering the benefits and disadvantages of outright purchase vs leasing of EVs there are a number of factors to consider, e.g. depreciation, servicing and maintenance costs, available EV grants, fleet replacement cycles, expected mileage, pace of market and technology advancements and battery life.

A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with these measures.

Fleet electrification

- Replacement of 65 diesel and petrol fleet vehicles with EVs and installation of charging points
- **230 tCO_2e**/year saving
- Costs:
  1. £1.6m estimated capital cost (outright purchase x 65 vehicles + installation of charging points)
  2. £200k estimated revenue cost (annual lease cost x 65 vehicles + installation of charging points)
- £69,100/year cost saving (difference between EV and current vehicle running costs)

Further assumptions and information can be found in Appendix 3.

Waste fleet electrification carbon reduction opportunities (7)

Further to the replacement of diesel vans and company cars with comparable electric vehicles (EVs), the rollout of electric HGVs to replace the diesel-fuelled waste fleet should follow once this technology becomes readily available. As the waste fleet is responsible for over 80% of total fleet emissions, this will have a significant impact on the Council's footprint once it becomes feasible.

A number of HGV manufacturers have announced plans to launch electric HGVs on to the market in 2020 or beyond; however, at present there appear to be limited options available to the Council. Also, many of the ELDC diesel-fuelled vehicles have recently been replaced. Therefore, it is recommended that ELDC consider e-HGVs or other zero carbon fuelled HGVs during the next vehicle replacement cycle, rather than immediately. The council is open to other forms of low or zero carbon transport that may be more appropriate given the region's geography and technically feasible in the timescales suggested, such as hydrogen fuel cell vehicles, or biofuels.

A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with these measures.

Furthermore, ELDC is part of Lincolnshire Waste Partnership which is looking collectively at sustainable options to decarbonise the county's waste fleet.

Waste fleet electrification

- Replacement of diesel-fuelled HGVs with e-HGVs and installation of charging infrastructure
- **1,097 tCO_2e**/year saving
- 41% reduction in total Council footprint

Further assumptions and information can be found in Appendix 3.

Commuting and business travel carbon reduction opportunities (8)

The emissions associated with staff commuting and business travel on behalf of ELDC currently total 585 tCO_2e, or ~22% of the Council's footprint. The following opportunities should be considered to encourage a reduction in commuting and business travel associated emissions. These opportunities largely revolve around reducing the total journeys and mileage being completed by Council employees.

- The use of video-conferencing tools are a great way to cut down on face to face meetings.
- Car sharing and encouragement of the use of active and public transport where possible should also be investigated.

Ultimately ELDC will need to engage with its employees to understand better the practical implications of reducing its business travel footprint.

Remote working

Video conferencing

Car sharing incentives

Encourage use of public transport

Employee engagement

Rooftop Solar PV carbon reduction opportunities (9)

~19% of ELDC's emissions are associated with the Council's electricity consumption. Identifying buildings such as schools and offices with significant areas of flat, south facing roof space could lend itself well for the installation of roof mounted solar photovoltaic (PV) panels. Solar PV installation is an economically 'low regret' measure; with benefits including helping to mitigate this substantial source of ELDCs' emissions, saving ELDC money by offsetting the need to purchase peak time electricity from the grid, utilising unused rooftop space as well as insulating the council from unexpected future electricity price fluctuations. The electricity generated can be used to meet the building's own energy consumption requirements or fed back into the electrical grid via the government's Smart Export Guarantee (SEG) scheme.

Electricity production from solar PV may not always coincide with times of electricity demand. Energy storage systems are often incorporated in parallel with solar PV to help address this issue. Electricity generated from the solar PV panels can be stored for use when the sun is not shining, or in order to limit the power exported to the grid. Currently the most commonly used storage technologies are batteries and water heating. Detailed feasibility studies will need to be carried out to assess the economic viability of this carbon reduction opportunity.

Rooftop Solar PV

- ELDC's 2018 electricity consumption was ~1635 MWh, which amounts to a daily usage of **~4.5MWh per day**
- To fully meet ELDCs electricity demand, an area of approximately **8,300m²** would need to be covered with solar PV panels. This is approximately the area of 1.3 football pitches
- This would result in GHG emission savings of **463 tCO_2e / year** and electricity bill savings of **£159264 / year**

Further assumptions and information can be found in Appendix 3.

It should be noted that the UK electricity grid is already in the process of decarbonising, and ELDC's electricity emissions will steadily fall as this proceeds.

District heating carbon reduction opportunities (10)

Heat networks have been identified as a key technology to decarbonise heat within the UK. District heat networks connect heat sources with local homes and businesses through a network of pre-insulated pipes carrying hot water. The heat source is often a combined heat and power (CHP) plant, but other heat sources such as electric heat pumps and waste heat recovery are also used. As well as offering the potential to decarbonise ELDCs natural gas emissions, district heating also improves air quality, provides low-cost heating as well as the ability to provide flexibility to the local energy system by providing large scale thermal energy storage.

It should be noted that district heating projects have very high upfront capital costs. Capital expenditure can account for around 2/3 of the heat network's total lifetime costs. These costs relate to the heat network infrastructure, as well as the energy centre where the heat is generated. District heat projects also have long project development timeframes and require long-term planning and alignment between investors, councils, and consumers.

Furthermore, district heating projects are often much less viable in rural areas due to the low population density. District heat networks are best suited for high-density urban areas, such as city centres. The cost per customer to build and run a district heat network in less dense areas makes them less attractive, and therefore often economically unviable. However, this can be overcome with low-temperature heat networks, and lower heat losses from rural dwellings (through better building efficiency). Estimating the precise heat demand profile of an urban area is not straightforward. Given the high costs associated with building the energy centre and heat network, the risk of underutilising the heat network is a barrier to deployment.

Detailed feasibility studies will need to be carried out to assess the viability of this carbon reduction opportunity.

Contents

Section 4: Governance and Engagement

Stakeholder engagement

Robust engagement with stakeholders from across the Council will be crucial for successful climate action implementation. The Council should explore innovative ways for the whole organisation to contribute towards achieving the targets of net zero by 2040, with a minimum emissions reduction of 45% by 2027.

An effective engagement strategy needs to be drawn up that actively involves all Council departments, employees and councillors. Achieving the greatest possible input and buy-in will allow ELDC to work closely with all stakeholders to identify the areas of the Council to prioritise to reduce emissions. It will be important for the Council to remain transparent throughout all engagement activities, and to provide stakeholders with the opportunity to contribute towards the planned reduction activities that the Council intends to implement across its own estate.

Developing a robust stakeholder engagement plan should build on previous engagement to:

- Develop an initial list of stakeholders from across the Council to engage on a continuous basis.
- Complete internal in-depth stakeholder mapping exercise to identify, map and prioritise key stakeholders from across (and, potentially, external to) the Council organisation. This will ensure that key stakeholder needs are identified and understood, with the relevant resources being targeted effectively.
- Develop and agree a communications/engagement strategy that clearly details the Council's approach towards stakeholder engagement, ensuring complete transparency.
- Develop the appropriate tools to plan and track all stakeholder interaction accurately and store stakeholder information.

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Section 5: Monitoring and reporting

Once a carbon footprint has been measured and a target set, monitoring progress is an important part of implementation. Monitoring and reporting are essential activities that should be undertaken at least annually between the baseline year and target year, and beyond.

Monitoring

Collecting the data should be completed internally on a regular basis. This process should become streamlined as the necessary data sources and associated contacts/owners become familiar with the process and adopt best practice data management. The 'Carbon Trust Footprint Calculator' provides a tool to collect data and calculate an updated footprint (using updated emission factors where necessary).

Not only does the footprint need to be monitored at least annually but progress with implementing carbon reduction opportunities should be actively monitored too, including implementation year, energy reduction and cost savings. In this way, successful projects can be reported in a quantitative as well as a qualitative way. This can help to drive momentum and support the securing of budget for future measures.

In addition to monitoring the footprint itself, the project team should continually monitor how local plans and policies will affect the Council's footprint and affect the ability of the Council to reach its carbon reduction targets. This will help the team to identify other potential carbon reduction opportunities and ensure that any carbon reduction co-benefits of specific policies and actions can be delivered.

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Appendix 1: Excluded emission sources

Some emissions categories under the GHG Protocol are not relevant to a Council's operations and have therefore been excluded from this footprint.

In future, ELDC could consider expanding its footprint to include supply chain and other Scope 3 emissions, such as procured goods and services, and investments. This would require additional data and analysis.

Emission Source (Scope 3)	
Capital goods	Out of scope: Does not play a key role in the Council's operations.
Purchased goods and services (contracts)	Excluded from scope of this report
Franchises	Out of scope: No franchises controlled by the Council
Investments	Excluded from scope of this report
Downstream transportation and distribution	Out of scope: No sold goods distributed by the Council
Processing of sold products	Out of scope: Not applicable to the Council's operations
Use of sold products	Out of scope: Not applicable to the Council's operations
End-of-life treatment of sold products	Out of scope: Not applicable to the Council's operations

Appendix 1: Excluded Emission Sources

It should be noted that two of the most significant scope 3 emission sources are not included within the footprint – Purchased goods and services, and Leased buildings. These emission categories typically form between 60-80% of an organisation's entire scope 1, 2 and 3 footprint.

These emission categories were excluded for the reason that the council wishes to focus its efforts at the start to reducing their own operational carbon footprint, once the governance and procedures are set in place then the council will aim to include other scope 3 emissions sources. This is a sensible stepped approach, and shows long term commitment to not only reducing their own emissions but also the emissions arising from goods, services and buildings that they have influence over. This reaffirms the Council's commitment to be seen as leading the way in reducing the region's carbon footprint.

'Crafty carbon accounting' could be used to outsource the council's own operations to contractors and external suppliers, therefore no longer having to account the associated emissions as their own. Under the GHG protocol's operational boundary setting, this is *technically* allowed. However, it should be made clear that this is not the Council's intentions, and they wish to be transparent, open and progressive in the way they report their carbon footprint.

Appendix 2: General notes

Capital Costs

- The capital costs stated in this report are based on the application of technical principles and professional evaluation. The professional evaluations are based on information available and are conditioned by data limits, scope of work and time.
- Whenever possible, calculation of energy and economic savings has been performed. Approximate capital costs were estimated which can be used to derive simple financial payback.
- All suggested projects require verification and detailed assessment prior to proceeding with implementation.
- It would be prudent to conduct detailed life cycle assessments, particularly for high capital value projects, factoring in a number of variables that are not included within this action plan, in order to derive more sophisticated metrics such as Net Present Value and Internal Rate of Return for improved evaluation and prioritisation of business cases for intervention measures.

Decarbonising Heat

- The majority of decarbonisation pathways include the electrification of heat sources (e.g. replacement of gas boilers with electrically-powered heat pumps).
- Heat pumps output at a lower temperature compared to gas boilers and their operation is therefore more sensitive to the energy efficiency of the building.
- Before electrification is considered, a building's fabric (notably air tightness, insulation, ventilation) should first be considered and upgraded where necessary to ensure that an appropriately sized heat pump can efficiently and effectively meet the heat demand of a building.

Appendix 3: Calculations and assumptions

General assumptions/notes:

- All energy consumption figures rounded to nearest 50 kWh, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.
- Fleet performance management savings assume that fuel consumption can be reduced by 5%. Driver training savings assume that fuel consumption can be reduced by 7%. This does not include potential associated maintenance cost savings.
- Fleet CAPEX assumes that vehicles will be leased on 4-year cycles, and includes the cost of installing EV charging points. EV savings assume that a renewable electricity tariff is procured for supply to EV charging points until the grid fully decarbonises.
- Across most sites it is estimated that energy consumption can be reduced by between 1 and 5% through improved energy management practices and staff awareness/behaviour change. Percentage savings have been applied to each site based on the auditor's assessment of current practices and the potential for improvement.
- BEMS optimisation assumes a 15% energy saving can be achieved through improved control of HVAC systems. A cost of £10,000 has been applied to include purchase and installation of required equipment.
- LED lighting savings have only been applied where we have reasonable confidence that current lighting is non-LED.
- Gas-fired boiler seasonal efficiencies have been applied where boiler model details have been provided. Where only the age of boilers is known a seasonal efficiency has been assumed based on age.

Appendix 3.1: Energy management calculations

- Across most Council office sites it is estimated that energy consumption can be reduced by between 1 and 5% through improved energy management practices and staff awareness/behaviour change. Percentage savings have been applied to each site based on the auditor's assessment of current practices and the potential for improvement.
- Existing energy consumption in this case relates to gas and electricity consumption only.
- The figures below include Tedder Hall and Skegness Town Hall.
- No capital cost has been applied as it is assumed that only internal resource will be required to implement this recommendation.
- All energy consumption figures rounded to nearest 50 kWh, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.

Improve standard of energy management and staff awareness within council offices

EXISTING ENERGY CONSUMPTION			SAVINGS			COST	
kWh	£	tCO2e	kWh	£	tCO2e	CAPEX	PB
2,258,800	£113,900	517	67,750	£3,400	16	£0	0.0

Appendix 3.2: Fleet management calculations

- Fleet performance management savings assume that fuel consumption can be reduced by 5%. Driver training savings assume that fuel consumption can be reduced by 7%. This does not include potential associated maintenance cost savings.
- No capital cost has been applied to Driver Performance Management as it is assumed that only internal resource will be required to implement this recommendation. A capital cost of £200 per driver has been applied to the Driver Training recommendation, assuming one driver per fleet vehicle.
- All fuel consumption figures rounded to nearest 50 litres, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.

DRIVER PERFORMANCE MANAGEMENT
savings refer to waste fleet

SAVINGS			COST	
litres	£	tCO2e	CAPEX	PB
20,900	£1,300	55	£0	0.0

DRIVER TRAINING
all

	SAVINGS			COST	
	litres	£	tCO2e	CAPEX	PB
FUEL COSTS	35,750	£45,000	94		
MAINTENANCE COSTS					
TOTAL	35,750	£45,000	94	£20,200	0.4

Appendix 3.3: Commuting & business travel calculations

- Based on the staff travel information available it has been assumed that a 10% saving can be achieved in commuting and business travel emissions. This could be achieved through a combination of 'mileage management' measures, including increased working from home, promoting conference calling over in-person meetings, and car sharing where feasible.
- All recorded commuting and business travel was via petrol or diesel car.
- As no business travel or expenses data was available no cost saving has been calculated for this recommendation, although it is understood that Council employees are able to claim back business travel costs.
- All fuel consumption figures rounded to nearest 50 litres, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.

ENERGY CONSUMPTION & COST:

	miles		tCO2e	% emissions
PETROL	1,513,200		437	77.66%
DIESEL	490,491		126	22.34%
TOTAL	**2,003,691**		**562**	**100.00%**

MILEAGE MANAGEMENT
(WFH, conference calling, car sharing)

SAVINGS	COST	
tCO2e	CAPEX	PB
56	£0	0.0

Appendix 3.4: HVAC control calculations

- Heating, ventilation and air conditioning (HVAC) control optimisation assumes a 15% energy saving can be achieved through improved control of HVAC systems at Council office sites. A cost of £10,000 has been applied to include purchase and installation of required equipment.
- It is understood that only Tedder Hall has a comprehensive Building Energy Management Control System (BEMS), with other Council offices having more basic, localised controls, leading to sub-optimal control of the various systems.
- All energy consumption figures rounded to nearest 50 kWh, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.
- A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with this measure.

Centralised/remote control and monitoring of office HVAC systems

EXISTING ENERGY CONSUMPTION			SAVINGS			COST	
kWh	£	tCO2e	kWh	£	tCO2e	CAPEX	PB
1,297,000	53,000	269	194,600	£8,000	40	£10,000	1.3

Appendix 3.5: Fan & pump calculations

- Based on the details of previously identified energy efficiency projects provided it is assumed that a 30% energy saving can be achieved through upgrades to the various fans and pumps in use at Council office sites and council-operated leisure facilities. A cost of £5,400 has been applied based on the calculated savings and typical payback of this recommendation.
- All energy consumption figures rounded to nearest 50 kWh, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.
- A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with this measure.

Fans & pump upgrades

EXISTING ENERGY CONSUMPTION			SAVINGS			COST	
kWh	£	tCO2e	kWh	£	tCO2e	CAPEX	PB
62,100	£6,000	18	18,600	£1,800	5	£5,400	3.0

Appendix 3.6: LED lighting calculations

- Based on details provided of existing lighting it is assumed that savings of between 60-80% can be achieved by replacing existing internal and external lighting with LED. Promenade lighting is understood to be mainly high pressure sodium while public toilet and office lighting is a mix of high and low frequency T8 and T5 fluorescent lighting. All of these are less efficient and effective than LED lighting solutions available on the market.
- All energy consumption figures rounded to nearest 50 kWh, cost figures to nearest £100, and emissions to nearest 1 tCO_2e.
- A full detailed feasibility assessment should be conducted to ascertain more accurate costs and savings before moving forward with these measures.

Upgrade promenade lighting to LED

EXISTING ENERGY CONSUMPTION			SAVINGS			COST	
kWh	£	tCO2e	kWh	£	tCO2e	CAPEX	PB
50,500	£7,300	14	40,400	£5,800	11	£6,900	1.2

Upgrade public toilet lighting to LED

EXISTING ENERGY CONSUMPTION			SAVINGS			COST	
kWh	£	tCO2e	kWh	£	tCO2e	CAPEX	PB
36,200	£5,700	10	27,200	£4,300	8	£3,100	0.7

Full LED lighting roll out across council offices

EXISTING ENERGY CONSUMPTION			SAVINGS			COST	
kWh	£	tCO2e	kWh	£	tCO2e	CAPEX	PB
204,000	£15,200	58	142,800	£10,600	40	£35,300	3.3

Appendix 3.7: Fleet electrification calculations

EV IMPLEMENTATION (to replace vans and company cars)

INPUTS AND ASSUMPTIONS	
Miles to km	1.609344
Diesel kg CO2 per litr	2.62694
Litre to gallon	0.219969
kg CO2/gallon	11.9423191
NIC calculation rate	13.80%
Cycle years	4
Distance per annum	20000

- CAPEX assumes that vehicles will be leased on 4-year cycles, and includes the cost of installing EV charging points. EV savings assume that a renewable electricity tariff is procured for supply to EV charging points until the grid fully decarbonises.

RUNNING COSTS	EVs		CURRENT FLEET	
	Electric van	Electric car	< 3.5 tonne van	Medium car
BiK/P11D buy value	£30,000	£30,000	£20,000	£25,000
Plug-in car grant	£5,500	£3,500		
CO2 g/km	0	0	122	105
CO2 g/mile	0	0	196	169
MPG			65	61
Residual value (4y, 80k miles)	£6,000	£6,000	£4,000	£5,000
Depreciation total	£18,500	£20,500	£16,000	£20,000
Depreciation PPM	23.13	25.63	20.00	25.00
Servicing & maintenance PPM	1.6	1.6	3.6	3.4
Servicing & maintenance total	£1,280	£1,280	£2,880	£2,720
Fuel PPM	4.1	4.1	10.1	9.7
Fuel total	£3,280	£3,280	£8,080	£7,760
Combined PPM	28.83	31.33	33.70	38.10
Total life cycle cost	£23,060	£25,060	£26,960	£30,480
CO2 over life cycle (tonnes)	0	0	15.71	13.52
No. of vehicles to be replaced	50	15	50	15
Range (miles)	124	239	n/a	n/a
MPGe	98	114	n/a	n/a

SAVINGS			COST	
	£	tCO2e	CAPEX*	PB
	£69,100.00	230	£200,000	2.9

Appendix 3.8: Rooftop Solar PV calculations

- Calculations were run using 250 W panels each occupying an area of ~1.6 m^2 per panel. ELDC was assumed to consume 100% of the electricity produced by the array.
- An energy storage system (e.g. a battery) has not been included in the calculation. Further consideration of a site's *actual* demand profile should be made to access the suitability of an energy storage system to increase the utilisation of electricity generated.
- Losses due to shading, solar panel inclination, azimuth angle, reflection losses, inverter inefficiencies have not been included within the calculation

Metric	Value	Unit	Assumptions/Sources
2018 Electricity Consumption	1635000	kWh	ELDC 2018 Electricity Carbon Footprint
Daily Electricity Consumption	4479.45	kWh	
UK Sun Hours per day	4	hrs	https://www.statista.com/statistics/322602/monthly-average-daily-sun-hours-in-the-united-kingdom-uk/#:~:text=The%20average%20annual%20number%20of,to%204.7%20hours%20in%202018.
Solar panel nominal power	0.25	kW	Assuming each panel is rated at 250W peak power
Energy produced per day per panel	1	kWh	Energy = Power x Time
Area of solar panel	1.85	m2	https://www.pvfitcalculator.energysavingtrust.org.uk/Documents/150224_SolarEnergy_Calculator_Sizing_Guide_v1.pdf
Total solar panel area required to meet daily electricity consumption of ELDC	8,286.98	m2	

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