Borough Council of
King's Lynn &
West Norfolk

Environment and Community Panel
Tuesday, 31st August, 2021 at 4.30 pm
in the Assembly Room, Town Hall, Saturday Market Place, King's Lynn PE30 5DQ

Background Papers

1. **Climate Change Strategy and Action Plan (30 minutes)** (Pages 2 - 33)

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Setting a Target for Carbon Neutrality for the Borough Council of King's Lynn & West Norfolk

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Setting a Carbon Neutrality Target for the Borough Council of King's Lynn & West Norfolk.

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Executive Summary

This report aims to identify a realistic target for which the Borough Council of King's Lynn and West Norfolk can achieve carbon neutrality and which strategies are the most cost-effective with significant emission reductions. This report is designed to help my client (Borough Council of King's Lynn and West Norfolk) identify a starting point to begin reducing emissions across scopes one to three and to set a target for which the council can achieve carbon neutrality. Using the 2018/19 carbon audit, areas for potential emissions reductions were identified. Throughout this report, emission reduction strategies for each scope will be discussed, as well as their financial costs or sources of funding, and when these solutions can be implemented by.

Scope One Emissions

Emissions from gas use and emissions from the council's vehicle fleet amount to 1,713.3 t CO_2e. To eliminate gas emissions, the use of a ground source heat pump (GSHP) is recommended. The GSHP will be able to provide a reliable supply of heat to the council's buildings all year round, unlike solar thermal energy. The cost of a GSHP varies from £14,000 - £16,000 with a 15-year payback period. However, the council can apply for the Clean Heat Grant to help cover the cost. The installation of a GSHP should be completed by the end of 2022.

To eliminate emissions caused by the council's vehicle fleet, the switch to an all-electric vehicle (EV) fleet is encouraged. The use of pure EVs is recommended, as the sale plug-in hybrids (as well as petrol and diesel vehicles) are due to banned in 2035. There are grants available for cars and vans which reduce the initial purchase price of a vehicle. The workplace charging scheme provides finance for EV charging infrastructure. Additionally, electricity is cheaper than petrol or diesel, therefore, reducing fuel expenses. The switch to an all-electric vehicle can be complete by 2023.

Scope Two Emissions

Emissions from scope two are caused by electricity use within council buildings, amounting to 1,425.5 t CO_2e. in 2021, the council is switching to a renewable electricity tariff. The introduction of this tariff will see electricity use emissions fall by >85%. The reduce the remaining 15% of emissions, the council should consider installing a solar PV system. The electricity generated from the solar PV system can be used across the council's buildings, and can also help reduce transmission and distribution losses by generation electricity on site.

Scope Three Emissions

Emissions in scope three emit 1,493.9 t CO_2e. Transmission and distribution losses caused by purchased electricity amount to 121.5 t CO_2e. These emissions can be reduced by the solar PV system, which is mentioned in scope two. The on-site electricity generation shortens the distance that electricity will have to travel before it is consumed, which will reduce transmission and distribution emissions. To compensate for remaining emissions, the councils 'Big Plant' 500 tree planting scheme can be used as an offset mechanism.

Emissions caused by water supply emit 26.7 t CO_2e. to reduce wasted water, the council should consider installing a water metre. This will allow the council to identify any potential areas for water reduction and lead to savings of water supply. Many water companies such as Anglia water, often install water metres for free, other water metres can cost up to £150. A water metre can be fitted by the end of 2020. Additionally, the council may consider the use of rainwater harvesting or greywater recycling to reduce the water supply needed for St. James pool and Oasis Leisure Centre. These use of recycled water techniques could be In place by the end of 2021.

Emissions from water treatment amount to 45 t CO_2e. these emissions are particularly hard to reduce. However, the UK water industry has announced its commitment to achieving carbon neutrality by 2030. This could eliminate the 45 t CO_2e emitted from water treatment. In the meantime, the council can look to offset these emissions through tree planting schemes such as the Big Plant' and Norfolk council's one million plant scheme, which the council are expected to be involved in.

Emissions from business travel emit 76.7 t CO_2e. to reduce these emissions, the council can introduce home working for employees to reduce staff mileage and vehicle emissions. Additionally, employees can be encouraged to use EVs for business travel. Homeworking can be implemented in 2020. However, it will take several years to encourage staff to use EVs, as vehicle use is a personal decision for each staff member. Taking this into account, the total reduction for business travel emissions could be until the 2030s. there should be no financial cost for the council to implement these strategies.

Lastly, refuse collection vehicles emit 1,222.9 t CO_2e. there is very little development around electric refuse collection vehicles (RCVs), with Westminster council being the only council trialling their use. This is another emission sector that will be hard to for the council to reduce and largely depends on what the next few years of research and development has in store for RCVs. At the current direction, electric RCVs can be expected to arrive in the early 2030s.

<u>Recommended Target</u>

After reviewing the above strategies, and giving the delays from RCV development, the council should aim to achieve carbon neutrality by 2035. By 2035, the strategies mentioned in scopes one to two should have already been implemented; a lot of these solutions can be implemented before 2024. The delay is caused by scope three emissions, which is out of the council's immediate control. However, by 2035, it is highly likely that there would have been technological advances in 'green' technology which will assist the council in achieving carbon neutrality by 2035.

It is important to recognise the impact the current COVID-19 situation may have on the council's ability to reach this target. COVID-19 has already caused delays for the completion of the King's Lynn Re-fit. There is a possibility that work operations and installers of certain solutions may not be readily available for some time and thus, potentially delaying the target years of when solutions can be implemented.

Introduction

In 2019, the UK government revealed its commitment to become net-zero carbon in 2050, this same, the UK's emissions dropped by 29% (The Carbon Brief, 2020). With the UK on the pathway to decarbonising the county, many councils across the UK revealed their plans to become net-zero carbon. Many councils such as Oxford City Council, have announced their commitment to being net-zero carbon by 2030. Therefore, the Borough Council of King's Lynn and West Norfolk are committed to setting themselves a target year to achieve carbon neutrality and how they will be able to achieve this.

To keep on track with the government's 2050 carbon neutral targets, the council are actively looking to decrease their CO_2 emissions. In February 2020, the council supported the 'Big Plant' tree scheme at King's reach. The 500 newly planted trees can help offset CO_2 emissions produced by the council's operations. Additionally, the council plans to involved in Norfolk's one million tree planting scheme. Large-scale tree planting schemes and management of green spaces can be a productive offsetting solution which the council can utilise to offset a proportion of their CO2 emissions. Furthermore, the council have organised a retrofit of council-owned buildings in 2018. The re-fit aims to create carbon savings by dramatically increasing the energy efficiency of buildings and implementing new, 'green' technologies.

Over the past five years, the council has seen a 25% reduction in their total CO_2 emissions, from 6,183.4 t CO_2e in 2014/15 to 4,642.2 t CO_2e in 2018/19. While this 25% reduction in CO_2 emissions is a great achievement, the council are still under pressure to produce larger reductions over the coming years.

This report addresses the emissions within scopes one to three and aims to identify solutions which can produce emissions reductions for the council's operations. Finance options and information are provided to enable the council to implement to the most cost-effective solution for them.

1.0: Scope One *1,713.3 t CO_2 e*

The emissions recorded within scope one are direct emissions from sources which the council own and/or control.

1.1: Gas Emissions; 1,320 t CO_2 e.

The gas emissions within scope one arise from heating the council's buildings. To reduce and/or eliminate gas emissions, three potential heating solutions have been identified:

- **Combined Heat and Power (CHP):** this system captures heat produced by electricity which is then used to heat water to be used for heating. This technology is highly efficient by using wasted heat and has the potential to reduce carbon emissions by 30% (UK Government, 2020)
- **Ground source heat pump (GSHP):** this method circulates a mixture of water and antifreeze around a loop of pipe. The heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump. This system is

powered by electricity, however, the council are said to be switching to EDF's green tariff in 2021, if implemented after the installation of the green tariff, then GSHPs has the potential to eliminate gas emissions.

- **Solar thermal energy:** uses solar energy to heat a water tank which will then be used within the central heating system to heat the council's buildings. Solar thermal systems generating 90% of solar radiation into heat, compared to only 15% - 20% for solar PV (Lightsource BP, 2014). However, there may be less energy generation during winter months due to increased cloud cover affect solar radiation, and so this may not be the most suitable option.

Prices and Funding

Solution	Price (£)	Payback period (years)
Combined heat and power	£32,000 (large scale)	10.5
Ground source heat pump	£14,000 - £19,000	15
Solar thermal	£5,000 - £10,000	6 – 10

Table 1.0: Displays the costs and payback period for each potential renewable heating solution. Source: (Bionic, 2020) available at: https://bionic.co.uk/business-energy/guides/guide-to-renewable-energy-for-small-businesses/ *(online) [last accessed 30/05/2020]*

Non-Domestic Renewable Heat Incentive (RHI) **Closes to new applicants March 2021**

The non-domestic RHI is a UK government scheme, which has been created to encourage the use of renewable heat technologies among public sector businesses as well as non-public sector business and not for profit of organisations (Energy Savings Trust, 2020. The council will be eligible for the non-domestic RHI if they decide to install any of the solutions mentioned in table 1.0.

The Clean Heat Grant (Commencing 2022)

The CHG is said the commence in 2022, one year after the closure of the non-domestic RHI. The CHG will offer funding support up to £4,000 for a business that implements a clean heat technology (Edie, 2020). The full list of eligible technologies has not yet been released.

Salix Finance

Salix is a company that proved government-funded, interest-free loans for public sector businesses to conduct energy efficiency improvements. Salix offers funding for CHP and solar thermal.

Recommendations for Gas Emissions

- The council should consider installing a GSHP as it will be able to supply significant amounts of heat all year round and would be a reliable heat source.
- The GSHP should be installed after the renewable tariff is in place, to ensure that the GSHP is powered on a renewable electricity supply, avoid any additional emissions.
- The council can look for funding with the Clean Heat Grant in 2022.

- A solar thermal energy system could be considered as it is the cheapest option, however, it is uncertain as to whether this system could provide significant amounts of heat during the winter months.

1.2: Council Vehicle Fleet 393.4 t CO_2

Switch to Electric Vehicles (EVs).

In 2035, the UK government will ban the sale of petrol and diesel cars, as well as plug-in hybrids (UK Government, 2020). With the ban only 15 years away, the sensible option, would be for the council to switch to a pure electric vehicle fleet, which emits zero emissions. Additionally, the pure electric vehicle is exempt from company car tax as of 2020. The use of hydrogen vehicles was also researched. However, it was found that EVs have much more technological development than hydrogen vehicles do; with a range of models, expanding charging infrastructure around the UK as well as a range of funding options available. Whereas, hydrogen vehicles are nowhere near as common within the UK. For example, there are 30,000 EV charging stations across the UK (EDF, 2019) compared to just 13 hydrogen refuelling stations in the UK (Energy Savings Trust, 2020). Thus, EVs are the most suitable option.

Battery or Pure Electric Vehicle

Batter or pure electric vehicles emit zero emissions. These vehicles are becoming very common with Volkswagen, Peugeot, Renault, Honda and Kia, have multiple car and van models available. The range with battery and pure electric typically range between 100 – 300 miles.

Charging a Pure EV

The council has the opportunity to make huge savings on fuel, once switching to a pure EV fleet. EV vehicles typically cost £2 - £4 to fully charge (for a 100-mile range model) in a petrol or diesel car, 100 miles would typically cost between £13-£16 for 100 miles. The introduction of an all EV fleet would call for the development of charging infrastructure for which there is a workplace charging scheme, as can be seen in table 2.0.

Energy Savings Trust Fleet Review

The Energy Savings Trust offer a free vehicle fleet review for businesses, in which they review which vehicles that are in the fleet and which EV models would make the best replacement based on the fleet's operations, i.e mileage, use etc.

Finance Available

Grant	Finance available
Plug-in car grant	Purchase price reduction, up to £3,000
Plug-in van grant	Purchase price reduction of up to £8,000
Workplace charging scheme	£350 per charging socket (up to 40 sockets)

Table 2.0: the list of funding schemes available for the purchase of EVs and EV charging infrastructure. Source: (Energy Savings Trust, 2020) available at: https://energysavingtrust.org.uk/transport/fleet/fleet-management-toolkit/switching-electric-vehicles [last accessed 22/05/2020]

Recommendations for Council Vehicle Fleet

- Changing over the current vehicle fleet to a pure electric vehicle fleet can be done by 2023.
- Make the switch to a pure EV fleet, with the help of the energy savings trust to make sure the most efficient EV models are used.
- The funding options displayed in table 2.0 can be utilised to save the council money on the purchase price of pure electric cars and vans, and reduce the cost of installing charging infrastructure.
- The old vehicles from the current fleet could be sold to scrap or to new owners, to accumulate additional funds for an EV fleet.

2.0: Scope Two, *1,425.2 t CO_2*

Scope two emissions are indirect emissions for the generation of purchased energy. The emissions within scope two are caused by electricity use within the council's buildings.

2.2: Electricity use in Council Buildings

To combat these emissions, the council are switching to a renewable electricity tariff provided by EDF Energy, estimated to occur in 2021. The switch to the renewable tariff will help eliminate over 85% of the 1,425.2 t CO_2 e emissions caused by electricity generation.

This switch could leave approximately 213.78 t CO_2 e left to reduce. A solution to eliminate these emissions could be to install additional solar PV systems for on-site renewable electricity generation.

Recommendations for Electricity Use

- Council are already switching to a renewable tariff in 2021, eliminating >85% of scope two emissions
- Implement additional solar PV system to reduce the remaining 213.78 t CO_2 e emissions, this can be installed by the end of 2021.

3.0: Scope Three *1,493.9 t CO_2 e*

Scope three emissions occur from all other indirect emissions which occur in a company's operations

3.1 Transmission and Distribution Losses 121.5 t CO_2 e

Transmission and distribution losses are indirect emissions caused by the transmission and distribution of the council's purchased electricity.

A solution to reduce these emissions would be to generate electricity closer to where it is consumed. It is highly unlikely that the council will be able to generate 100% of their electricity supply, but the council should be able to produce at least 10% via installing renewable energy generating technologies such as solar PV systems. The council could also offset the remainder of emissions through the 500 tree planting scheme, which took place in February 2020.

On-Site Electricity Generation with a Solar PV System

As mentioned in section 2.2, the additional solar PV system can provide renewable electricity generation for the council's buildings, could also help reduce emissions from the transmission and distribution of electricity. As the solar PV system would be generating electricity close to where it is consumed, it would mean that the electricity that the solar PV produces, has very little distance to travel and thus helps decrease transmission and distribution emissions.

Price of a Solar PV System

A typical solar PV system costs between £6,000-£10,000 (4kw system) and a payback of 6 – 10 years.

Recommendations for Transmission and Distribution Emissions

- Generate some electricity on-site with the use of solar PV systems; installation by the end of 2022.
- Offset the remaining emissions through the King's Lynn Big Plant scheme and management of other green spaces.

3.2: Water Supply 26.7 t CO_2e and Water Treatment 45 t CO_2e

To reduce water supply wastage, the council can look to install a water metre. A water metre could help the council identify where reductions can be made and so cut the water supply. Prices for water metres vary from free of cost up to £150, depend on water supplier.

The council own two community swimming pools, St. James' and Oasis. Both of which need a significant water supply. The council can consider the use of greywater recycling or rainwater harvest to reduce their industrial water supply emissions. However, both of these solutions would require the water to be treated again for use within the pools. Although, a study by the Environment Agency (2010) found that buildings using harvested rainwater or treated greywater recycling increased CO_2 emissions in comparison to using mains water.

In March 2020, the water industry their plans to become net-zero by 2030 by cutting greenhouse gases released during water treatment, increasing energy efficiency, the use of renewables and many more improvements (Water UK, 2020). This plan could reduce the 45 t CO_2 e emissions produced by water treatment.

Recommendations for Water Supply and Treatment

- Install a water metre to monitor wastage of water and to identify reductions by the end of 2020
- Consider the use of greywater recycling or rainwater harvesting for St James and Oasis Leisure centre to reduce water supply emissions.
- UK water industry to be net-zero carbon by 2030, should reduce all water treatment emissions by 2030; Able to be net-zero carbon by 2030 at the latest.
- Continue to offset remaining emissions through the Big Plant scheme and Norfolk's one million tree plant plan.

3.3: Business Travel 76.7 t CO_2e

Business travel includes emission created by staff travel for businesses purposes.

Home Working
Staff can be advised to work at home to save business mileage and reduce vehicle emissions. Additionally, MPs who travel to King's Lynn for meetings should hold meetings virtually instead of a 100+ mile plus trip which produces unnecessary emissions.

EV Use
Staff may be encored to purchase EVs rather than petrol or diesel vehicles. Taking into consideration the 2035 ban of the sale of petrol and diesel vehicles, EV usage is something the staff should be considering. Staff can use the workplace charging facilities which may be installed after the switching of the council's vehicle fleet to EVs. Staff may benefit from the EV home charging scheme from the UK government, which offers £350 off the installation fee.

There should be no financial cost for King's Lynn council to implement these two solutions.

Recommendations for Business Travel

- Implement home working; immediate start (2020)
- Encourage the use of EVs among staff members, the start date will largely vary on the willingness for staff to make the switch.
- Look to offset business travel emissions through 'Big Plant 2020' tree planting scheme and management of green spaces.

3.4: Contractor Travel 1,222.9 t CO_2e

The council is currently in an 8-year contract with the contractor for refuse waste collection. Currently, Westminster is the only council trialling a fully electric refuse vehicle. Therefore, it is highly unlikely the council will be able to implement EV refuse collection vehicles within this decade, we will likely begin to see the use of electric refuse vehicles in the 2030s, following further research and development. Until this time, the council will remain in their 8-year contract and optimise collection routes to reduce unnecessary mileage.

4.0: Conclusion

It is recommended that the council achieve net-zero carbon emissions from their operations by 2035. Solutions for scope one and two can be implemented by 2023 at the latest. Scope three emissions from water supply & treatment and business travel can be reduced by the start of 2022, through the implementation of suggested solutions and offsetting. However, contractor travel significantly delays the ability of the council to achieve carbon neutrality within the next few years. This is due to the lack of existing electric refuse vehicles, and so additional years of research and development are needed. vehicles should be widely accessible Therefore, the council can realistically achieve carbon neutrality by 2035.

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Appendix A:

Project Brief

Project Brief 1

Title: Recommend a realistic target for the Borough Council of King's Lynn & West Norfolk to achieve carbon neutrality and the most cost effective policies/strategies to achieve this.

a) ***A summary of the project 'problem' or challenge.***

Our 2018/2019 financial year emissions were 4632.38 tonnes of CO2e. There are certain areas where we can easily reduce these emissions (switching to a green electricity tariff). However, some areas are harder to reduce (vehicle emissions, emissions from water use). Some councils in the district have set targets for their council emissions to be carbon zero by 2030. We are unsure if this will be possible for the BCKLWN, and therefore, what target we should set for ourselves.

b) ***What you want the student consultant to deliver at the conclusion of the consultancy exercise.***

Using our carbon audit as a starting point (available in Jan 2020) we would like the student to identify a realistic target for carbon neutrality for the borough council's operations that takes into consideration how we deal with hard to reduce emissions. We would also like the student to look into strategies to reduce emissions and recommend those they believe are most cost effective and bring in large emissions reductions and potential offsets.

c) ***Any specific skills the student consultant should have*** *(e.g. familiarity with ArcGIS, soil coring, SPSS stats analysis).*

1. Understanding of Excel for use of secondary data sets.
2. Ability to communicate the report in a clear and accessible way to individuals with no prior knowledge of the subject area.
3. Options appraisal (including costs and potential funding/grants sources.)
4. General understanding of UK government climate change targets.

d) ***Any particular resources required from the student consultant*** *(e.g. transport for fieldwork, benthic net).*

e) ***Any particular resources that you will provide*** *(e.g. specified secondary data).*

We will provide secondary data, such as the BCKLWN's 2018/2019 carbon footprint report and official BEIS Local Authority emissions data.

f) ***Additional comments, if relevant*** *(e.g. need for confidentiality agreement)*

Figure 1.0: The project brief for this report.

BCKLWN Emissions Reduction: Climate Change Action Plan Gap Analysis

	Scope	Emissions Source	National Policy/Priorities: UK Government: Green Industrial Revolution 10-Point Plan	National Policy/Priorities: Climate Change Committee: Net-Carbon Budget Policy Recommendations	National Policy/Priorities: UK Industrial Decarbonisation Strategy	National Policy/Priorities: UK Hydrogen Strategy	National Policy/Priorities: Decarbonising Transport Strategy	National Policy/Priorities: UK Government Energy White Paper
Corporate Emissions Reduction	Scope 1:	Gas Consumption	5 GW of low carbon hydrogen by 2030. Pilot hydrogen town by 2030. Public sector decarbonisation scheme.	See District Emissions Reduction Section.	Support the increased fuel switching to low carbon fuels over the 2020s. Establish the right framework to ensure the uptake of fuel switching.	See 'Power Supply Below'		Consulting on whether to end gas grid connections to new homes from 2025. Growing installation of electric heat pumps. Hope 30,000 per year to 600,000 per year by 2028.
		Vehicle Fleet	Aim the sale of new petrol and diesel cars and vans by 2030 (hybrids with low tailpipe emissions by 2035). £1.3 billion to accelerate roll out of charging infrastructure. Plug-in Car, Van, Taxi & Motorcycle grant extended to 2022-2023.	See District Emissions Reduction Section.		See 'Transport Below'	See 'Transport Below'	
	Scope 2:	Electricity Consumption	40GW of offshore wind by 2030. Hinkley C Nuclear power by 2025. Public sector decarbonisation scheme.	Delivering 88% TWh of generation by 2035, which should all be low-carbon. This will require 80% TWh of new low-carbon generation. Deploying variable renewable energy at scale, with 40 GW installed offshore wind capacity by 2030 and sustaining that build rate to support deployment of up to 100 GW by. Deploying at least 30 TWh of dispatchable and flexible generation (e.g. gas CCS, hydrogen) by 2035 that constitutes a system driven by renewables at low emissions. Developing a holistic deployment strategy and planning and convening regime for offshore wind as soon as possible to improve coordination, taking into account wildlife concerns, commercial activities, and radar systems. Ensuring transmission investment in networks can accommodate future demand levels in coordination with Ofgem. Commit to phasing-out unabated gas generation by 2035, subject to ensuring security of supply and publish a transparent decision making strategy for unabated gas phase-out. Ensure new gas plant are properly CCS- and/or hydrogen-ready as soon as possible and by 2025 at the latest. From 2030, not allow new unabated gas capacity to be built. Developing a clear long-term strategy as soon as possible, and certainly before 2025, on market design for a fully decarbonised electricity system. Continuing the use of long-term contracts as an appropriate investment mechanism. Focusing on developing the market for gas CCS and hydrogen, strongly deploying low carbon generation, and phasing out unabated gas. Establish and grow market for decarbonised dispatch able power solutions (NZ turbines + gas CCS) to support unabated gas phase-out in seven generation by 2035.					Require all non-domestic buildings to be EPC B by 2030.
	Scope 3:	Transmissions & Distribution Losses						
		Water Supply & Treatment						
		Business Travel	Aim the sale of new petrol and diesel cars and vans by 2030 (hybrids with low tailpipe emissions by 2035).					
		Refuse Collection	Consult on a date to phase out new diesel HGVs in 2025.			See 'Transport Below'	See 'Transport Below'	
	Residual	Green Habitat/Tree Planting		See District Emissions Reduction Section.				
		Carbon Credits						
	Other	Commuting	Aim the sale of new petrol and diesel cars and vans by 2030 (hybrids with low tailpipe emissions by 2035). £1.3 billion to accelerate roll out of charging infrastructure. Plug-in Car, Van, Taxi & Motorcycle grant extended to 2022-2023.					
		Procurement						
		Corporate						

	Scope	Emissions Source	Local Authority Guidance: Friends of the Earth: 35 Actions Local Authorities Can Take on Climate Change	Local Authority Guidance: ADEPT: Preparing Climate Change Good Practice Guidance for Local Authorities	Local Authority Guidance: Local Government Association: A Councillor's Workbook on Acting on Climate Change	Local Authority Guidance: ASHDEN: 31 Climate Actions for Councils	Local Authority Guidance: Local Authorities and the Sixth Carbon Budget
Corporate Emissions Reduction	Scope 1:	Gas Consumption	Retrofit council-owned properties. Reduce energy use in own estate and add renewable energy. Produce biogas.	Develop a retrofit programme.		Upgrade the insulation and heating systems of council buildings. Require the integration of renewable energy such as solar thermal, PV or heat pumps to local authority owned buildings.	
		Vehicle Fleet	Procure the rapid transition of own fleet electric vehicles.			Deliver a rapid transition of the council's own fleet to electric.	
	Scope 2:	Electricity Consumption	Retrofit council-owned properties. Switch street lighting to well designed and well directed LED lights. Reduce energy use in own estate and add renewable energy. Divest from fossil fuels and invest in renewable energy projects. Buy green energy.	Promote energy efficiency. Develop a retrofit programme.	Direct cost savings: through initiatives to reduce the council's use of energy and water and to minimise waste. Potential savings for low cost, quick wins and medium to long term investments range from £60,000 to £1.6 million a year for an individual council!! Income generation: by investing in revenue-generating technology such as microgeneration and decentralised energy, and creating public-private partnerships to minimise risk, maximise investment and build	Encourage and enable energy-saving behaviour by all council staff. Switch streetlighting to well designs and well directed LED lights. Require the integration of renewable energy such as solar thermal, PV or heat pumps to local authority owned buildings. Identify areas suitable for renewable energy in the local plan. Invest in the development of renewable energy and storage.	Switch to renewable or low carbon electricity where possible.
	Scope 3:	Transmissions & Distribution Losses					
		Water Supply & Treatment	Retrofit council-owned properties.	Promote water efficiency. Develop a retrofit programme.			
		Business Travel	Support the development of car-sharing.			Encourage car sharing.	Reduce business and customer travel to council services.
		Refuse Collection					Procure electric or hydrogen fuelled waste collection and recycling vehicles. Collection authorities should prepare to provide or continue to provide separate collections.
	Residual	Green Habitat/Tree Planting	Use council land to drawdown carbon	Identify natural capital assets. Review local biodiversity action plans. Fund and implement a tree planting policy. Use green infrastructure to provide shading and cooling.	Building the resilience of your own estate through appropriate tree planting, water harvesting, use of sustainable drainage and natural shading	Set up a carbon offset fund through section 106 agreements. Increase tree cover in council owned land.	Commit to biodiversity net gain. Support woodland creation and management. Increase urban green space.
		Carbon Credits					
	Other	Commuting	Introduce workplace parking charging measures			Encourage car sharing.	
		Procurement	Divest from fossil fuels and invest in renewable energy projects. Buy green energy. Aim to win on sustainability. Require deliveries to be by electric vehicles.			Ensure council's procurement strategies specifies that low carbon lights and appliances are procured. Pressure the local authority supply chain to minimising carbon emissions.	
		Corporate	Stop promoting measures that will increase greenhouse gas emissions. Commit to opposing fracking and other fossil fuel extraction. Explore forming a non-profit green energy company. Influence LEPs.	Identify key officers within the LA responsible for adaptation of key services. Appoint a political leader with responsibility to climate change and adaptation.	Generating income for the council making the most of the council's natural resources and assets to generate power. National funding: maximising opportunities to bring in investment through external funding mechanisms.	Cut the council's paper waste. Use food waste according the hierarchy of prevent, reuse, recycle and use remaining biodegradable waste to generate biogas.	Develop net zero or climate actio plan with delivery projects. Monitor and report on progress reducing emissions. Conduct policy and service reviews. Implement training and increase capacity.

	Scope	Emissions Source	Wider Guidance: Tyndall Centre Setting Climate Commitments for King's Lynn and West Norfolk
Corporate Emissions Reduction	Scope 1:	Gas Consumption	
		Vehicle Fleet	
	Scope 2:	Electricity Consumption	
	Scope 3:	Transmissions & Distribution Losses	
		Water Supply & Treatment	
		Business Travel	
		Refuse Collection	
	Residual	Green Habitat/Tree Planting	
		Carbon Credits	
	Other	Commuting	
		Procurement	
		Corporate	

	Scope	Emissions Source	Local Authority Emissions Reduction / Climate Change Action Plans: Norwich City Council	Brecks Authority	Breckland Borough Council	Cambridge City Council	East Cambridgeshire District Council	Ipswich Borough Council	Huntingdonshire District Council	Warrington Borough Council	Wiltshire Council	Basingstoke and Deane	BCKLWN (Pre Action Plan Agreed Actions Only)	Possible BCKLWN Future Actions
Corporate Emissions Reduction	Scope 1:	Gas Consumption	Investigate the use of green gas Install more ASHPs and SSHPs. Make cren more sustainable through ECO incentives and 'for nature' planting.		Establish a reserve that will enable the council to undertake works to understand and reduce asset impacts.	Investigate district heating for council sites. Commercial property acquisitions must be EPC C+. Business case for developing a district heating scheme. Review of office space, to consolidate staff in existing spaces and relocate where viable.	Invest and save principle for energy efficiency improvements. Use renewable heating sources for all council buildings by 2025. Assessment of all buildings and infrastructure by 2023, and ensure retrofits are designed to increase resilience to extreme weather.	Explore options for alternative heating methods for council buildings. Investigate the requirements for 350kPh, and 100kPh for council owned homes. Investigate the options to improve the insulation + all for council buildings. Investigate improvements at the crematorium to reduce energy usage or provide heat recovery.	Adopt and energy policy to reduce consumption across the councils buildings and activities. Departmentalised metering of energy. Remove "excellent" rating for new office building. Install 350kPh at Huntingdon bus station and look for further opportunities for solar thermal.		Replacement of conventional gas boilers with 90% efficiency condensing boilers.	Ensure energy efficiency improves at buildings. Audit of council buildings.	Pressure green gas.	Agreed: Rec B1 to improve energy efficiency across council buildings. Agreed: Rec B2 using the Public Sector Decarbonisation Grant to obtain funding for	Green gas options. Assessment of all buildings and infrastructure. Council sites district heating options. Office space review and consolidation. Crematorium gas reduction measures.
		Vehicle Fleet	Refitted vehicle fleet with more EV/Hybrid. Rationalise & reduce fleet by 2-5%.	Develop location electricity Hydrogen-built technology.		Fleet replacement, including 7 electric vans and 4 fuel efficient vans and trucks.	Investigate opportunities for zero or low emission fleet vehicles. Implement replacement of diesel and fire cars and vans to EV by 2025. Develop a business case for EV charging suitability, with charge points installed by 2025.	Continue to replace fossil fuelled cars and car derivate vans with EV alternatives. Develop plan to replace diesel type vans with EV or PHEVs. Continue necessary replace diesel type vans and large goods vehicles with ultra low emissions vehicles if zero emissions are not cost effective. Ongoing monitoring of technology improvements and are that all large goods vehicles are replaced have LEZ0 emissions, such as our refuse collection.	Undertake a green fleet review from the Energy Saving Trust.	Investigate some council vehicles being based at employees homes, to avoid trips to depot. Trial new technologies and alternative fuels. Continue close monitoring of mileage and control technologies.	Replacement of 12 diesel sand cars with ULEV and PHEV.	Phase electrification of vehicle fleet. Increase chargepoints.		Review fleet electrification.
	Scope 2:	Electricity Consumption	Trial battery storage. Solar PV for commercial / operational sites. Make cren more sustainable through ECO incentives and 'for nature' planting. Investigate decentralised energy.		Establish a reserve that will enable the council to undertake works to understand and reduce asset impacts. Promote more sustainable and renewable energy schemes. Procure energy from a renewable only supplier and explore PPA agreements with other councils.	Install solar PV on high demand sites. Review of office space, to consolidate staff in existing spaces and relocate where viable. Office building energy efficiency upgrades. Commercial property acquisitions must be EPC C+.	Purchase 100% green electricity. Invest and save principle for energy efficiency improvements. Assessment of all buildings and infrastructure by 2023, and ensure retrofits are designed to increase resilience to extreme weather. Install a network of Solar	Procure renewable energy for the council estate. Install solar PV on council properties. Investigate options for solar car ports. Introduce capacity to store low carbon energy. Investigate evaporative cooling for the IT server room and general IT improvements. Investigate voltage optimisation. Investigate alternative to current hand driers. Investigate suitability of pool covers. Investigate retrofit options for LED lighting and sensors. Investigate the feasibility of the creation of a council solar farm.	Adopt and energy policy to reduce consumption across the councils buildings and activities. Departmentalised metering of energy. Printer rationalisation. Remove "excellent" rating for new office building. Keep a regular review of electricity supply contracts, increasing proportion sourced from renewables. Look at opportunities for solar thermal.	Install automatic switch off IT technology. Investigate reducing office space through home working and hot desking. Endeavour to retain CHP in financially viable. Bring forward draft energy policy for full approval. Consider invest to save fund for energy improvements. Implement green office campaign to capture zero-cost savings. Eliminate floodlighting for public buildings after 11pm and before dawn. Investigate more hybrid working and hot desking to reduce office space requirements. Reduce lighting levels or switch off where and when possible.	Purchase solar PV arrays (at least 200 kWp)	Explore renewable energy at leisure centres. Ensure energy efficiency improves at buildings. Install LED5 to car park lights. Audit of council buildings.	Agreed: Rec B1 to improve energy efficiency across council buildings. Agreed: Purchase 100% green electricity. Agreed: Increase Solar PV on council buildings through Rec B1 B1 & B2. Agreed: Investigating commercial options through Rec B1 B2.	Streetlighting switch off policy. Corporate energy policy. Investigate longer term home working and/or hot desking. IT infrastructure replacement programme.
	Scope 3:	Transmissions & Distribution Losses	Solar PV for commercial / operational sites. Investigate decentralised energy.				Install a network of Solar PV.	Install solar PV on council properties.				Purchase solar PV arrays (at least 200 kWp)		Agreed: Increase Solar PV on council buildings through Rec B1 B1 & B2. Agreed: Investigating commercial options through Rec B1 B2.	
		Water Supply & Treatment	Produce & deliver a council water reduction action plan. Replace water intensive planting with more drought resistant species.	Work with Anglia Water to promote water efficiency.	Establish a reserve that will enable the council to undertake works to understand and reduce asset impacts.		Ensure all buildings have water saving devices. New buildings to consider gray water where possible.	Measure & analyse water usage in all operational sites. Report on water usage annually. Investigate solutions to reduce rainwater usage.	Introduction of water saving measures. Production of water management plans. Rainwater harvesting and grey water system.		Commit to a programme of water management and monitoring.			Water reduction policy and management plans. Water savings devices across council estate.
		Business Travel	Run staff awareness campaign to reduce emissions from business operations.		Establish a reserve that will be used to support initiatives to encourage sustainable travel.	10 pool bikes to be provided.	Encourage staff to use public transport as much as possible. Investigate reasons why staff use their own vehicles on business and provide alternatives.	Encourage homes and/or local working. Encourage staff to adopt sustainable transport	Review employee lease car scheme.	Incentive for staff to purchase or lease more fuel efficient cars. Introduce a cycle mileage rate to encourage the use of cycles for short business journeys. Monitor CO2 emissions on expenses claims.	Use DLEV Funding to install EV charging points. Replacement of pool vehicles with ULEVs. Identify grey fleet miles and emissions to reduce this.	Review HR policies to consider reduction in staff travel.		Agreed: Update to lease policy to only offer petrol hybrids or EVs. Awareness campaign for public transport and online meetings.	As pool vehicles.
		Refuse Collection	Joint Norfolk Councils waste strategy.				Research options for 'Clean Hydrogen fuelling' for HGVs. Influence waste collection infrastructure and collection options for new developments.	Ongoing monitoring of Technology improvements and are that all large goods vehicles are replaced have LEZ0 emissions, such as our refuse collection.	Rescheduling of refuse collection and recycling rounds to reduce fuel use.	Provide training on fuel efficient driving. Continue to monitor new technologies as they appear		Improve efficiency through waste contract.		Agreed: New joint council contract which includes King's Lynn and West Norfolk, Breckland and South Norfolk. Potential refuse collection CO2 savings across the 4 councils	Monitor new technologies.
	Residual	Green Habitat/Tree Planting	Continue to replace trees and deliver sponsorship opportunities. Review objectives for a Norwich Tree Strategy. Deliver a new open spaces strategy.	Offsetting strategy development.	Establish a reserve that would support the delivery of a number of tree planting or other environmental initiatives.	New tree strategy. Increase city centre canopy cover by 2%. Ensure a percentage of planting in open spaces are drought resistant.	Local properties and maintenance plans to identify opportunities for natural capital. Management of verges to increase biodiversity and natural capital. Increase woodland to double land for nature by 2030. Plant new woodlands on council land.	Identify opportunities to increase the range of ecological variability of habitats and species. Map the potential for additional tree planting. Explore opportunities for urban greening. Identify, measure and report on unavoidable emissions to ensure the value is regularly monitored	Engage with local private landowners in relation to using their land as access to green space.			Manage council owned green spaces. Improve sequestration rate calculations. Identify appropriate spaces for planting.	Agreed: Pilot tree planting on 3-97ha land of council land. Agreed: Further options to be investigated for planting on 8ff other council owned	Engagement with private land owners. Map tree planting potential (inc. canopy cover etc.). Explore urban greening.	
		Carbon Credits						Other fund to be use for activities such as tree planting or energy efficiency measures. Investigate the feasibility of the creation of a council Solar farm.						Agreed: Investigating commercial options through Rec B1 B2.	Explore credit options and funds.
	Other	Commuting	Refresh council employee travel plan to reduce single occupancy car journey by 25% by 2024.	Car free promotions.		Promoting alternative transport measures e.g. pool bikes provided to staff.	Encourage homes and/or local working. Encourage staff to adopt sustainable transport	Corporate travel plan. Review employee lease car scheme.	Re-launch a staff travel plan. Install secure cycle parking. Investigate the potential for more home working					Agreed: Installation of staff EV charging points. Possible: Staff travel plan in 2021.	Future home / local working policy. Accessible staff cycle parking. Encouragement of staff to use public or active transport options.
		Procurement	Implement a sustainable procurement strategy. Ethical investment policy, with commitment to divest from fossil fuels. Ask all contractors to offset their emissions.		Review procurement strategy.	New procurement rule on sustainable procurement to be produced.	100% of renewals to existing contracts to include carbon reduction targets. 100% of new procurements to include carbon reduction. Develop training for procurement advisors on climate change and emissions reduction, including carbon footprint, bespoke procurement guidance and standard contractual terms to include climate change impacts.	Improve procurement processes to ensure suppliers support carbon neutral ambitions. Include agreed sustainability/environment clauses within tender/ bidding documents. Work to agree a percentage weighting of supplier environmental performance in our selection process. Review the carbon footprint of materials/products/services we procure and to identify options to reduce emissions from the council's supply chain.	Sustainable purchasing guidance.	Address environmental issues throughout the tender process. Purchasing only high efficiency lighting or the energy efficiency that meets the demanding Energy Star criteria. Review and develop environmental purchasing guidelines. Develop supplier management strategy that will assess their environmental credentials.				Agreed: Incorporate environmental considerations into cabinet report template. Possible: Update to BCKLWN procurement strategy.	Climate change / emissions weighting during selection process. Training for procurement Training for procurement Contractor emissions reporting and reduction requirements.
		Corporate	Create climate change on the risk register, with DEFRA study. Ensure all emergency plans for major weather events are kept up to date. Environmental themed Lord Mayor. Revise TOR of the council's Sustainable Development Panel.	Baseline emissions and net zero trends development.	Establish a fund to commission a feasibility study to create more renewable energy in the	Target for reducing emissions from council estate by 33% from 2016-2021. Energy efficiency awareness campaigns for staff. Building manager energy efficiency training.	Training courses for all staff and members on climate change, climate mitigation, adaptation and key policies. Committee paper templates updated to included a requirement for officer / measure of climate change impacts, including reference for climate change mitigation, adaptation and natural capital. Business continuity plans for buildings that'll be subject to unacceptable levels of increased flood	Review and update Climate Change Strategy. Establish an informal staff environmental group. Ensure the inclusion on climate/environment impact and climate risk assessments during the discovery and scoping phases of all project development, to ensure environmental impacts are implemented project take place. Measure the reductions in our energy usage and GHGs annually against the baseline year.	Review overtime and weekend working policy. Staff awareness through the green champions project to encourage good purchasing practice. Environmental Management System. Environmental education Officer post.		Annual energy consumption reduction of at least 5%. Publish and implement a carbon management plan.	Streaming available to raise awareness. Climate Change impact included in report templates. Promote sustainable working choices.	Agreed: Environmental implications on cabinet report template. Agreed: Environmental implications on PMDs. Agreed: Annual corporate carbon audit. Agreed: 2-year fixed term climate change officer post	Energy consumption Reduction targets. Climate change works budget. Staff training on climate change.

									Provide advice.				Collaborate with neighbouring authorities, communicate with local communities and businesses.												Agreed: Staff climate change education and updates through internal	
Industry & Commercial	Electricity Consumption, Gas Consumption, Large Industrial Installations, Other	5 GW of low carbon hydrogen by 2030. 400kW of offshore wind by 2030. Hinkley C Nuclear power by 2025. Carbon capture and storage capturing up to 10MT CO2e per year by 2030.	The Government's Industrial Decarbonisation Strategy should provide a clear vision of the long-term policy mechanisms for industrial decarbonisation that will maintain the competitiveness of UK manufacturing on the path to Net. Government should set targets for zero-based steelmaking and cement production in the UK to reach near-zero emissions by 2035 and 2040. Emissions from emissions of off-road mobile machinery should not be omitted from the Government's set of plans and strategies. In the near term, Sagayer funding should be used to support deep decarbonisation projects in industrial sectors at risk of carbon leakage. Work should begin immediately to develop the longer-term options of applying either border carbon tariffs or minimum standards to imports of selected emissions-intensive products. This should be accompanied by carbon intensity measurement standards, mandating these are disclosed and fostering international consensus around trade policies. Establish funding mechanism(s) to support operational and capital costs of both electrification and hydrogen use in manufacturing, to be awarded from the Industrial Decarbonisation Fund. Mechanisms to support industrial CCS & continue to support innovation and demonstration of fuel switching and CCS technologies. Extend consumer product standards to lower how a product is made and work with industry to develop and implement minimum whole-life carbon standard for both buildings and infrastructure. Create a clear incentive for non-traded manufacturing sectors to switch to lower carbon energy sources by reforming energy and carbon pricing, lengthen carbon prices and lower-carbon manufacturers. Reform electricity pricing to reflect the much lower costs of supplying low-carbon electricity in the mid-2020s and beyond. Address manufacturers' low appetite for risk, either through loans or grants. Establish at least two CCS clusters in the mid-2020s, at least four by the late 2030s, and further clusters around 2030 to support industrial decarbonisation activities to support and create jobs, especially in regions with reliance on industrial jobs. Prompt award of existing funding can help the recovery. Develop the capacity of skills and supply chains. Incentivise hydrogen use, but on small-scale field with electrification.	Support the deployment of CCUS on industrial sites in clusters and store around 5MTCO2 per year by 2030. Support the increased fuel switching to low carbon fuels over the 2020s. £300 million to a Net-Zero Hydrogen Fund to start commercial CCUS-enabled and electrolytic hydrogen production projects, with projects in the 2021 hydrogen strategy. Bioenergy strategy in 2022 to review the amount of sustainable biomass available in the UK. This will also establish the role which Bioenergy with CCUS can play. Consider CCC recommendation to set targets for one-based steelmaking to reach near-zero emissions by 2035. Work with industry to identify requirements to make sites Net-to-Fit-ready. Work with the cement sector to explore options to decarbonise sites. Review policies to address barriers faced by less energy intensive industrial sites and improve energy efficiency thorough adoptions of Funding: £20m industrial fuel switching competition. £12m industrial energy efficiency accelerator. £14m CCUS innovation programme. £5m Carbon Capture and Utilisation Demonstration. £4.4m Accelerating CCUS technologies. £30m Low carbon hydrogen supply competition. Support innovation in fuel switching technologies and into advanced technologies. Support the skills transition so that the current and future work force benefit from new jobs.	CoH for evidence on "hydrogen-ready" industrial equipment by the end of 2021. CoH for evidence on phaseout of carbon intensive hydrogen production in industry "within a year". Phase 2 of the £315m Industrial Energy Transformation Fund. £315 million Industrial Fuel Switching 2 competition in 2021. Hydrogen demand of up to 38 terawatt-hours (TWh) by 2030, not including blending it into the gas grid, and rising to 55-140TWh by 2050. Hydrogen production sees low-carbon hydrogen scaling up to 90TWh by 2035 – around a third of the size of the current power sector. Hydrogen use should be restricted to "areas best suited to electrification, including transport and heating and industry" and providing flexibility to the power system. Develop a hydrogen business model to encourage private investment and a revenue mechanism to provide funding for the business model in 2022.			Support and deployment eg CCUS in industrial cluster, with at least 1 being operational by 2030. Aim to deliver 8 low-carbon clusters by 2030 with at least on fully zero-carbon by 2040. Invest £1bn up to 2025 to facilitate the deployment of CCUS in two industrial clusters. Consult on steps to ensure that new thermal plants can convert to low carbon alternatives. Industrial Decarbonisation Strategy in spring 2021. Dedicated hydrogen strategy in Spring 2021.		Identify areas for renewable energy in the local plan.	Ensure biodiversity net gain in new developments are screened to ensure future climate suitability.	Supporting local economic growth through the development of a low carbon economic strategy that identifies local opportunities and barriers to low carbon investment, jobs, knowledge and infrastructure Helping local businesses to cut costs and increase competitiveness by working with them to cut energy, water and resource use Boosting local employment by ensuring that practical training opportunities are provided in local colleges, including in energy assessment and the installation of solar panels.		Carefully consider emissions from energy from waste plants.		CO2 emissions in the carbon budget related to electricity use from the National Grid in King's Lynn and West Norfolk are largely dependent upon national government policy and changes to power generation across the country. Recommended that King's Lynn and West Norfolk promote the deployment of low carbon electricity generation within the region and where possible influence national policy on this issue.	Promote sustainable living to reduce organisations emissions.			Update the Conservation and Peterborough Green Infrastructure Strategy.		Encourage businesses to undertake environmental audits. Look to introduce a £500 business grant scheme to deliver energy efficiency measures.		Work with power stations to investigate potential for increasing the combustion of biomass. Work with national and regional support organisations to promote good carbon management practice to smaller businesses. Attract more sustainable energy and recycling business. Lobby government for an early decisions on plans for nuclear energy development.			Work to encourage and attract sustainable businesses. Work with business to promote and share good practice. Business grant scheme to improve energy efficiency.
Transport	Major Roads, Minor Roads, Other	Ban the sale of new petrol and diesel cars and vans by 2030 (fully-lit with low tailpipe emissions by 2035). £1.3 billion to accelerate roll out of charging infrastructure. Plug-in Car, Van, Taxi & Motorcycle grant extended to 2022-2023. Tens of billions of pounds into rail, £1.2b into city public transport and £6b on buses, cycling and walking. Investment into low carbon buses. 2000+ miles of safe and direct cycling and walking networks delivered by 2025 in every town and city in England.	Strengthen schemes to support walking, cycling and public transport to reduce demand for higher - carbon travel. Project Rapid EV charging has the right ambition for the strategic road network and should be developed into a full strategy for the 2020s and beyond. Zero-emission vehicle mandate requiring car manufacturers to sell a rising proportion of zero-emission vehicles (including hybrids), reaching 100% sales by 2035. Strong consumer incentives to purchase zero-emission vehicles in the form of purchase subsidies, preferential company car tax, fuel duty exemption and lower vehicle excise duty should continue. These can be scaled back as costs of this fall. Implement the recommendations of the EV Energy Taskforce to ensure that delivering additional power capacity and electricity demand required for EVs is efficient, cost-effective and fair for the consumer. Ensure that as many EV users as possible can access smart tariffs that incentivise charging when low carbon and cost-CO2 emissions is zero. Clear assessment of how best to re-use and recycle EV batteries and fund development of competitive, large-scale battery recycling facilities. Consider a phase out date for zero-emission HGVs in the early 2020s. Evaluate schemes to reduce HGV and van use, particularly in urban areas. Government should set out a clear vision to deliver Net Zero in rail and support Network Rail in delivering the target to remove all diesel trains by 2040. End new diesel bus and coach sales by 2030 at the latest. End new diesel HGV sales by 2040 at the latest. Incentivise hydrogen/ammonia use and aim to develop a 'Green maritime cluster' by 2030. Build towards decisions on zero carbon aviation fuels and technology beyond 2050.		"Clearly" be important for decarbonising transport – particularly heavy goods vehicles, shipping and aviation Supporting hydrogen use in transport with a £20 million Hydrogen for Transport Programme Analysis places transport as one of the biggest components of the hydrogen economy in future, with 200 thousand potentially reaching up to 160TWh Setting an end-date for the sale of new diesel buses and the Zero Emission Bus Regional Areas (ZEBRA) scheme. ZEBRA will provide up to £135 million in 2021/22 to begin delivery of 4,000 new zero emission buses, either hydrogen or battery electric, and the infrastructure needed to support them. Trials for electric road systems and hydrogen fuel cell HGVs and to run a battery electric trial to establish the feasibility, deliverability, costs and benefits of these technologies in the UK.	Support delivery of 4,000 new zero emission buses and infrastructure needed to support them 2021-22 invest up to £120 million in zero emission buses through the Zero Emission Bus Regional Areas scheme. This will deliver around 400 zero emission up to 500 zero emission buses and the infrastructure needed to support them. West Midlands Combined Authority has been awarded £92 million to replace the entire local operator bus fleet in Coventry with electric buses Consulting on a phase out date for the sale of new non-zero emission buses £500 million for plug-in car, van, taxi, and motorcycle grants until 2022-23, reducing EV purchase prices for We will deliver an action plan in 2021 to build new UK opportunities for zero emission light powered vehicles £1.3 billion over the next four years in charging infrastructure with industry. £950 million Rapid Charging Fund will invest in upgrading grid capacity at service areas across motorways and A-roads. By 2035 expect to support the roll-out of 6,000 ultra-rapid charging points on strategic road. A new £90 million Local EV Infrastructure Fund, opening in 2022, will support the rollout of larger on-street charging schemes and rapid charging hubs across England. Publish an EV infrastructure guide for local authorities later in 2021. Consult on our net zero strategy Consult on a target for UK domestic aviation to reach net zero by 2060 Kick-start commercialisation of UK sustainable aviation fuels (SAF) and consult on a UK sustainable aviation fuels mandate		Introduce white low emission zones and/or congestion charging areas. Require all taxes to be EV through licencing. Support the development of car-sharing. Integrate the need to reduce car use into the local plan. Invest in active travel infrastructure and quality public transport. Require the use of electric buses. Put in place EV charging. Require renewable energy such as solar thermal, PV or heat pumps. Ensure the sub-national transport body strategy is in line with carbon budgets.	Using the planning system to reduce the need to travel and promote cycling, walking and public transport	Introduce a workplace car parking levy and/or similar initiatives to fund sustainable transport. Introduce measure to encourage walking and cycling. Ban or discourage private cars from city centre. Establish urban consolidation centres. Encourage car sharing. Enable the rapid shift to electric vehicles through parking in place EV charging. Replace existing buses with electric buses. Require all taxes to be electric through licencing. Reduce the need to own and use a car through managing developments in the local plan.	Ensure policies and plans support walking, cycling and public transport. New developments should prioritise walking and cycling infrastructure. Local plans should identify sites for consolidation centres near road links. Work jointly with bus operators to provide a regular reliable and affordable bus network. Work in partnership with LEPS and sub-national transport bodies. Use parking powers. Implement low emissions and clean air zones. Reduce business and customer travel to council services. Promote EV update.	Recommend that King's Lynn and West Norfolk seriously consider strategies for significantly limiting emissions growth from aviation and shipping.	Car free day promotions. Cycle charing scheme Encourage more walking and cycling Introduce a new Norwich cycle map. Introduce 20mph zones. Establish new rapid transport route. Review Norwich electric charging provision. Encourage more electric taxis.	Car free promotions.	Create a fund that will be used to match fund and secure further funding to expand EV charger delivery. Aspire how to use licensing powers on taxis to reduce their emissions.	Provide up to 5% business advice on reducing their energy consumption and water sustainability issues. 100% of vehicles in the private fleet fleet are EVs. 100% of buses accessing controlled zones are EVs. Number of charging facilities improves. Number of cycling routes improved. Increase number of EV charging hubs provided. Increase number of additional car club spaces delivered at major	Ensure all new transport schemes are sensitive to environment and biodiversity net gain. Council will work in partnership to achieve a shift towards public and active transport. 100% of new transport projects to deliver climate change mitigation, adaptation and biodiversity net gain. Research options for 'Green hydrogen fuelling' for HGVs. Support proposals to make sure that active and public transport are more competitive to private transport. Deliver new sustainable transport infrastructure. Provide educational guides on how to best manage your life to overcome negative perceptions.		Cycle path improvements. Updated car parking strategy. Promote the uptake of travel plans for business and organisations. Guided busway project. Amendment of taxi and private hire licencing requirements, requiring age and emissions limitations.	Extend scope of travel plans to local employers. Investigate extensions to LTPP3 to near-traffic flows. Investigate lower town centre parking charges for low-emission cars.	DEFE funding to install a network of EV charge points along main routes. DEFE funding to install a network of EV charge points along public sector estate.	Agreed: Updated car parking strategy.	Install public accessible EV chargers in line with demand. Improvements to cycle paths. Tax EV/hybrid policies (e.g. in line with gas-fuel). Public perception campaign to change perception regarding EV range and cost. Investigate car club options and incentives. Promote car free days etc.
Domestic	Electricity Consumption, Gas Consumption, Other Fuels and Other	5 GW of low carbon hydrogen by 2030. 400kW of offshore wind by 2030. Pilot hydrogen town by 2030. Pilot hydrogen village by 2025 Hinkley C Nuclear power by 2025. Implement future homes standard in shortest possible timeframe. Consult on increased standards for non-domestic buildings. 600,000 heat pump installations per year by 2028. Green homes grant extension; social housing decarbonisation fund; homes upgrade grant; public sector decarbonisation scheme. Extend ECO to 2028.	Produce a robust and ambitious heat strategy which sets the direction for the next decade, with clear signals on the phase out of fossil heating and commitments to funding. Bring forward the date to reach 6TW C in social homes to 2028, in line with the Private Rented Sector (PRS) proposals, and finalise the delivery mechanism. No buildings can be sold unless they meeting a minimum EPC C by 2028. Publish proposals for standards to phase out liquid and solid fossil fuels by 2028, and in-use standards in commercial buildings. Implement a strong set of standards – with robust enforcement – that ensure buildings are designed for a changing climate and deliver high levels of energy efficiency, alongside low carbon heat. Publish a robust definition of the future Homes Standard and legislate in advance of 2025. Provide a stable long-term policy framework to support sustained growth at sufficient scale (i.e. 600,000 heat pumps per year in existing homes by 2028). Ensure continuing support for non-residential heat pump installations, including including low-carbon heat sources for district. BEIS and Ofgem should undertake a programme of research to identify priority candidate zones for hydrogen, along with areas which are unlikely to be suitable, to inform development and network investments. Undertake one or more hydrogen trials in candidate zones in the early 2020s (e.g. 300-3000homes), to inform decisions on low-carbon zoning from 2025. Continue further pilots in the late 2020s, where valuable to inform larger scale take-up. All new boilers to be hydrogen-ready by 2025 at the latest. Research and pilot projects are needed to provide evidence for strategic decisions.		Overall the demand for low carbon Hydrogen for heating by 2030 to be relatively low (17TWh) Promise blending up to 20% hydrogen into the gas network by late 2022 and aim to make a final decision in late 2026 Hydrogen heating trials and consultation on "hydrogen-ready" boilers by 2026		Consulting on whether to end gas grid connections to new homes from 2025. Growing installation of electric heat pumps. From 30,000 per year to 600,000 per year by 2028. Framework to introduce opt-in switching. Establishing the future homes standard. Consulting on regulatory measure to improve home energy performance. Extend ECO to 2026.	Enforce minimum energy efficiency standards in the private rented sector. Use powers to require higher standards than current national standards for new builds. Help energy companies target fuel poor or vulnerable households with energy efficiency measures. Enforce building standards Develop district heating.	Ensure biodiversity net gain in new developments are screened to ensure future climate suitability. Work with infrastructure owners and operators to develop proposals for retrofitting at risk infrastructure. Include policies in local plan to outline adaptation approaches. Promote water and energy efficiency. Require energy and water efficiency and flood resilience in any local authority enabled development. Work with partners to deliver larger scale retrofit.	Saving money for the council and local people by ensuring that local homes, businesses and public buildings use energy and water efficiently. Helping the most vulnerable by understanding who is most at risk from fuel poverty and the impacts of extreme weather such as flooding, over heating and cold Helping households save money on their energy bills and keep warm by improving the energy efficiency of local homes. Working with partners to promote active, healthy lifestyles and to refer those at risk of fuel poverty to sources of help.	Enforce minimum energy efficiency standards in the private rental sector. Encourage 100 energiesprong (or similar) retrofits a year in social housing and then rolling out into the private sector. Retrofit council owned homes to EPC C. Require higher than national energy efficiency standards for privately-built new homes. Encourage /enable retrofit of all existing owner-occupied housing stock to EPC level C or above. Require homes built on council land to be Passivhaus standard or similar. If develop council facilities, ensure they are to the highest standards e.g. BREEAM excellent.	Local Plans should support renewable energy and low carbon heat.	CO2 emissions in the carbon budget related to electricity use from the National Grid in King's Lynn and West Norfolk are largely dependent upon national government policy and changes to power generation across the country.	Support earth hour. Provide grants for community energy projects. Run auctions for household solar PV. Only allow 100% renewable energy as standard in the Big Switch. Promote ECO. Update council district heating map. Run a training event on climate change adaptation for planners and members of the planning committee. Set up an energy company to help citizens access renewables. Ensure new developments have sustainable travel. Promote sustainable living to reduce resident Develop new homes for the city that conform to the 'Network Standard'. Develop a new 'Warwick Housing'. Feasibility study for low carbon modular homes.	Promote energy efficiency residents.	Promote more sustainable and renewable energy schemes. Refresh local plan.	Explore large scale solar PV on council homes and commercial properties. Seek high sustainability standards in new developments, through the local plan. Number of low carbon and renewable energy installations by type improving planning	100% of new housing developments deliver climate change mitigation technologies, adaptation design and biodiversity net gain. Update the Cambridgeshire and Peterborough Green Infrastructure Strategy. Support new community designs that minimise air pollution. Work with oil-based communities to find low carbon heating and hot water solutions to reduce carbon footprints and tackle fuel poverty. Explore the potential access to reduced cost renewable energy technology through collective purchasing schemes (chivacor). Encourage residents to reduce water waste through installing technologies that minimise water use and recycle it. Develop property level renovaccelerator locations to educate and encourage residents to invest in adaptation and mitigation technologies.		Encourage developers to all new homes by ensuring they are built to the highest possible level. New local development framework to require new dwellings to achieve high levels of thermal efficiency and include renewables. Establish sustainable homes showcases for existing builds and new builds. Develop a homes reception 'Observer Homes For Life' project. Deploy the warm front scheme. Develop a fuel poverty strategy. £600 grant towards the cost of installing solar hot water. Encourage sustainable construction and design from the LDF.	Encourage developers using levers such as planning policy to help move new building and refurbishment schemes closer towards meeting low carbon standards. Identify opportunity for energy mapping including district heating studies. Actively promote the installation of appropriately designed sustainable urban drainage systems. Embed robust policy to support and incentivise renewable energy to support new development.		Agreed: Promotion of the government green homes grant vouchers. Agreed: Green homes grant 100 through Norfolk Warm Homes Fund. Agreed: Climate change policy in Local Plan update	Facilitate collective purchasing schemes (chivacor). Provide grants for community energy projects. Develop a King's Lynn Standard to reduce carbon homes, through the LP. Work directly with oil-based communities to help increase EPCs and switch to low carbon heating. Develop a fuel poverty strategy. Wider promotion schemes to encourage the public to improve energy efficiency.
		Creation of new national parks and forests.	Develop new support schemes for GHG removals, sustainable aviation fuels, biofuelgrower and growing perennial energy crops in the UK.								Use green infrastructure to provide shading and cooling.	Promoting green and blue infrastructure by supporting investment natural solutions that will help protect against extreme weather		Commit to biodiversity net gain.		Recommend that CO2 emissions and sequestration from LULUCF are monitored separately from the energy only carbon budgets.	Promote local food production on council allotments.	Peat mapping.				Scrub fen reclamation.					Work with partners to bring/ establish a peat restoration strategy.

	Land Use Land Use Change & Forestry	Cropland and Settlements	Between 2022 and 2024 initiate 10 long term landscape recovery projects.	Regulations are needed to cover low-cost, low-regret options, including standards for emission reduction through the use of existing legislation (e.g. the Nitrates Directive to extend the coverage of Nitrate Vulnerable Zones to all of the UK) and new legislation (e.g. the Clean Air Strategy) The extraction of peat and rotational peat cutting for use in the horticultural sector should An increase in afforestation rates to at least 30,000 hectares per year across the UK by 2025 (in line with the Government's commitment) and an average of 40,000 hectares per year in England by 2050 (in line with ambition). This is not possible, stabilise the peat; by 2030, and restore or stabilise the remaining the area by 2050 Revert 20% of lowland cropland area and sustainably manage a further 10% by 2025. Revert 10% to 10% of farmland while maintaining their primary use, extend hedgerows by 20% and better manage hedgerows by 2035 Plant energy crops on 30,000 hectares per year across the UK by 2025. High take-up of low-carbon agricultural practices (precision farming, low-tilling, cover crops and grass legume crop) & waste management (anaerobic digestion and slurry covers). Government should set out a clear path to incentivise the take-up of zero or near-zero-emission options for agricultural machinery and to develop a strategy for decarbonising farmed soil. On-going public funding should continue, and where necessary be Terms of funding available under existing programmes (e.g. Countryside Stewardship) should be amended to incorporate measures that directly reduce emissions. Knowledge exchange of low-carbon farming practices, contractual issues for tenant farmers, support upskilling and scale-up of supply chains. Barriers to invest in R&D to improve productivity and resilience (e.g. crop breeding, low-carbon fertilisers, low-carbon machinery (e.g. trackers), low-cost, low-regret actions to encourage a 20% shift away from all meat by 2030 rising to 35% by 2050, and 20% shift from dairy products by 2030. An evidence-based strategy to establish options to successfully change behaviour and demonstrate Reduce food waste and food packaging waste by 50% by 2030 and 60% by 2050; with the public sector taking a lead through measures such as target setting and effective product labelling. Establish GHG Monitoring, Verification and Reporting (MRV) structures in the Different MRV and accounting frameworks may be required for different types of GHGs. This will include developing and publishing criteria for sustainable, verifiable GHG removals within the UK that can be used by UK sectors to offset their gross emissions, and a framework for accounting between different schemes, sectors, nations or accounting systems. The overall Net Zero Strategy should place GGRs in the context of a wider strategic approach to reaching Net Zero, setting out a plan for development and deployment of removals, but also for action Ensure there is a public engagement strategy for Net Zero includes national, regional and local communities to improve the public's understanding and acceptance of GGR approaches and their implications – awareness is currently very low, and support is																											
	Other	General						Establish a new UK Emissions Trading System.	Zero waste to landfill or incineration.			Support SME business to access funds and expertise for reducing emissions. Encourage and support schools to cut carbon. Engage with schools to ensure meals are delivered in accordance to the Eatwell guide.		Reach zero or near zero carbon no later than 2040. To stay within the recommended carbon budget, the Tyndall Manchester Climate Change Research Centre, need to achieve average mitigation rates of CO2 from energy of around -15.8% per year Stay within a maximum cumulative carbon dioxide emissions budget of 8.0 million tonnes (MtCO2) for the period of 2020 to 2100. At 2017 CO2 emission levels, King's Lynn and West Norfolk would use this budget in approximately 6 years time. Recommended that King's Lynn and West Norfolk promote the deployment of low-carbon electricity generation within the region and where possible influence national policy on this issue. CO2 emissions in the carbon budget related to electricity use from the National Grid in King's Lynn and West Norfolk are largely dependent upon national government policy and changes to power generation across the country.	Free awards scheme for residents and organisation.			Awareness of climate change issues and changes in behaviour to residents and business.		Establish new forms of partnership, collaboration and engagement. Create a suite of engagement and communication activities. Exert influence to direct behaviours of companies where BIC is a shareholder.	Power to the people renewable energy events. Severe weather text alert system.				Agreed: Officer engagement at local awareness groups events. Agreed: Promotion measures for residents to reduce their carbon footprints.	Kick / climate change awards scheme.
		Power Supply		Net a requirement that from 2022 any new plans for offshore oil and gas platforms and associated installations must use low-carbon energy for their operations. As a result, all new oil and gas platforms should have no direct emissions from operational energy use by 2027, at the latest. Develop a policy to reduce emissions from existing oil and gas platforms in line with our Balanced Pathway. Develop carbon intensity (or broader) measurement standards for gas and oil, by working with industry and the International community Facilitate increased collaboration between the UK's offshore oil and gas and offshore wind sectors, exploring the potential for direct power connections between Ensure hydrogen demand on areas where that cannot feasibly decarbonise without it. Set out vision for contributions of hydrogen production from different routes to 2035. Blue hydrogen. It is important to deploy fossil gas CCS early to prove that it can deliver suitable emissions reductions vs. fossil gas (i.e. at least 85% CO2 capture, 85% lifecycle GHG reduction vs. fossil gas) and work is required to improve the cost and performance of electrolysers. All new power capacity should be hydrogen- and/or CCS-ready as soon as possible and at the latest by 2025, including being located where hydrogen/CO2 infrastructure will be available. Hydrogen boilers in buildings to be hydrogen-ready from 2026 at the latest, without pre- judging the respective roles of hydrogen and electrification. Government should consider at what point and which level it would make sense to set a maximum carbon-intensity for hydrogen. Ensure that low-carbon hydrogen capacity is incentivised to contribute emissions reductions (including energy with fossil gas) at least for power generation, industrial clusters and grid injection. Hydrogen-producing electrolysis based on low-curtailed grid electricity, as likely to push up emissions – focus on curtailed generation and dedicated renewable electricity.		By 2030, we could see a small but important role for low carbon hydrogen to generate power, with demand for hydrogen in power ranging from 0-10TWh. We expect to see further ramp-up beyond 2030. hydrogen demand could increase to 20-30TWh in 2035, and 25-40TWh by 2050 Electrolytic hydrogen production can also provide grid flexibility by drawing on 'excess' renewable or low carbon electricity that would otherwise be constrained Expect hydrogen blends to be the primary use of hydrogen in the power sector, shifting to the first 100 per cent hydrogen turbines later in the decade Expect that low carbon hydrogen, will play an increasing role in providing peaking capacity and ensuring security of supply. Subject to competition we are supporting innovation in energy storage through electrolysis via our £68 million Long Duration Storage Engage with industry on possible requirements for a research and innovation facility to support hydrogen use in industry and power		60GW of offshore wind by 2030, including 10GW of floating wind. Support and deployment ag CCUS in a industrial cluster, with at least 1 being operational by 2030. Aim to bring at least an large scale nuclear project to point of final investment decision by the end of current parliament. Consulting on whether to end gas grid connections to new homes from 2025. Increasing installation of electric heat pumps, from 30,000 per year to 600,000 per year by 2028. Build world leading digital infrastructure for our energy system. Working with industry to develop 50 GW of low-carbon hydrogen production capacity by 2030. £385m in an advanced nuclear fund. Support the delivery of the sectors target of 40% UK content in offshore wind projects by 2030. £140m to support the development of offshore wind manufacturing infrastructure. Publish new smart systems plan in spring 2021.	Identify areas for renewable energy in the local plan.			Identify areas suitable for renewable energy in the local plan. Invest in the development of renewable energy and storage.	Local Plans should support renewable energy and low carbon heat. Develop onshore wind strategies.															

Tree Planting for Net-Zero

Assessing the feasibility, effectiveness and cost of a district tree planting programme as a strategy to offset the Borough Council of King's Lynn and West Norfolk's emissions.

Project Title:

Assess the feasibility, effectiveness and cost of a district tree planting programme as a strategy to offset the Borough Council of King's Lynn and West Norfolk's emissions.

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Disclaimer

Cover image: https://www.gov.uk/government/news/government-launches-new-scheme-to-boost-tree-planting (2020)

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Executive Summary

Background:

To comply with the 2015 Paris Accord, the UK Government has set legislation targeting net-zero greenhouse gas (GHG) emissions by 2050 (Committee on Climate Change, 2019). As part of this, it is the responsibility of local authorities (e.g. Borough Councils) to reach net-zero themselves. To achieve this, total GHG emissions must be reduced. For emissions that are difficult to reduce, it is possible to sequester carbon to reach net-zero; this project focuses on tree planting as a means for sequestering this carbon. The purpose of this report is to assess the feasibility, effectiveness and cost of a district tree planting programme to offset the Borough Council of King's Lynn & West Norfolk's (BCKLWN) emissions so as to comply with the governments net-zero by 2050 target.

Required carbon sequestration:

The amount of carbon sequestration necessary to reach net-zero depends entirely on the success of reducing BCKLWN's pre-existing emissions. The latest carbon audit reveals that BCKLWN was responsible for 4632.4 tonnes CO_2e in the 2018-2019 period. However, the plans to move to entirely renewable energy sources means that 1425.2 tonnes CO_2e of scope 2 emissions need not be sequestered. The planned refit of council buildings is also predicted to reduce emissions from heating by 450 tonnes CO_2e per annum. Thus, after these schemes – if we are to assume no further change in emissions – 2757 tonnes CO_2e must be sequestered per year for the council to be net-zero by 2050. However, this is a low-ambition scenario: further reductions can likely be made in scope 1 and 3 emissions, for instance by introducing electric vehicles to the Council's fleet.

Which trees are most suitable?

For such a project, there will be no "perfect" tree (nor woodland), but instead the benefits and suitability of different species much be weighed-up. A key trade-off is whether sequestration capability is prioritised above all else – in which case Conifer plantations would be used – or whether other factors such as biodiversity are to be included. Species suitability varies according to the site, but species such as Oak, Alder, Lodgepole Pine and Scots Pine have been identified as suitable for the (current and future) climate and soil characteristics of the region generally. Forest Research's *Ecological Site Classification-Decision Support Tool* was used to determine which species would be suitable. However, this is not exhaustive and, crucially, species suitability will vary according to *specific* sites' characteristics (for instance, soil type can vary from field to field).

The sequestration benefit of coniferous species such as Scots Pine is found to be approximately 2.7 tC ha^{-1} a^{-1} (tonnes of carbon sequestered per hectare per year), while the sequestration potential of deciduous woodlands generally (including a mixture of species) is found to be approximately 2 tC ha^{-1} a^{-1}. However, as the report states, calculating these figures is complex and figures may vary between sources.

Cost:

To estimate the rough costs of any scheme, the Forestry Commission's Standardised Costs were used. This gives an appropriate cost per tree, including the tree itself, stake, protection (tubing), and labour (both planting and maintenance). These Standardised Costs are £3.79 for small "feather" trees (150-175cm in height and 4-6 years old), and £2.29 for "whips" (100cm-125cm and approximately a year old). These costs were double-checked using the online wholesale stores of two tree-nurseries (Alba Trees and Christie Elite); where – including tree, stake and guards – the cost per Oak tree (whip) would range from £1.00-1.29, while the cost per Scots Pine (whip) would range between £1.07-£1.13. This is without labour: adding the cost of planting and maintenance would likely lead to a similar figure suggested by the Forestry Commission. The cost of planting a mature tree is considerably more expensive. For instance, from Barcham Trees (used by BCKLWN's arboricultural officer) the cost of a single Oak is £166 if 10 trees are bought.

Funding opportunities:

There are various funding opportunities available for local authorities wishing to undertake such schemes, ranging from government grants to private investment. However, private investment is unlikely to be an option: businesses may pay for tree-planting schemes with the assumption that the sequestration can offset their own emissions. It is not possible to double-count these, and thus this would not be helpful for BCKLWN to reach net-zero. Instead, two government schemes have been identified as potential sources of funding. These are the Countryside Stewardship Woodland Creation Grant (CSWCG) and the Urban Tree Challenge Fund (UTCF). The CSWCG is the scheme that is most heavily promoted by the Forestry Commission and entitles local authorities for up to £6,800 per hectare of woodland created – the total amount received depends on actual capital costs, such as saplings, protection, fencing (Natural England, 2018). However, the CSWCG is only available for larger sites. For smaller plots, the UTCF is more appropriate, which covers up to 50% of the costs of planting (with the Council covering the other 50%). The UTCF is catered specifically towards planting in urban areas, and so is particularly suitable for BCKLWN.

Recommendations:

The first two of the recommendations in this project focus on what is feasible on the land identified as available for planting. Recommendation 1 involves planting deciduous species such as Oak, Rowan and Alder on the 1.12 ha site at Chalk Road (Walpole St Peter), which would have an anticipated 2.2 tC/year sequestration potential. Recommendation 2 involves planting similar species on 31 separate sites; these total 5.1 ha and would result in 10.2 tC/year sequestered. The rough costs of these two schemes would be approximately £6,412 and £29,198 respectively. Recommendation 3 acknowledges that the previous two recommendations are inadequate to offset the Council's emissions and thus suggests buying land in order to implement a large-scale planting project. Acknowledging the cost and risk of this, no *specific* plan is laid out, but instead several different scenarios are given to demonstrate the various sequestration potentials of different planting outcomes.

1. Background and Required Sequestration

To avert the negative effects of anthropogenic climate change the UK Government has set legislation to target net-zero greenhouse gas (GHG) emissions by 2050 (Committee on Climate Change, 2019). As part of this legislation, it is the responsibility of local authorities (e.g. Borough and District Councils) to reach net-zero on their own GHG inventories. In order to achieve net-zero, overall GHG emissions must be reduced. However, it is inevitable that some emissions – for instance those from water supply - are difficult to reduce; while future technological gains may contribute towards these reductions, in the meantime these must be sequestered if net-zero is to be reached. One of the most prominent methods of sequestering emissions is the planting of trees, which absorb carbon through photosynthesis. The purpose of this report is to assess the feasibility, effectiveness and cost of a district tree planting programme to offset the Borough Council of King's Lynn & West Norfolk's (BCKLWN) emissions so as to comply with the governments net-zero by 2050 target.

Before making suggestions on tree planting programmes, it is important to first understand the scale of sequestration required. The Council's most recent carbon audit shows that BCKLWN was responsible for 4632.4 tonnes CO_2e in the 2018-2019 period. However, recent plans to move to entirely renewable energy sources means that the 1425.2 tonnes CO_2e from scope 2 need not be sequestered. The planned refit of council buildings is also predicted to reduce emissions from heating by 450 tonnes CO_2e per annum. Thus, after these schemes – assuming no further changes in emissions – **2757 tonnes CO_2e must be sequestered per year for the Council to be net-zero by 2050.** However, this is a low-ambition scenario: further reductions can likely be made in scope 1 and 3 emissions, for instance by introducing electric vehicles. However, making these suggestions and coming up with a different target for sequestration is beyond the scope of this report.

2. Species Identification

2.1. Which tree species are most suitable?

To determine which tree species would be suitable to plant within the borough, Forest Research's *Ecological Site Classification-Decision Support Tool* (henceforth referred to as ESC Tool) was used. The ESC Tool takes into account current *and* future climate scenarios within a specific area, as well as soil characteristics. The soil data from the ESC Tool was trusted to be accurate, however it is worth noting several things relating to soil. Firstly, the borough has a wide range of soil types: as appendix 1 demonstrates, the distribution of these different types is complex and makes giving concrete suggestions of which species will and won't thrive rather difficult. Soil varies from site-to-site, and so soil analyses should be undertaken for any large-scale planting scheme.

Table 1 demonstrates a variety of species that the ESC Tool identifies as Very Suitable, Suitable, Marginal and Unsuitable in three specific areas within the Borough (these were chosen based on the land availability information provided – see section 6). This suitability was determined under the "Medium-high 2050" climate scenario.

A few things from table 1 need to be clarified. Firstly, the unsuitability of Beech is due to the incorporation of future climate data: as Wesche (2003) argues, future warming and decreased rainfall (which is expected to particularly affect the East of England) will make conditions unsuitable for Beech trees.

Secondly, the unsuitability of most tree species in the areas surrounding Burnham Market is due to the high carbonate levels in the soil, which can cause mortality is most species (Forest Research, 2016). However, this is not always the case: if the information in table 1 is true, there would be no trees in Burnham Market (quite obviously not the case), and thus this reinforces a) the importance of taking these results with a slight pinch of salt, but, more importantly, b) for any significantly large planting project, a site-specific soil analysis *must* be undertaken. This is reinforced by Shining Gum being deemed unsuitable at the chosen location within Downham Market, but suitable just 1-2km southeast.

Species	Suitability		
	Kings Lynn (TF637200)	Downham Market (TF608034)	Burnham Market (TF832420)
Sitka Spruce	Unsuitable	Unsuitable	Unsuitable
Scots Pine	Suitable	Suitable	Unsuitable
Lodgepole Pine	V. Suitable	V. Suitable	Unsuitable
Corsican Pine	V. Suitable	V. Suitable	Unsuitable
Common Alder	Suitable	Suitable	Unsuitable
Beech	Unsuitable	Unsuitable	Unsuitable
Oak	Suitable	Suitable	Unsuitable
Rowan	Suitable	Suitable	Marginal
Poplar	Suitable	Suitable	Unsuitable
Silver Birch	Marginal	Marginal	Unsuitable
Hornbeam	V. Suitable	V. Suitable	Suitable
Shining Gum	V. Suitable	Unsuitable	Unsuitable
Wild Service Tree	V. Suitable	Suitable	Suitable

Table 1. The suitability of different tree species for different locations within the Borough, determined using the ESC Tool. Grid references for each site used have been included for reference.

2.2. What is the carbon sequestration of these species?

It is first important to note that the estimation of a tree's carbon sequestration ability is difficult, and figures vary between different sources. There seems to be no universally accepted figure that is widely used, with uncertainty due to varying factors such as soil characteristics, the year of planting, and management (Brainard *et al.,* 2009). The most comprehensive figures for different species are those from Cannell and Milne (1995). While this is an old paper, it is frequently cited by more recent work. Table 2 demonstrates the sequestration abilities of five different forest types, giving the long-term carbon storage of each species per rotation, and then the annual carbon flux. It is interesting to note that the long-term sequestration potential of Beech and Sitka woodland end up being broadly similar (with beech woodland taking longer to reach this so-called equilibrium). This is important in terms of strategy: if trees are planted with the intention that they will be permanent – e.g. in residential areas – then the *long-term* sequestration of carbon will not differ much between these species.

Tree Species (yield class)	Rotation Length (years)	Long-term average amount of carbon in trees, products, litter and forest soil (tC ha^{-1})	Net annual carbon flux including trees, products, litter and soil (rate of storage) (tC ha^{-1} a^{-1})
Sitka Spruce (16)	55	192	3.6
Sitka Spruce (12)	59	167	3.0
Scots pine (10)	71	178	2.7
Beech woodland (6)	92	200	2.4
Oak woodland (4)	95	154	1.8

Table 2. The carbon storage of different forest types of Britain. The data for Sitka Spruce refer to stands subject to intermediate thinning. Adapted from Cannell and Milne (1995).

These figures *do* correspond with other similar analyses. For instance, Nijnik *et al.* (2009) argue that thinned stands of beech (YC 6) would sequester 2.3 tC ha^{-1} a^{-1} (tonnes of carbon sequestered per hectare per year), and that thinned stands of Sitka (YC 12) would sequester 2.8 tC ha^{-1} a^{-1} – both calculations similar to those above. Another interesting analysis – with similar results – comes from Poulton *et al.* (2003), who found that a reforested deciduous woodland, dominated predominantly be Oak (but featuring other species), gained 2.0 tC ha^{-1} a^{-1} over the 120 year period. This is also reflected by Cannell's (1999) assertion that hardwood species *generally* sequester 2 tC ha^{-1} a^{-1}. It thus seems to be universal that 1 ha of deciduous hardwood species sequesters *approximately* 2 tC ha^{-1} a^{-1}, and thus this is the figure that will be used. The sequestration potential of ground-level plants has not been considered as these are unlikely to contribute significantly to the numbers: when carbon is stored in plants, it is done so predominantly in its wood (Dewar and Cannell, 1991) and thus shrubby plants have limited (but not zero) sequestration ability.

3. Cost

It is obvious that the cost of any scheme will vary depending on its specific details. However, this section aims to provide a broad overview of the different costs associated with tree planting projects, for instance the saplings/whips themselves, tree guards, fencing, etc. The Forestry Commission's (2020) Standardised Costs of planting give the best estimates of the cost-per-tree. This suggests that the cost of the tree itself, stake, protection (tubing), and labour (planting and maintenance) will be £3.79 for small "feather" trees (150-175cm and 4-6 years old), and £2.29 for "whips" (100cm-125cm and 1 year old). This was double checked using the online stores of two tree-nurseries (Alba Trees and Christie Elite); where – including sapling, stake and guards – the cost per Oak (whip) would range from £1.00-1.29, while the cost per Scots Pine (whip) would range between £1.07-£1.13. Adding labour to this would likely lead to a similar figure to those suggested by the Forestry Commission, and thus these (Forestry Commission) figures will be used. However, these costs are based on the price for small whips, *not* mature trees. If these were to be used, costs would be considerably higher. For instance, from Barcham Trees – used by BCKLWN's arboricultural officer (Saunders, 2020) – the cost of a *single* 3-4m Oak is £166 if 10 are bought (Barcham, 2020). While this may be expensive, planting mature trees means that the tree is more likely to establish itself, as it is less vulnerable than smaller saplings.

4. Funding Opportunities

There are several funding opportunities available for local authorities wishing to undertake such schemes, ranging from government grants to private investment. However, private investment is unlikely to be an option: businesses may pay for tree-planting schemes with the assumption that the sequestration can offset their own emissions. It is not possible to double-count these, and thus this would not be helpful for BCKLWN to reach net-zero.

Instead, government schemes such as the Countryside Stewardship Woodland Creation Grant (CSWCG) will be more viable. The CSWCG is the scheme that is most heavily promoted by the Forestry Commission. This entitles local authorities for up to **£6,800 per hectare of woodland created** – the total amount received depends on actual capital costs, such as saplings, protection, fencing (Natural England, 2018). The amount that a scheme can claim per capital item is shown in the official government document. There is also a yearly £200 payment for maintenance, however, local authorities *are not* eligible for this. There are several criteria that any planting scheme must meet to be eligible. **The one that most heavily affects BCKLWN is that the minimum area per application is 3ha, the minimum block size is 0.5ha, and the minimum width per block is 20m.**

For areas that are not eligible for CSWCG, there is also the Government's Urban Tree Challenge Fund (UTCF), which covers 50% of the costs of planting, with an upper limit of £1.15 per whip (100% standardised cost £2.29). The UTCF is suitable for sites that do not meet CSWCG requirements. The UTCF requirements are that: "any individual or organisation can submit up to five distinct applications to the UTCF, each of which can contain up to three planting sites or projects. Planting sites cannot exceed half a hectare and must contain a minimum of 150 and a maximum of 5,000 small trees per site" (Forestry Commission, 2020). The current application window for Round 2 has been extended to the 30th June, with planting for this round expected to commence winter 20/21. It is currently unclear whether there will be a third round.

5. Recommendations

Firstly, it remains **highly unlikely that tree planting alone will be enough for BCKLWN to reach net-zero**, and that emissions reductions are essential, reflecting Brainard *et al.*'s (2009) assertion that "storing carbon in British woodlands [is] only…a small stopgap strategy". For illustration, assuming 2050 emissions of 2757 tonnes CO_2e, it would require 1021 ha of Scots pine to be planted by 2050, or 34 ha (85,000 trees) per annum to achieve carbon-neutrality. First and foremost, the recommendations made must be feasible within the constraints of the Council's available land area for planting, information for which was provided by Henry Saunders on 12/05/2020. The information provided had little detail, with only a road-name and the village/town – Google Maps was used to infer the specific parcel of land identified for planting. Once this was identified the OS Roam feature on https://digimap.edina.ac.uk/ was used to measure the area of these patches. **For 26 of the initial 58 areas provided, it was not clear where the area for planting was, either through no identifiable empty space, or the road being a country road surrounded by fields, most of which are unlikely to be owned by the Council: these have not been included in the below recommendations.** The

remaining 32 areas – shown in appendix 2 – total 6.2 ha. All but one of these sites (Chalk Road, Walpole St Peter) are small plots of land predominantly in residential/urban areas. For these, it is clear that commercial-type forestry (i.e. coniferous plantations) is not feasible. These recommendations thus work from what is *feasible* on these parcels of land, rather than making overly ambitious, unrealistic plans. Table 3 below provides a brief overview of recommendations 1 and 2, while table 4 details recommendation 3.

	Hectares Planted	**Cost**	**Funding**	**Sequestration Potential**
Recommendation 1	1.12 (Chalk Road, Walpole St Peter)	£6,412	Potential for 50% of costs to be covered by UTCF, but only up to 0.5 ha. Upper limit thus ~£1,431	2.2 tC per year
Recommendation 2	5.1 (31 different sites)	£29,198	Potential for 50% of costs to be covered by UTCF.	10.2 tC per year

Table 3. A summary of recommendations 1 and 2.

Recommendation 1:

Planting on larger plots of land should be prioritised due to the larger sequestration and biodiversity benefits of larger habitats. However, Chalk Road (Walpole St Peter) was the only continuous site larger than 0.5 ha, with a total of 1.12 hectares. However, because the total area is less than 3 ha, this site will not be eligible for the CSWCG **unless a further 1.88 hectares close to the site are found.** The *total site* is also too large for the UTCF. However, if the planting of the site is split into two (so that half is planted first), the site is likely to then be eligible (assuming applications can be made before June 30th or there is a Round 3). The remaining half could thus form an application for subsequent UTCF rounds, or the council could pay the entire costs without the support of a funding scheme. This site should be planted with a mixture of deciduous trees, such as Oak, Rowan, Alder, Poplar and Hornbeam at a recommended spacing of approximately 2m (Woodland Trust, 2020) which would result in approximately 2500 trees/hectare. The use of whips is recommended due to their low-cost and ease of planting. A combination of such deciduous species would be expected to sequester approximately 2 tC ha^{-1} a^{-1}, as section 2.2 argues. By ensuring a variety of species, the risk of pests and disease are minimised (Forest Research, 2020). Buying from respected nurseries also minimises this risk. Using the Forestry Commission's Standardised Cost (£2.29 – explained in section 3), planting the entire estimated 1.12 hectares at 2500 trees/ha would cost £6,412. £1,431 of this could be reclaimed as part of the UTCF (50% of planting cost of 0.5 ha). **Planting this area would result in a carbon sequestration benefit of approximately 2.2 tC/year.**

Recommendation 2:

The remaining 31 areas were all smaller parcels of land in urban areas. Two of these (Nar Ouse Way and Parkway) currently *are* large parcels of land, but major developments are planned on these sites, significantly reducing planting potential. It is unclear how much land will be available after the development, and so Ged Greaves' suggestion of 10% of the original total area will be used. This reduces potential planting area from 1.87 ha to 0.187 ha at Nar Ouse Way, and from 7.77 ha to 0.77 ha for Parkway. Once this is considered, these 31 areas total approximately 5.1 hectares. On these, the types of planting that should occur is similar to that in

recommendation 1. It is likely that these smaller plots of land *may* be eligible for UTCF. **These 5.1 ha should have the potential to sequester a further 10.2 tC/year if all these sites are planted.** The costs of planting on these sites will be similar to recommendation 1, and thus using the Forestry Commission's Standardised Cost (see section 3) planting these (estimated) 5.1 ha at 2500 trees/ha would cost £29,198. These sites would be eligible for UTCF funding, so the costs could technically be split 50:50 between the Council and UTCF. However, as section 3 states, each organisation can only make 5 distinct applications each including up to 3 sites: priority should thus be given to the largest sites with the most sequestration potential.

Recommendation 3:

While recommendations 1 and 2 will provide carbon sequestration, it is still far from what is necessary for BCKLWN to come anywhere close to net-zero. The final – and most ambitious – recommendation is thus buying land in order to implement a *large-scale* planting programme, with a mixture of deciduous (as above) and coniferous (e.g. Scots Pine) species. The exact size of any such project would depend on the land available and the Council's level of acceptable risk/expenditure. It is meaningless to make broad recommendations with something of this scale and no knowledge of what the Council would be willing to undertake, so instead table 4 illustrates 5 different planting scenarios (the bottom demonstrating what is necessary to achieve net-zero). The top 4 scenarios assume a mixture of deciduous and coniferous species, and this uses an average of the aforementioned 2 tC ha^{-1} a^{-1}, and Scots Pine's 2.7 tC ha^{-1} a^{-1} – a 50/50 mix would mean an approximate sequestration potential of 2.35 tC ha^{-1} a^{-1}. **All of these scenarios would be eligible for the CSWCG.**

Hectares Planted per Year (2021-2050)	Cost per Year (Excluding Land Costs)	Total Hectares Planted by 2050	Annual Carbon Sequestration by 2050
5	£28,625	150	352.5 tC ha^{-1} a^{-1}
10	£57,250	300	705 tC ha^{-1} a^{-1}
15	£85,875	450	1057.5 tC ha^{-1} a^{-1}
20	£114,500	600	1410 tC ha^{-1} a^{-1}
34 hectares of Scots Pine	£194,650	1021	2757 tC ha^{-1} a^{-1}

Table 4. Five different ambitious planting scenarios.

6. Summary

This project has explored the feasibility, cost and effectiveness of a district tree planting scheme to offset the Borough Council of King's Lynn and West Norfolk's emissions in order to reach net-zero by 2050. Three recommendations have been made: the first two of these focus on planting on pre-identified council land, totalling approximately 6.2 ha with an estimated 12.4 tC sequestered per year. However, it is clear that these two alone will not make a significant difference to BCKLWN's net-emissions – as such recommendation 3 suggests buying land to plant trees. Acknowledging the cost and size of such a project, no *specific* plan is laid out, but instead several different scenarios are given to demonstrate the potential sequestration benefits of this.

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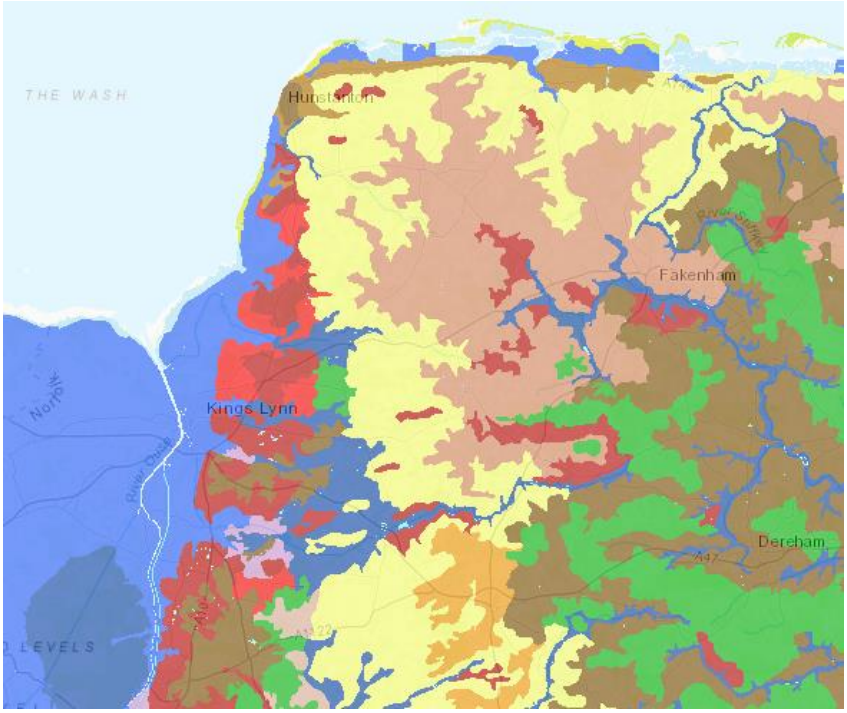
Appendices

Appendix 1 – soil types within the region. A key has not been provided because these soil types were not used to determine species suitability, the map has only been included to demonstrate that soil across the Borough is not uniform (Source: http://www.landis.org.uk/soilscapes/)



Appendix 2 – all 32 sites and their area and eligibility for the two schemes identified. The "sites" column refers to whether the entire area is continuous, or whether – for example – it is separated by a road.

	Site Address	Village/Town	Sites	Area (m^2)
1	Sutton Estate	Burnham Market	2	4290
2	Crofts Close	Burnham Market	1	400
3	Goodricks	Burnham Thorpe	1	500
4	Warrens Road	Clenchwarton	1	800
5	Wildfields Road	Clenchwarton	1	2300
6	Brady Close	Denver	1	330
7	Retreat Estate	Downham Market	1	500
8	Snape Lane	Downham Market	1	4900
9	Town Close	East Winch	1	520
10	Manby Close	Hilgay	1	1480
11	Pearce's Close	Hockwold	1	530
12	Collingwood Road/Nelson Drive	Hunstanton	1	300
13	Hardwick Roundabout	King's Lynn	1	545
14	Riversway	King's Lynn	1	3300
15	Pleasance Close	King's Lynn	1	560
16	Oak Circle/Bishop's Road	King's Lynn	2	3000
17	Hillside	Marham	1	1050
18	Priory Road	North Wootton	1	540
19	Jarvie Close	Sedgeford	1	3450
20	Bluestone Crescent	South Creake	1	680
21	Tower Road	Terrington St Clement	2	1570
22	Caves Close	Terrington St Clement	1	370
23	Alma Avenue	Terrington St Clement	1	2200
24	Westfields	Tilney St Lawrence	1	1700
25	Lode Avenue	Upwell	2	2860
26	Townley Close	Upwell	1	350
27	Hankinsons Estate	Walpole St Peter	1	770
28	St Andrews Close	West Dereham	1	1200
29	Turners Close	Wimbotsham	1	600

30	Nar Ouse Way	King's Lynn	1	1872
31	Parkway	King's Lynn	1	7772
32	Chalk Road	Walpole St Peter	1	11180