Suffolk Climate Emergency Plan, Technical Report

Consultancy Support

Report for Suffolk Climate Change Partnership

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Executive summary

On 21st March 2019, Councillors at Suffolk County Council voted to declare a climate emergency. The declaration included an aspiration to make the county of Suffolk carbon neutral by 2030. Similar declarations have been made by Babergh and Mid Suffolk District Councils, East Suffolk Council, Ipswich Borough Council and West Suffolk Council. This report considers indicative emissions reduction pathways to achieve carbon neutrality in Suffolk by 2030 and the possible policy options and actions to deliver this.

Carbon neutrality, also known as net zero emissions, means a balance between emissions to the atmosphere and removals of emissions from the atmosphere (for example, from forests, carbon capture and storage etc). For this project, carbon neutrality has been defined in its broadest sense, meaning a net balance between emissions of all greenhouse gases (not just carbon dioxide) to the atmosphere as a result of activities in Suffolk[1] and GHG emissions removals taking place in Suffolk.

What this means is that any emissions removals in Suffolk in 2030 are likely to be needed to balance out any residual GHG emissions in the harder to tackle non-energy sectors, such as waste, agriculture, forestry and land use. Therefore GHG emissions in the energy sectors (mainly carbon dioxide) will need to be reduced almost to zero. This report does look at ways in which GHG emissions in the non-energy sectors can be tackled, but the focus of the report is on the energy sectors.

The main messages coming out of this work are:

Box 1: Key messages on reaching carbon neutrality in Suffolk by 2030

- Achieving carbon neutrality by 2030 will require significant action across a range of stakeholders in Suffolk and will need budget to be mobilised quickly.
- 38% of CO_2 emissions in Suffolk in 2017 came from industry and commercial energy use, 37% from transport and 26% from domestic energy use. CO_2 emissions overall have fallen by 30% since 2005, but whilst emissions in the industry/commercial and domestic energy use sectors have fallen over that period, transport emissions have fallen then risen and are currently at the same levels as in 2005.
- The County and District Councils' carbon emissions from their own activities are a small fraction of Suffolk's overall emissions and whilst they hold some levers for achieving carbon neutrality, they do not have the power, influence or budget to deliver the target alone. But they do have a key role to play, in terms of leadership, coordination and policy direction.
- Meeting the aspiration will be dependent, to a great extent, on national-level policy, so Suffolk's Local Authorities will need to continue to engage fully with Government Departments, to lobby for policy changes and funding.
- But there is also a lot that can be done locally. The nature of the local response will naturally be shaped by the specific challenges that the county faces, for example its rural nature, the heavy reliance on private cars and the relatively low density of heat demand in many areas.
- Where activities (e.g. heat pump installations, uptake of electric vehicles) will need to be scaled up to deliver carbon neutrality, it is assumed that this is done in a phased manner,

[1] More specifically, this report focuses on 'Scope 1' emissions (direct GHG emissions in Suffolk) and 'Scope 2' emissions (emissions that may occur outside of Suffolk as a result of electricity consumption in Suffolk).

meaning relatively lower levels of activity or rates of uptake in earlier years and much higher rates in later years.

- However, even the lower initial rates of uptake represent significantly increased delivery than at present. Work will also be needed in the earlier years to reduce demand, for example for heating and individual car use.
- The priority areas that should be the focus of local action are:
    - Improving the thermal efficiency of the building stock and decarbonising the supply of heat.
    - Encouraging greater take-up of public transport and active travel (walking and cycling) and a massive roll-out of zero emissions vehicles.
- In addition, Suffolk should consider:
    - Increasing uptake of local distributed renewables, as a way of reducing reliance on national-level grid decarbonisation.
    - Working with industry on decarbonisation options.
    - Take further measures to encourage GHG reductions in waste and agriculture.

This report also looks at the 'narrative' in individual sectors and sets out the pathways that they will need to follow to enable Suffolk to become carbon neutral by 2030. More details can be found in the main body of the report, but key messages for the priority sectors are outlined below.

Box 2: Key messages for the buildings sector

Vision:

- Many more homes need to be more thermally efficient and all homes will need to switch to some form of low carbon heating by 2030.
- As other low carbon heating options, such as district heating, have relatively less potential in Suffolk than in other parts of the country, and other options, such as hydrogen, are unlikely to be scaled up in time, huge numbers of heat pumps will be needed. Around 330,000 homes might need heat pumps by 2030.
- There should be a big push in initial years on building energy efficiency retrofit, to reduce emissions in the short term and to prepare buildings for heat pumps (which work better in thermally efficient homes).
- At the same time, in those earlier years, heat pump installations should be encouraged where more feasible, for example on the Council's own buildings, in new build developments and with the able-to-pay segment of the market.
- Meanwhile, an upskilling should be encouraged through training courses to ensure there are enough heat pump installers to meet the increasing demand.
- In addition, the Council could work on the design of a larger-scale scheme for incentivising greater heat pump uptake to reach the numbers required in later years.

Opportunities:

- The County Council, District & Borough Councils and other public service providers:
    - Look for immediate opportunities to install heat pumps in Council-owned buildings.

    - Lobby government to enhance subsidies for heat pump and retrofit costs in domestic properties and businesses.
    - Develop ideas for a policy that can incentivise heat pump uptake.
    - Develop materials and training, in conjunction with industry, on options for and benefits of heat pumps, to target the able-to-pay market early.
    - Support local installers and supply chain to move to mass roll-out.
    - Consider scope for local planning policy to be used to encourage the move to zero carbon homes.
- Businesses:
    - Landlords of private rented homes should increase the insulation of their properties and install low or zero-carbon heating where appropriate.
    - Heating installers could start marketing low carbon heating solutions more.
- Academia:
    - Develop training courses on heat pump installation and maintenance.
- Individuals:
    - Look to install no-regrets insulation measures such as topping up loft insulation, filling unfilled cavities, reducing leakiness etc.
    - Consider opportunities for where large-scale building improvements (e.g. extensions) might be used as an opportunity for installing low carbon heating options.
- National government:
    - Consider options for a national-level scheme for incentivising heat pumps and greater thermal efficiency.
    - Enhance current Building Regulations and National Planning Policy Framework to deliver zero carbon homes for new builds and retrofits.

Box 3: Key messages for the transport sector

Vision:

- Most vehicles on the road in Suffolk will need to be zero emission (mostly fully electric) by 2030.
- Currently, 0.16% of vehicles in Suffolk are fully electric and there are 120 charging points across the County; achieving this therefore will require a significant effort.
- The burden of doing this can be reduced by encouraging modal shift to public transport and active travel (walking and cycling). However, the rural nature of the county will present challenges in doing this.
- A scenario has been modelled that assumes a significant (25%) reduction in car miles travelled, through a combination of reduction in demand for transport (e.g. car sharing, working from home) and modal shift to public transport and active travel. It also modelled a 15% reduction in freight miles.
- This reduces vehicle numbers to 390,000 by 2030 - all would need to be zero carbon.

- Reduced in a linear profile, this would mean 39,000 vehicles a year, with all new vehicles being zero emissions immediately. Assuming this is not possible, greater numbers of zero emission vehicle uptake will be needed in later years and this would need scrappage incentives to take vehicles off the road that have not yet reached end of life.
- There will need to be around 300,000 private charging points for cars and vans, and around 3,300 public charging points.
- This would add about 1,000 GWh of electricity demand by 2030, about 30% of existing electricity consumption.

Opportunities:

- The County Council, District & Borough Councils and other public service providers:
  - Seek extra investment for public and community transport (e.g. increased routes, frequency, through ticketing etc) and for significant infrastructure that supports a modal shift to walking and cycling.
  - Consider scope for measures to dampen demand for private car transport, e.g. increasing parking charges, road user charging, introduction of workplace parking levies etc. At the same time, such measures could be crafted to encourage take-up of EVs, for example preferential access to urban areas, reduced parking charges for EVs etc.
  - Install and incentivise EV charging points.
  - Run additional campaigns to champion public transport and active travel.
- Businesses:
  - Set up EV car clubs to remove the need to own a car.
  - Install EV charging points at workplace car parks.
  - Travel companies to introduce journey planning / smart ticketing services.
  - Amend vehicle fleet procurement rules to favour zero emissions vehicles.
- Individuals:
  - Join car sharing schemes.
  - Look to undertake shorter journeys on foot or by bicycle where feasible.
- National Government:
  - Increase current grants for low emissions vehicles and/or scrappage of fossil fuelled vehicles.
  - Increase revenue funding for local authority public transport schemes.
  - Make capital available to support substantially enhanced walking and cycling infrastructure.

Box 4: Key messages for the power sector

Vision:

- For Suffolk to be carbon neutral by 2030, the supply of electricity needs to fully decarbonise by then.
- This means decarbonising the generation of electricity that feeds into the grid and/or creating more renewables within Suffolk for local use (distributed renewables).
- Some reliance on grid decarbonisation by 2030 is unavoidable, as the increasing demand for electricity in Suffolk (due to electrification of heating and transport) cannot be met through local distributed generation alone.
- Full grid decarbonisation is not likely to happen by 2030 on current plans and the Suffolk Local Authorities do not have full and direct influence over it. But they can influence national policy to encourage a speeding up of grid decarbonisation.
- And increasing levels of distributed generation will help limit Suffolk's reliance on grid decarbonisation and manage the risk of not meeting its carbon neutrality target. However this can be less cost effective than large scale renewables.
- Some of the things that can be done locally to encourage power sector decarbonisation include:
    - Looking at collective purchasing power, and peer-to-peer electricity supply.
    - Ensuring that the network is not a constraint on renewable supply – e.g. ensuring the network has capacity to meet higher levels of renewable energy supply, increasing flexibility, storage etc, encouraging a smarter grid. The Suffolk local authorities will need to work closely with UK Power Networks on this.
    - There are things that can be done on the generation side – e.g. planning support for new renewables. However, this will require changes to national planning policy.
    - At the same time, efforts will need to be made on the demand-side to manage the increased demand for electricity – energy efficiency in buildings and transport.

Opportunities:

- The County Council, District & Borough Councils and other public service providers:
    - Ensure 100% electricity in Council buildings is green energy.
    - Look into options for collective purchasing power and peer-to-peer agreements across the county.
    - UK Power Networks to work with the Suffolk Climate Change Partnership (SCCP) and Ofgem to assess potential demand on grid and options for meeting this higher demand, ensuring flexibility etc.
    - Review planning rules to maximise incentives for new renewable projects.
    - Lead a review of renewable potential across the county.

    - Consider options and scope for a major, co-ordinated programme of solar PV installation in both domestic and non-domestic sectors.

- Businesses:
    - Consider scope for distributed renewables on site.
    - Move to 100% renewable electricity tariffs.
- Individuals:
    - Move to 100% renewable energy tariffs.
    - Consider opportunities for where rooftop solar could be installed, for example when planning a new roof.
    - Form community energy schemes to encourage local renewable energy generation.
- National Government:
    - Remove subsidies and tax breaks for fossil fuels and phase-out the use of fossil fuels in back-up and peaking plant generators.
    - Put in place consumer protection to cover flexibility services, time-of-use tariffs, peer-to-peer trading etc.
    - Introduce policies to increase rate of grid decarbonisation.

Box 5: Other sectors

Waste:

- Emissions from waste have already fallen drastically (70% at the national level between 1990 and 2017), and waste currently is a relatively small share of overall UK GHG emissions (4% in 2017).
- Waste emissions in Suffolk could be further reduced by 2030 in the following ways:
    - Ongoing funding of targeted behaviour change campaigns. Widespread small changes in behaviour can make significant differences to reducing carbon emissions.
    - Promote and support third sector and community reuse and repair activities.
    - Target reduction of materials, such as textiles, aluminium, steel and plastics, based on volume and carbon intensity.
    - A continued focus on a reduction in food waste to achieve the Suffolk Waste Partnership's target of 20% reduction in food waste by 2025.
    - Increase the recycling rate from 47% household waste recycling rate to achieve at least a 65% municipal recycling rate by 2035 as a minimum.
    - Use enforcement, residual waste restrictions, financial incentives and potentially service design changes (informed by carbon metrics) to increase recycling and reduce residual waste generation.

  - Support businesses to introduce separate glass, metal, plastic, paper and card, and food recycling (expected to be legislated through the anticipated Environment Bill).
  - Use of anaerobic digestion for food waste treatment to help generate more biogas.
  - Front end removal of fossil fuel derived content (e.g. additional plastics and textiles) from residual waste feedstock to reduce emissions from waste sent to Energy from Waste.
  - Reducing biodegradable waste being sent to landfills located within Suffolk.
- Whilst it is important for the sector to achieve further emissions reductions as set out above, as part of overall efforts towards Suffolk's carbon neutrality target, achieving net zero emissions in the sector is challenging due to the difficulty of further reducing methane emissions from the landfills located within the County[2], and tackling emissions from waste water treatment.
  -

Agriculture:

- Agriculture is very important for the area with arable production systems making up the largest land area. Emissions from arable production occur as nitrous oxide emissions arising from nitrogen in soils and carbon dioxide emissions from oxidation of organic matter.
- It is not possible to fully decarbonise the agriculture sector but it is nonetheless important that Suffolk makes efforts to reduce GHG emissions from the sector as much as possible to contribute towards the UK's overall net zero target.
- There are a number of ways the sector can reduce its GHG emissions from crop production, including reduced or zero tillage, leaving crop residues on the soil surface and planting of cover or catch crops.
- Conversion of arable land to grassland or woodland, to sequester carbon dioxide, can help reduce net emissions, although the scope of the emissions removals are likely to be small.

[2] The Suffolk Waste Partnership currently only sends very small quantities of household waste to landfill (i.e. during EfW outages) but within the county of Suffolk 205,000 tonnes[2] of waste was sent to Masons non-hazardous landfill in 2018. In addition, there are several closed landfill sites, some of which will continue to emit GHGs. See chapter 7 for more details.

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1 Introduction

On 21 March 2019, Councillors at Suffolk County Council voted to declare a climate emergency, with an aspiration of making the county of Suffolk carbon neutral by 2030. Similar declarations have been made by Babergh and Mid Suffolk District Councils, East Suffolk Council[3], Ipswich Borough Council and West Suffolk Council[4]. These declarations recognise the urgency of tackling climate change and the need for action to be driven at the local level.

This report sets out indicative pathways for meeting the carbon neutrality target by 2030. The findings of the report will be used as the basis for wider stakeholder engagement, with the results being used to produce a Suffolk Climate Emergency Plan later in 2020.

This report is structured as follows:

- Section 2 gives background on what a climate emergency is, what we mean by carbon neutrality or net zero emissions, the current situation with CO_2 emissions in Suffolk and specific issues that the county faces to become carbon neutral.
- Section 3 looks at what general messages there are about pathways to carbon neutrality from sources such as the Tyndall Centre Carbon Budget Tool, the Committee on Climate Change net zero report and the SCATTER tool.
- Sections 4-8 then look in more detail at each sector – transport, buildings and industry, power, waste and agriculture. They consider the current situation in the sector, indicative pathways to carbon neutrality and policy options for delivering it.

2 Background

2.1 What is a climate emergency and what does it mean?

There is no single definition of what we mean by a climate emergency but generally it reflects the urgent need to drastically cut emissions of greenhouse gases (GHGs) to be able to deliver the objective of the Paris Agreement, namely to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels[5]. The definition of climate emergency can also include elements of inter-generational equity (making cuts in emissions now to limit the climate impacts on future generations) and of climate resilience (adapting to unavoidable impacts of climate change and making communities more resilient to extreme weather events). But for this project our focus is on making emissions cuts that reflect the level of urgency set out by the Intergovernmental Panel on Climate Change (IPCC)[6], who state that deep cuts in global GHG emissions are needed by 2030 and for emissions to be net zero by 2050, to have a chance of keeping global temperature rises to 1.5°C above pre-industrial levels.

2.2 Definition of carbon neutrality

Carbon neutrality means a balance between emissions to and removals from the atmosphere of carbon dioxide (CO_2). So if CO_2 emissions were reduced to zero then no emission removals would be

[3] Formerly Suffolk Coastal and Waveney District Councils.
[4] Formerly Forest Heath and St Edmundsbury District Councils.
[5] See Article 2, page 22 of the Paris Agreement - https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf
[6] For example, see their "Special Report: Global warming of 1.5°C. Summary for policymakers'. https://www.ipcc.ch/sr15/chapter/spm/

needed. But if we assume some level of emissions removals, then an equivalent amount of residual emissions would still be possible under a carbon neutrality target.

This is also known as 'net zero' carbon emissions. Similarly, net zero greenhouse gas (GHG) emissions means a balance between emissions to and removals from the atmosphere of all GHGs, i.e. not just CO_2 but also other GHGs such as methane and nitrous oxide.

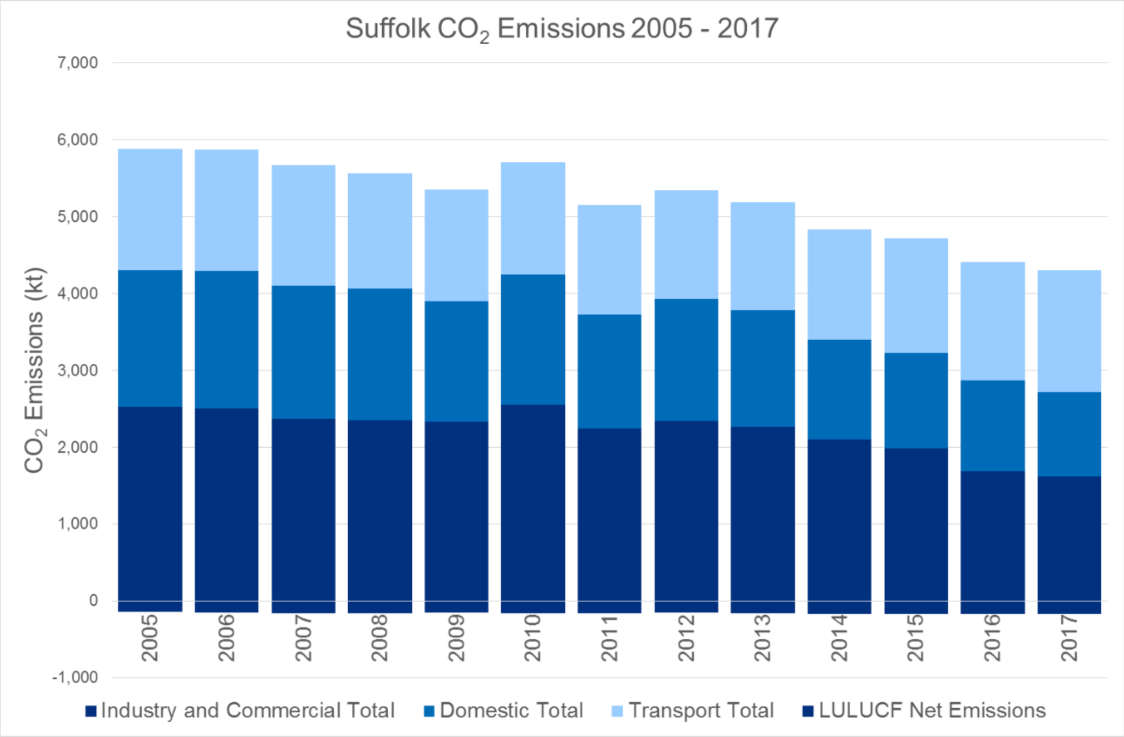
It can therefore be seen that what carbon neutrality, or net zero carbon, means in practice for the economy depends on the levels of removals of CO_2. Emission removals can be delivered by carbon sinks, such as forests or peat bogs, or by negative emissions technologies (NETs) such as carbon capture, usage and storage (CCUS). Paradoxically, NETs cannot be assumed for the more ambitious (i.e. earlier) net zero targets where their assistance would be most greatly needed. The Government's CCUS action plan commits the UK to "having the option to deploy CCUS at scale during the 2030s subject to the costs coming down sufficiently". This means it is not reasonable to assume any emissions removals from NETs for a 2030 target. Hence for Suffolk's carbon neutrality target, the only removals that could be considered are from forestry and land use change. In any case, NETs are inherently uncertain and not yet proven at scale, so banking on them too much can be risky and some argue it can distract attention from the pressing need to reduce emissions. That said, the CCC argue in their Net Zero report that CCS is a necessity not an option for getting to net zero GHGs by 2050, and they assume aggregate annual capture and storage of 75-175 $MtCO_2$ in 2050.

Generally speaking, it is assumed that it is not possible to reduce GHGs to near zero in non-energy sectors such as agriculture or waste and that any emissions removals will therefore cover residual emissions in those sectors. And energy sectors, such as transport, buildings, industry etc, will need to reduce their carbon emissions to near zero.

2.3 Emissions in Suffolk

CO_2 emissions data for local authorities in the UK is collected by Ricardo on behalf of the UK Government. This data shows that CO_2 emissions in Suffolk were 4,134 kt CO_2 in 2017. These emissions have generally been falling since 2005.

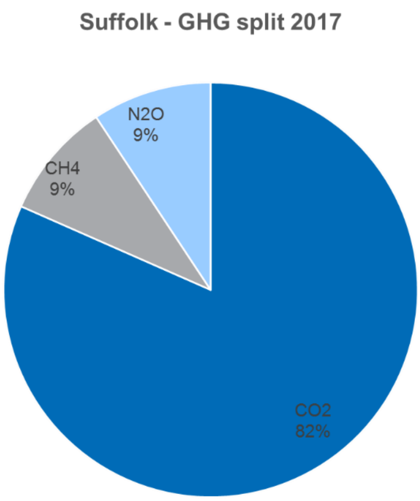
Figure 1: CO_2 emissions in Suffolk over time



These CO_2 emissions come from energy use in transport, buildings and industry. The graph above also shows that emissions removals from land use, land use change and forestry (LULUCF) are a fairly small fraction of overall emissions (about 4% in 2017), with this 'carbon sink' fluctuating over time between 150 and 171 kt CO_2.

If methane and nitrous oxide emissions are added in, the total GHG emissions in 2017 were 5,066 kt CO_2e[7]. 82% of this is CO2, with the rest evenly split between methane and nitrous oxide.

Figure 2: Split of GHG emissions in Suffolk in 2017



[7] CO_2e means CO_2 equivalent, which is a common metric for all GHGs, whereby all the GHGs are converted into an equivalent amount of CO_2 emissions. This therefore takes into account the fact that non-CO_2 gases have higher global warming potentials (in some cases, for example fluorinated gases, much higher).

2.4 Specific issues for Suffolk

Subsequent sections look in more detail at sectoral pathways to carbon neutrality by 2030, and these consider specific issues in Suffolk that are likely to influence the response. But to summarise, some of these issues are as follows:

- The rural nature of much of the County. This means that agriculture is a strategically important sector. But it will also influence the way that Suffolk responds to tackle its GHG emissions. For example, it may be less able to encourage modal shift away from car use and towards public transport compared to more compact urban areas.
- Felixstowe Port. As the UK's busiest container port, this will contribute to traffic, much of which will pass through Suffolk on its way to destinations throughout the country.
- Sizewell C. The development of Sizewell C can be viewed both in terms of its likely contribution to transport and construction emissions during the build phase but also in terms of its future contribution to a lower carbon future in the UK. Leiston Parish Council (where Sizewell is located) is currently pushing forward its own net zero initiative with other key stakeholders.

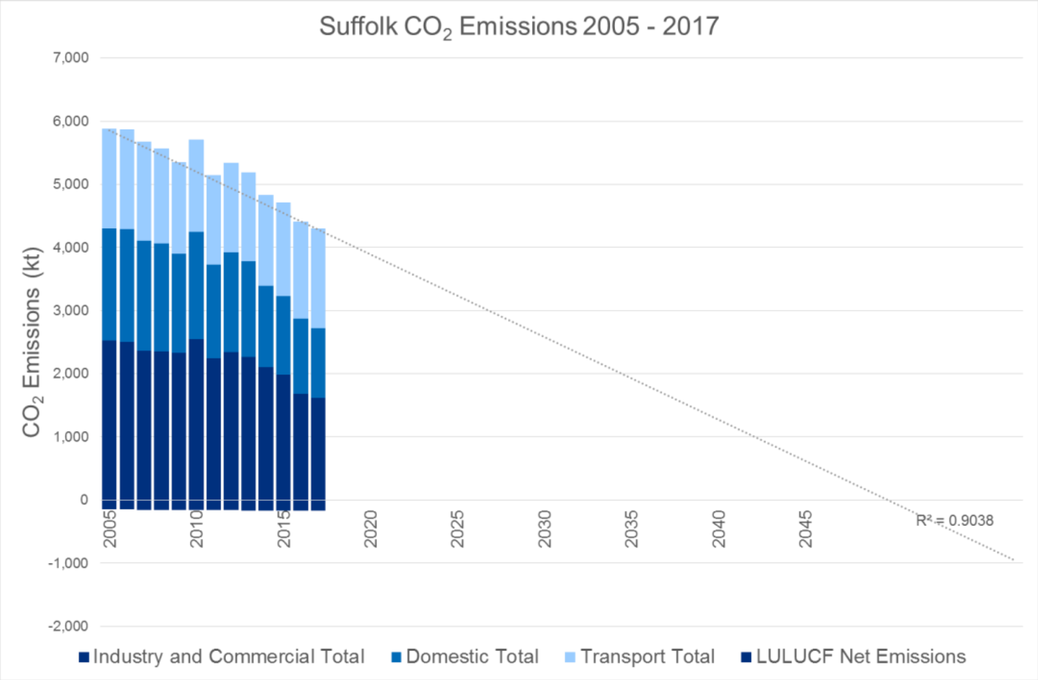
3 Pathways to carbon neutrality

Before looking in detail at sectoral pathways to carbon neutrality by 2030 in Suffolk, this section considers the existing evidence base and modelling work on carbon neutrality/net zero pathways. This includes a simple extrapolation of emissions trends in Suffolk, the Tyndall Centre Carbon Budgeter tool, the Committee on Climate Change's report on meeting net zero by 2050, the SCATTER tool and a scoping report by University of East Anglia on possible adaptation and carbon reduction actions in Suffolk and Norfolk.

3.1 Extrapolation

A very simple approach can be to take the recent trend in CO_2 emissions for Suffolk and to extrapolate this trend to see when emissions would be reduced to zero. The results of doing this are shown in Figure 3.

Figure 3: extrapolation of past emissions trends in Suffolk



This shows CO_2 emissions being reduced to zero by around 2050. However, this analysis needs to be treated with some caution, for the following reasons:

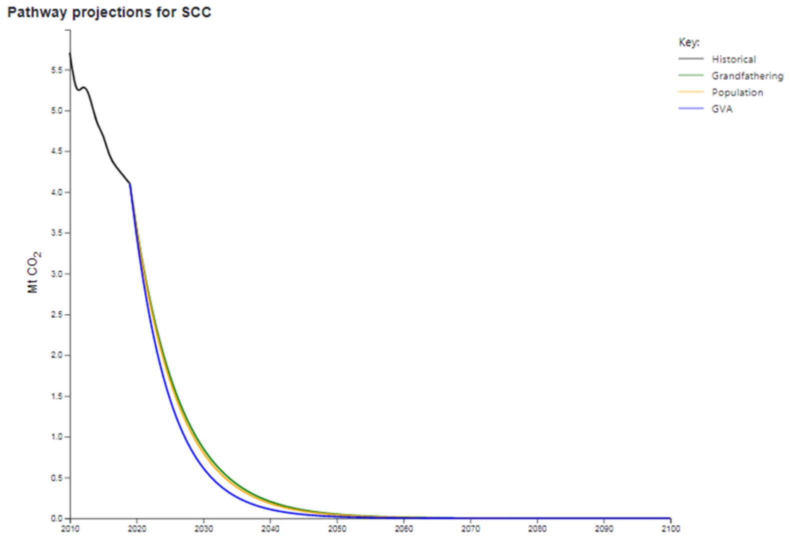
- This does not take account of non-CO_2 gases. Whilst these are a smaller proportion of overall GHG emissions than CO_2, they can be harder to reduce. Many net zero scenarios therefore tend to assume a certain amount of residual non-CO_2 emissions.
- Depending on the scale of emissions removals in 2030, a certain amount of residual emissions will be acceptable.
- This extrapolation is focused on the emissions total, which is made up of a combination of sectors and categories. This assumes uniform reductions in emissions across all sectors. In reality some activities such as emissions associated with electricity use are currently reducing quickly while others, such as road transport, are not.
- Past performance is not necessarily a good indication of future performance. It is to be expected that emissions reductions will get harder and costlier over time as the easier 'low-hanging fruit' gets used up. On the other hand, we know that emissions reductions will need to accelerate to be able to address the climate emergency and to achieve net zero emissions.

3.2 Tyndall Centre Targeter

The Tyndall Centre has developed a tool[8] that can help local authorities set science-based targets that show their fair share of global efforts under the Paris Agreement. The tool effectively takes the Paris Agreement's 1.5°C objective, translates that into a global carbon budget, shares this budget out between countries and then shares the UK portion out between local authorities on the basis of previous emissions (or grandfathering). The tool only calculates a pathway for energy-related CO_2 emissions. The proposed pathway for Suffolk is shown in Figure 4.

[8] https://www.tyndall.ac.uk/news/tyndall-carbon-targeter-helps-local-authorities-respond-their-climate-emergency

Figure 4: A science-based target for Suffolk



The tool provides the following analysis for Suffolk:

- Suffolk should stay within a maximum cumulative CO_2 emissions budget of 26.7 $MtCO_2$ (i.e. 26,700 kt CO_2) for the period 2020 to 2100. At 2017 CO_2 emission levels, Suffolk would use this entire budget within seven years from 2020.
- Suffolk should reach zero or near zero carbon no later than 2041 (5% of carbon budget remains).
- This would require average annual emissions reductions of 13.3%.

3.3 Committee on Climate Change Net Zero report

The Committee on Climate Change (CCC) is an independent, statutory body established under the Climate Change Act 2008. Their purpose is to advise the UK Government and Devolved Administrations on emissions targets and report to Parliament on progress made in reducing GHG emissions and preparing for climate change. In May 2019 they published their advice to the UK Government on meeting a net zero GHG emissions target. Below are some of the main conclusions.

- The UK should commit to a net zero GHG target by 2050, but not all parts of the UK will move at the same pace. For example, the CCC recommends a 2045 target date for Scotland, and for Wales to reduce net GHG emissions 95% by 2050.
- A net-zero GHG target for 2050 will deliver on the UK's commitment under the Paris Agreement. The aim should be to meet the target through UK domestic effort, without relying on international carbon units (or 'credits').
- Major infrastructure decisions need to be made in the near future and quickly implemented.
- Overall costs are manageable but must be fairly distributed (annual resource cost of up to 1-2% of GDP to 2050).
- Meeting a net zero target can also bring significant benefits, including improved quality of life (e.g. improved air quality, health benefits), lower risks from climate-induced impacts and industrial opportunities (e.g. green jobs, productivity improvements etc.).
- Some sectors (e.g. the power sector) could reach net-zero emissions by 2045, but for most sectors 2050 currently appears to be the earliest credible date. Setting a legal target to reach net-zero GHG emissions significantly before 2050 does not currently appear credible and the Committee advises against it at this time.

- The analysis considers three scenarios:
  - "Core Scenario" – a reduction of about 80% in net GHG emissions (75% reduction in gross emissions, with the further 5% from removals).
  - "Further Ambition" scenario – a 96% reduction in net GHG emissions (89% reduction in gross emissions, with the further 7% from removals).
  - Some 'speculative' measures needed to get to net zero.
- Current policy is insufficient for even the existing targets – while many of the policy foundations are in place, a major ramp-up in policy effort is now required.
  - 2040 is too late for the phase-out of petrol and diesel cars and vans. Since the CCC report was written, this phase-out date has now been brought forward to 2035, but this would still not be sufficient for local authorities that have set carbon neutrality targets for 2030, and current plans for delivering the phase-out remain vague.
  - The CCC criticised the lack of serious plan for decarbonising UK heating systems and the fact that no large-scale trials have begun for either heat pumps or hydrogen. More recently, the Government has published a consultation[9] on its plans for low carbon heat beyond the Renewable Heat Incentive.
  - Carbon capture (usage) and storage, which is crucial to the delivery of zero GHG emissions and strategically important to the UK economy, is yet to get started.
  - Afforestation targets for 20,000 hectares/year across the UK nations (due to increase to 27,000 by 2025), are not being delivered, with less than 10,000 hectares planted on average over the last five years. The voluntary approach that has been pursued so far for agriculture is not delivering reductions in emissions.
- There are also other policy challenges that have not yet been addressed:
  - Industry must be largely decarbonised.
  - Heavy goods vehicles must also switch to low-carbon fuel sources, such as hydrogen.
  - Emissions from international aviation and shipping must also be addressed.
  - A fifth of UK agricultural land must shift to alternative uses that support emissions reduction, such as afforestation, biomass production and peatland restoration.

3.4 SCATTER

The SCATTER tool[10] was developed by Anthesis (UK) for use by Local Authorities to support their climate action planning. Ricardo has used the tool on behalf of the Suffolk Climate Change Partnership (SCCP)[11].

The SCATTER tool is based on the UK Government's 2050 Calculator in that it presents the user with a number of 'levers' in different sectors – effectively different possible interventions – and allows them to vary the level of ambition applied for each. The levers include different forms of energy generation and different indicators for sectoral ambition, for example:

- Transport:
  - Distances travelled

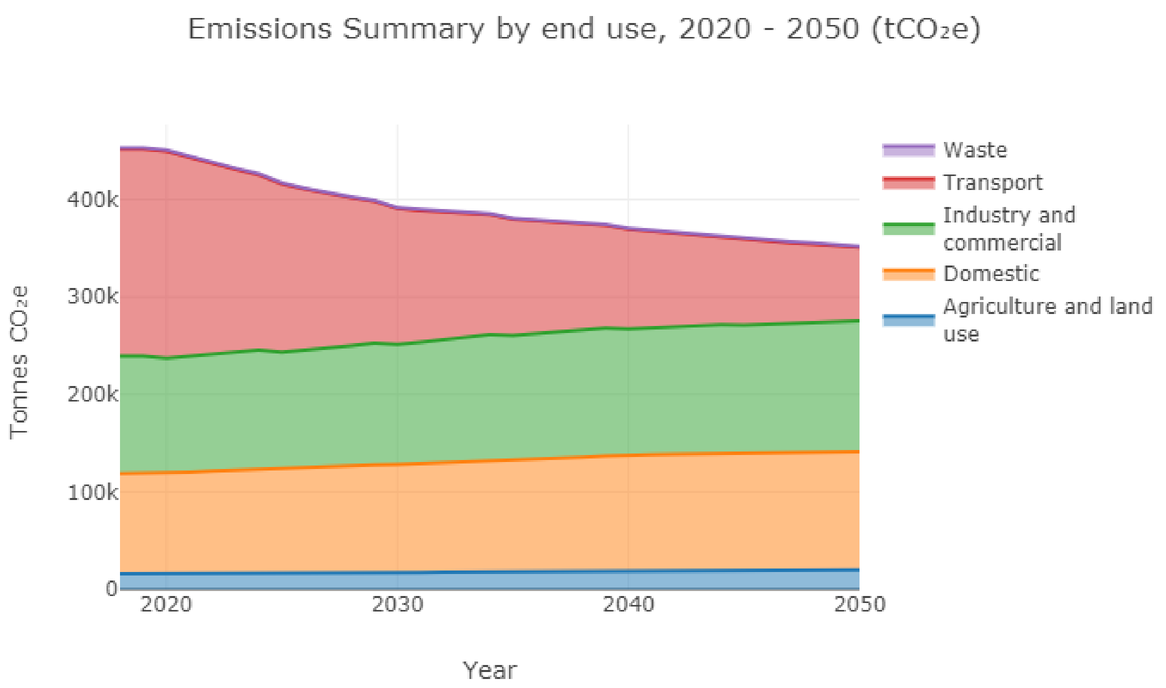
[9] https://www.gov.uk/government/consultations/future-support-for-low-carbon-heat?utm_source=67e059ab-467c-4445-821e-7b5a721d07d6&utm_medium=email&utm_campaign=govuk-notifications&utm_content=immediate
[10] https://scattercities.com/
[11] The Suffolk Climate Change Partnership (SCCP) consists of Suffolk's Local Authorities and the Environment Agency, working together locally with other organisations including New Anglia LEP, Groundwork Suffolk and University of Suffolk under the banner of Creating the Greenest County.

   - Modal shift
- Waste:
   - Quantity of waste produced
   - Rates of recycling
- Domestic buildings:
   - Levels of home insulation
   - Energy demand from lighting and appliances
- Land use:
   - Levels of tree planting
   - Levels of peatland restoration

With each lever the user can select a level of ambition, between one and four, one being the least ambitious and four being the most ambitious (although not all levers have four levels – some have fewer). These levels of ambition are then applied to local authority-level GHG data to calculate an emissions pathway.

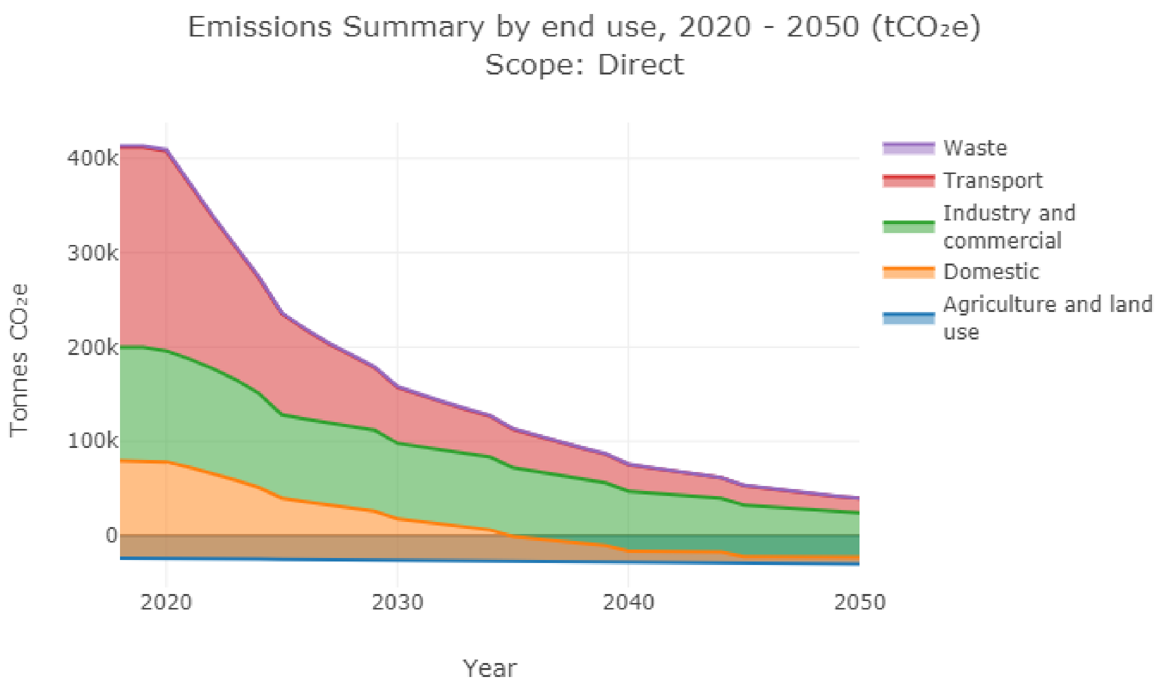
Level one is effectively a 'baseline' or 'business-as-usual' scenario. This doesn't represent a 'do nothing' scenario – it still assumes a certain degree of emissions reduction action will take place. The level one scenario for Suffolk is set out in Figure 5 below. This shows that GHG emissions would be reduced to 3.9 $MtCO_2e$ by 2030, a reduction of only 4.6% from current levels.

Figure 5: SCATTER level one scenario for Suffolk



Increasing all levers to maximum ambition in the tool (i.e. level 4 where possible) results in GHG emissions falling much faster, to 1.58 $MtCO_2e$ in 2030, a reduction of only 61.5% from current levels. Hence it can be seen that it still would not result in carbon neutrality by that date.

Figure 6: maximum scenario for Suffolk in SCATTER



Some of the key implications of level four are summarised below. Evidently to deliver carbon neutrality by 2030 will require some of these to be brought forward or made more ambitious.

- Transport sector:
    - 25% reduction in total travel demand by 2030; share of distance travelled by car reduces by 22% by 2050
    - By 2035, 100% zero emissions vehicles and buses, complete railway electrification by 2025
    - 100% of zero emission cars use batteries by 2050
    - Road modal share for freight falls to 50%; greater hybridisation. Rail freight is all electric
- Domestic buildings sector:
    - 60% homes insulated; average thermal leakiness decreases by 75%
    - Energy demand for domestic lights and appliances decreases by 60%
    - Energy used for domestic cooking is entirely electric
- Commercial and industry:
    - Space heating demand drops by 40%, hot water demand by 30%, cooling demand by 60%
    - The proportion of commercial heat supplied using electricity is 80-100%
- Waste sector:
    - Quantity of waste decreases 20%
    - 65% Recycling, 10% landfill, 25% incineration achieved by 2035, increasing to 85% by 2050

3.5 UEA scoping study on adaptation and mitigation actions

This scoping study from 2019 looked at climate change adaptation and mitigation actions and how they could be incorporated into the objectives of the New Anglia LEP for Norfolk and Suffolk. It has three main sections:

- Existing knowledge on observed and projected climate changes.
- Trends and geographical distribution of greenhouse gas emissions.
- Local priorities for climate change mitigation and adaptation.

It considered priorities to include:

- Buildings – alternative means of heating, especially for off-gas grid homes, and homes that are better adapted to a warming climate.
- Transport – greater use of public transport and increasing electrification of transport.
- Agriculture – improved water management and sequestration of CO_2 emissions.
- Energy – an investment strategy to address the current constraints on the capacity of the transmission and distribution network.

The report also highlights the benefits of early action, on both adaptation and mitigation.

4 Sectoral pathways – transport

Key messages:

- To achieve carbon neutrality in Suffolk, the large majority of vehicles on the road will need to be zero emission by 2030. Yet currently, only 0.16% of vehicles in Suffolk are fully electric and there are only 120 charging points across the County[12].
- The burden on this can be reduced by encouraging modal shift to public transport and active travel (walking and cycling). However, the rural nature of the county and the reliance on private cars will present challenges in doing this.
- A pathway has been developed that reduces carbon emissions from transport in Suffolk by 97.5% from current levels by 2030. This scenario assumes:
    - A 25% reduction in car miles travelled through a combination of reduction in demand for transport (e.g. car sharing, working from home) and modal shift to public transport and active travel. It also assumes a 15% reduction in annual freight (vans and trucks) mileage.[13]
    - This results in total road vehicle miles falling from 4,194 miles to 3,114 miles. Total vehicle numbers could fall by as much as 20% from just over 500,000 in 2020 to around 390,000.
    - This vehicle fleet will need to be zero carbon in 2030, which would represent 39,000 annualised ultra-low emissions vehicles purchases between now and 2030.
    - To support this number of electric vehicles on Suffolk's roads, by 2030 there will need to be around 330,000 private charging points for cars, vans, trucks and buses, and around 3,300 public charging points.
    - Analysis shows that a fully electric fleet by 2030 would add around 1,000 GWh of electricity demand, compared to existing total electricity consumption of around 3,400 GWh[14], or 30%.
    - More zero emission vehicles would need to be purchased if it was felt that the levels of modal shift and demand reduction outlined above are not achievable. For example, a 13% reduction in car miles would mean around 50,000 more zero emission vehicles and 500 more public chargers needed by 2030.
- Achieving this will require a huge investment in encouraging the switch to electric vehicles – for example, significant roll-out of the EV charging network, grants for new EVs, schemes to support scrappage of old vehicles and electric car sharing clubs across the county.
- Alongside this, measures to achieve modal shift would need to include radical improvements to bus and train services, including more routes and increased frequency, alongside 'push' measures to encourage people out of their cars, for example access restrictions and raising parking prices.
- A sensible strategy would be to focus on modal shift in the short term, while laying the groundwork to accelerate EV uptake later in the decade.

[12] Correspondence with Suffolk County Council

[13] Reductions in road mileage are based on today's road mileage values and do not include any expected increases in road mileage in a 'business as usual scenario. Considering road mileage data for the last 25 years, mileage on Suffolk roads could increase by 10-15% over the next 10 years without intervention.

[14] https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level

- Specific challenges for Suffolk include:
  - The rural nature of much of the County, meaning rural isolation is a particular challenge and modal shift can be more challenging than in urban areas.
  - Dependency on private car and higher than average ownership levels.
  - Expected housing and economic development, such as Felixstowe Port and Sizewell.

4.1 The current picture

4.1.1 Key actors, strategies and activities

Like other counties across the UK, delivery of transport services across Suffolk is delivered by several private and public organisations, including Suffolk County Council, Suffolk District Councils, Suffolk Community Transport, Highways England, and the bus and train operators. Information relating to transport strategies for Suffolk can be found in a number of key plans:

- Suffolk Local Transport Plan, 2011-2031 (under review)
- Suffolk Cycling Strategy, 2014
- Parking Strategy, 2019 & Suffolk Guidance for Parking, 2019 (technical document)
- Suffolk Climate Action Plan 3, 2017 (under review)
- Road safety strategy, 2012-2022 (Last reviewed 2016)
- Rail prospectus, 2015
- New Anglia transport strategy, 2018
- Suffolk growth strategy, 2012

The plans above have varying commitment levels to actions attached to them, for example, the Local Transport Plan sets out the council's long-term transport strategy and a non-binding implementation plan, while the Climate Action Plan presents actions that have been committed to by the Suffolk Climate Change Partnership. Furthermore, although the parking guidance is largely for introducing Civil Parking Enforcement (CPE), it defines technical requirements associated with developments - residential developments must have the ducting in place to allow a charger to be installed, while commercial development must provide suitable charging systems for a number of the parking spaces.

A number of active transport initiatives and activities are already in place. Some are the responsibility of the core stakeholders identified above, while others are linked to public-private partnerships and local action groups. These initiatives include:

- Suffolk car share
- Suffolk Spokes
- Plug-in Suffolk
- Highways England EV charger deployment along network
- Suffolk on board

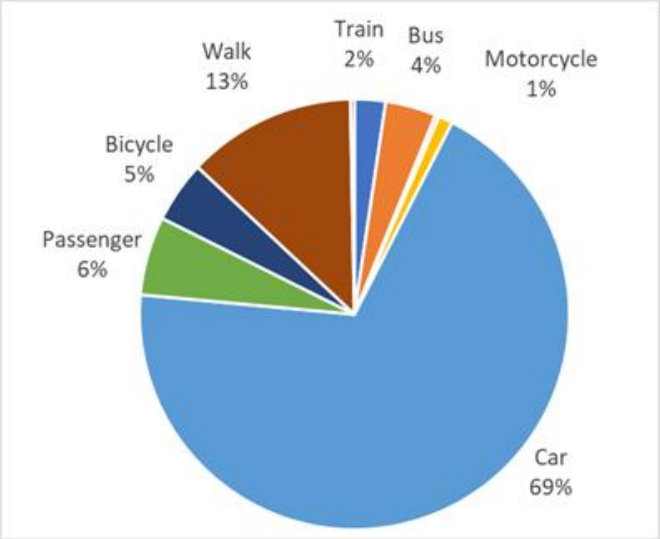
There are also activities in planning and development stages, including a rural transport on-demand service, freight consolidation around the Port of Felixstowe, a freight management facility at Sizewell and a bid to bring electric bus scheme to Ipswich.

4.1.2 The local context – challenges and opportunities

No two transport strategies should be the same – they should reflect the local ambition levels and, most importantly, the local context in which transport measures are being implemented. This includes an appreciation of the 'baseline' situation as well as the local conditions that represent both barriers and opportunities. Correspondingly, initiatives and actions should be selected with the targets in mind but tailored to focus on addressing the most significant barriers and taking advantage of local strengths.

The most significant challenge in Suffolk is the current reliance on private car travel, which is interrelated with several local factors. The reliance on the private car can be seen clearly in Figure 7 below, which shows that over three quarters of journeys to work are carried out by private car, with very little use of public transport. Another measurement that shows Suffolk's preference for private car is the levels of ownership. The last census on car ownership showed that the average in Suffolk (1.34 cars per household) was higher than the national average (1.16)[15].

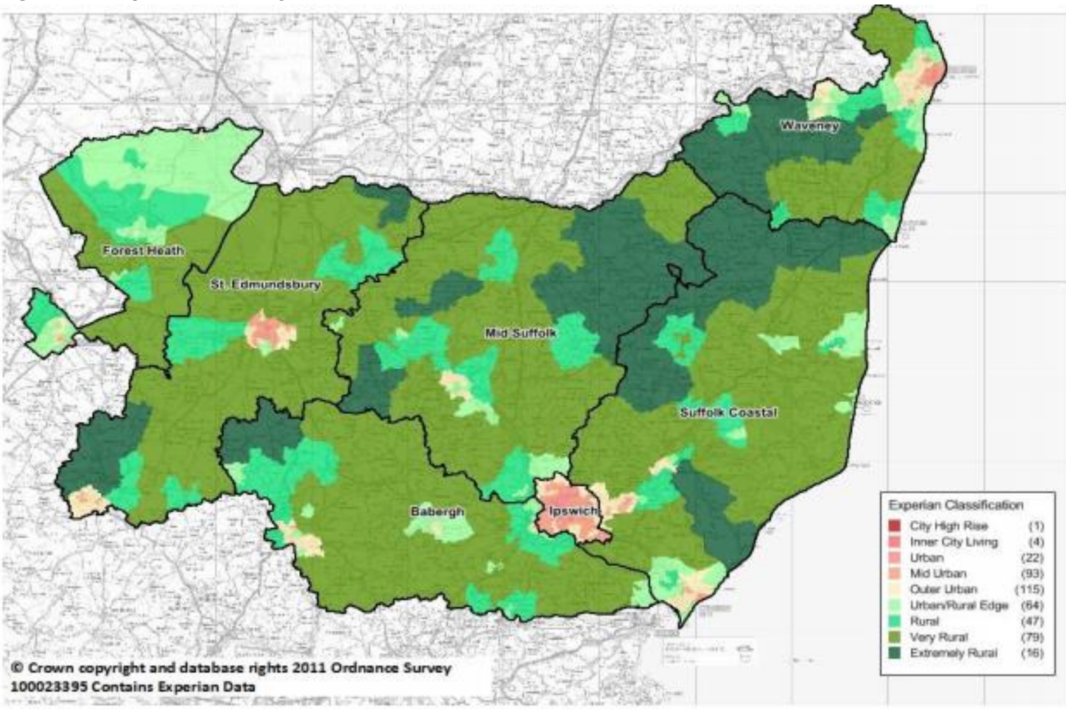
Figure 7: Travel to work modal share (Suffolk County Council)



Suffolk's high levels of car usage is partly explained by its geography. Suffolk is characterised by large swathes of countryside, dotted with a few densely populated urban areas and many more smaller settlements (see Figure 8 below). While the figure highlights that there are some densely populated areas in Suffolk, it also shows the extent of the 'very' and 'extremely' rural areas in all local authority areas of the county except Ipswich Borough.

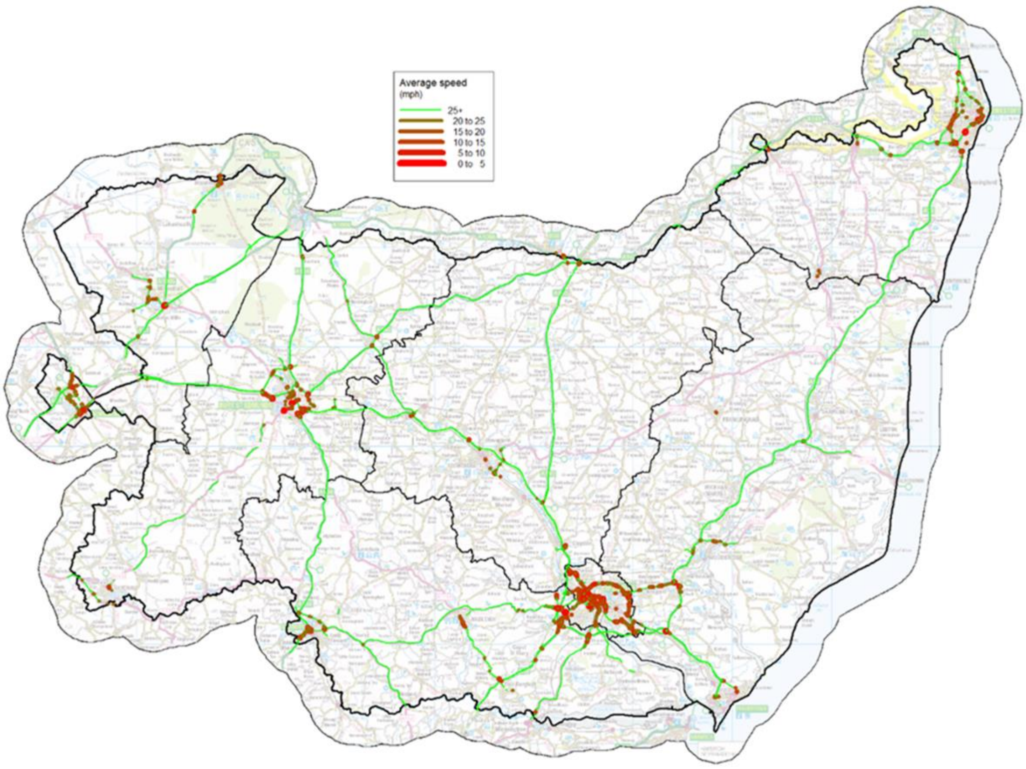
[15] https://www.suffolk.gov.uk/assets/planning-waste-and-environment/planning-and-development-advice/Suffolk-Guidance-for-Parking-2019-Adopted-by-SCC.pdf

Figure 8: Experian rurality indicators at LSOA level, Suffolk 2016[16]



The most urban areas across the county also reflect where the majority of jobs and amenities are located. Figure 9 below shows the levels of congestion across the county, with hotspots evident in Ipswich, Bury St. Edmunds and Lowestoft resulting from inflow of people for work and access to trip destinations like shops and leisure facilities.

Figure 9: Congestion in Suffolk (Suffolk County Transport Model)



[16] Experian. Rurality and Financial Vulnerability in Suffolk. 2016.

However, in line with what is seen in rural areas across the UK, public transport links in rural Suffolk are poor, with limited choice and irregular services, and so the majority of people rely on cars to make these trips. The Local Transport plan reported that in Babergh, even the larger settlements are not big enough to be able to justify their own internal bus services. This factor should also be considered in the national context of declining bus subsidies, exacerbating the challenge to improve services.

In addition to Suffolk's rural nature and poor public transport provision, a further contributing factor to car dependency is Suffolk's relative wealth compared to other counties. There are some very affluent areas across the county, although localised rural deprivation is also an issue and wealth inequality in Suffolk has been reported on in the past[17,18].

A final local factor that supports car use is the lack of disincentives. Car parking is generally very cheap and often free, and beyond some localised congestion there is generally good capacity on the roads. As a result, driving in Suffolk is relatively convenient, especially when compared to the alternatives available.

Some other local challenges and strengths are presented in the box below:

Box 5: challenges and opportunities related to transport in Suffolk

Challenges:

- Increasing transport activity from the Port of Felixstowe and construction at Sizewell.
- Expected growth in housing in a number of districts

Opportunities:

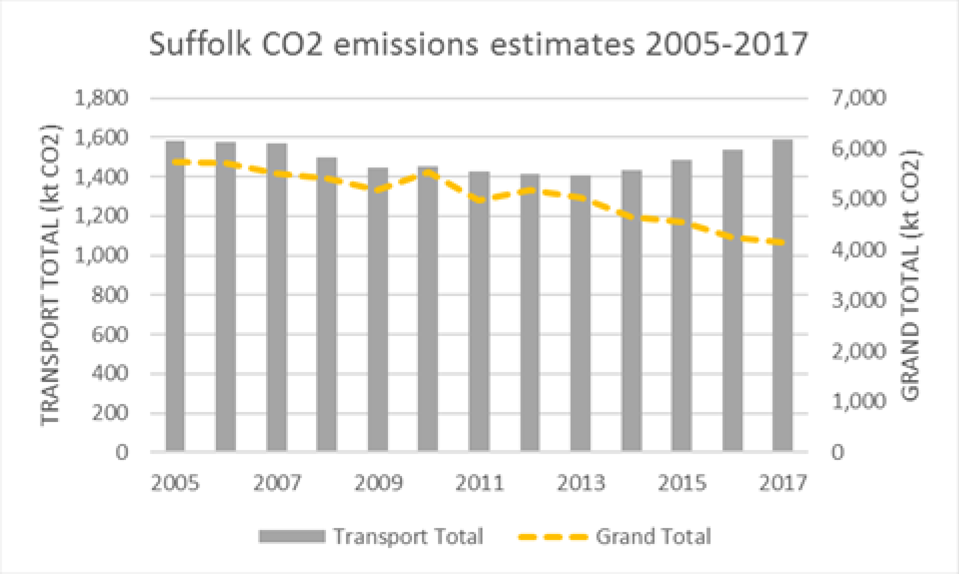
- A wealth of public rights of way for walking and cycling

4.1.3 Transport emissions

The UK's local authority CO_2 data shows that since 2005, transport emissions have stayed relatively consistent, and are even slightly higher now compared with 10 years ago (see below). This goes against the overall trend of declining emissions and means that transport is now one of the biggest source of CO_2 emissions in Suffolk.

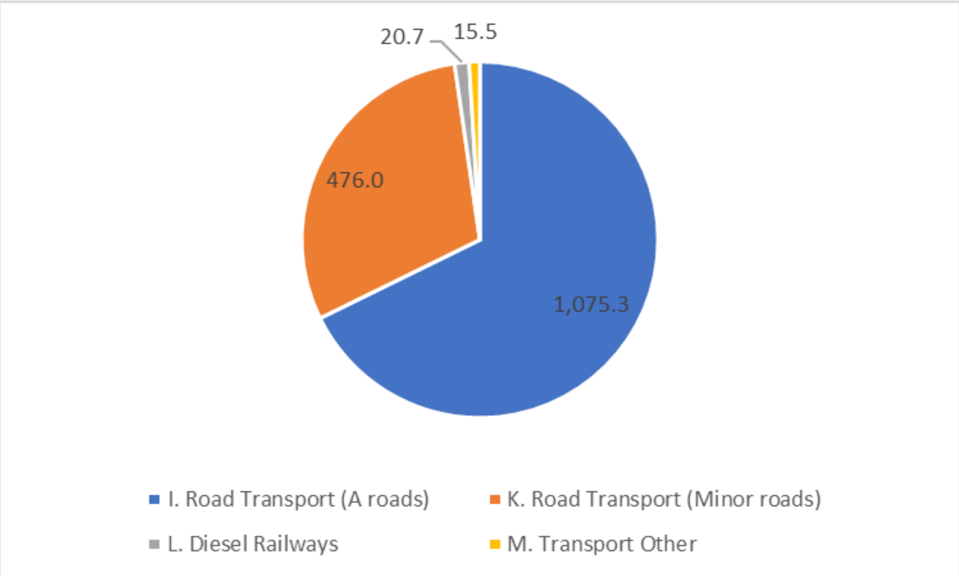
[17] https://www.eadt.co.uk/news/suffolk-three-quarters-of-county-s-population-classed-as-financially-comfortable-or-wealthy-new-research-shows-1-3660529
[18] https://www.healthysuffolk.org.uk/uploads/Rural-Deprivation-in-Suffolk-May-2016.pdf

Figure 10: Suffolk CO2 emissions from transport



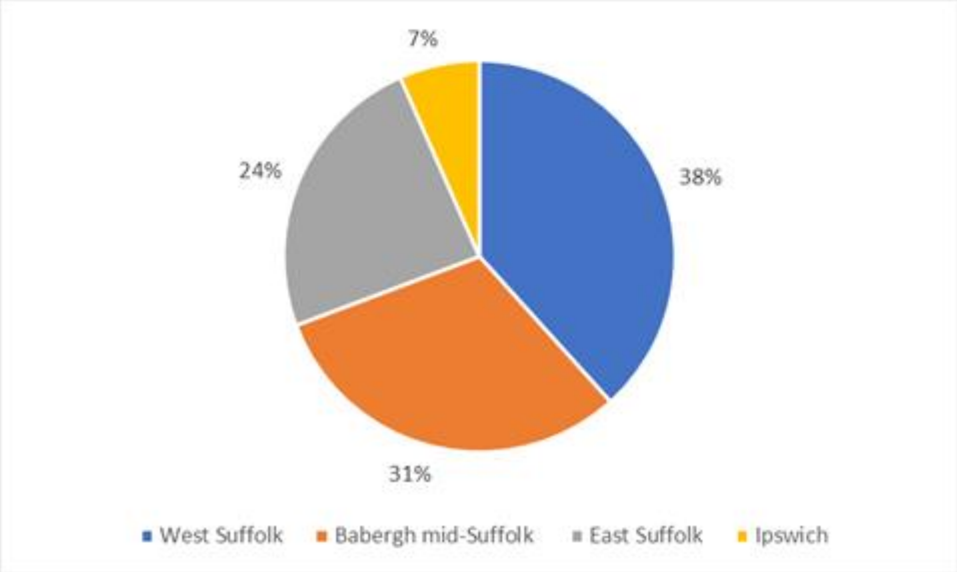
Almost all transport emissions come from road transport, with a small proportion coming from diesel railways. Of all road transport emissions, the majority is from activity on A roads with a smaller proportion originating from activity on minor roads.

Figure 11: Breakdown of transport emissions in Suffolk (kt CO2)



Emission can be further broken down into the districts within Suffolk. As shown in the figure below, emissions are relatively evenly distributed between the districts.

Figure 12: Transport emissions by district



4.2 The pathway to carbon neutrality

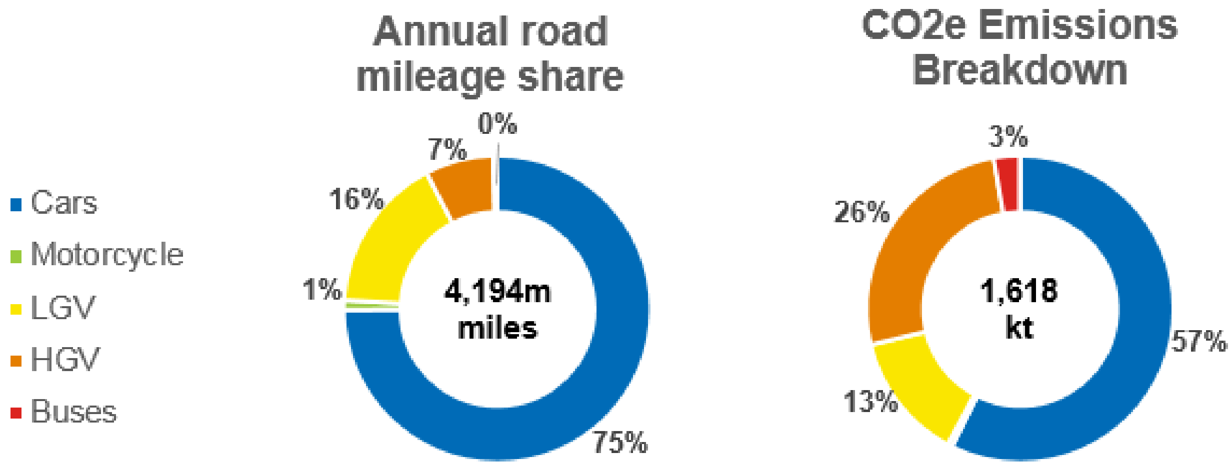
A summary of the required action on transport to achieve carbon neutrality by 2030 is as follows:

1. Focus on modal shift in short term and accelerate electrification through to 2030.
2. Electrification of operating transport fleet is required to reach the carbon neutrality target. There is an overarching assumption that the power sector will be decarbonised by 2030, although this is largely outside of Suffolk's influence.
3. The burden on electrification can be reduced through modal shift (fewer cars) whilst contributing to reduced emissions and supporting a number of other important objectives including public health (active transport), social mobility and improved air quality.

4.2.1 Baseline and emission reduction pathways

Drawing on available fleet and activity data, a baseline situation for 2020 has been constructed for road transport carbon emissions in Suffolk. Figure 13 below shows that total annual road mileage stands at just over 4,000 million miles, 75% of which is from cars. When considering CO_2 emissions from vehicles operating on Suffolk's roads, the figure also shows that the majority of emissions are still from cars, but a large proportion also come from commercial vehicles (39%). Relative to the mileage road share, less efficient operation results in a relatively larger share of emissions from buses and HGVs.

Figure 13: Base year vehicle activity on Suffolk's roads and resulting CO2e emissions



Based on historical trends from the last 25 years, a 15% increase in road traffic over the next 10 years is assumed, and so any shift in road vehicle mileage in the pathways should be considered against this background trend.

4.2.2 Emission reduction pathways

Initially, three transport emission reduction pathways were developed for Suffolk (see Box 6). These demonstrate the types of policy levers that can be applied and the resulting impacts on emissions.

Box 6. High level emission reduction pathways

Pathway 1

- Reflects a situation where **travel demand (and modal share) is constant** and there are 100% zero emission vehicles (ZEVs) across the fleet by 2050, resulting in a fleet penetration of around **30% ZEVs in 2030.**
- This is in-line with Scatter Level 1.

Pathway 2

- Imagines a much more ambitious drive to discourage private car use and manage overall road transport demand. There is a **25% reduction in passenger travel demand** with journeys shifted to bus and motorcycle on the road, as well as out of the road system to trains and active modes, such as walking and cycling. Travel demand may also be reduced through an increase in car sharing.
- There is a **15% reduction in road freight** (LDVs and HDVs).
- Compared to Pathway 1, there is also a more ambitious switch to electric with 100% ZEVs by 2035, resulting in a fleet penetration of around **50% ZEVs by 2030.**
- This is in line with Scatter Level 4.

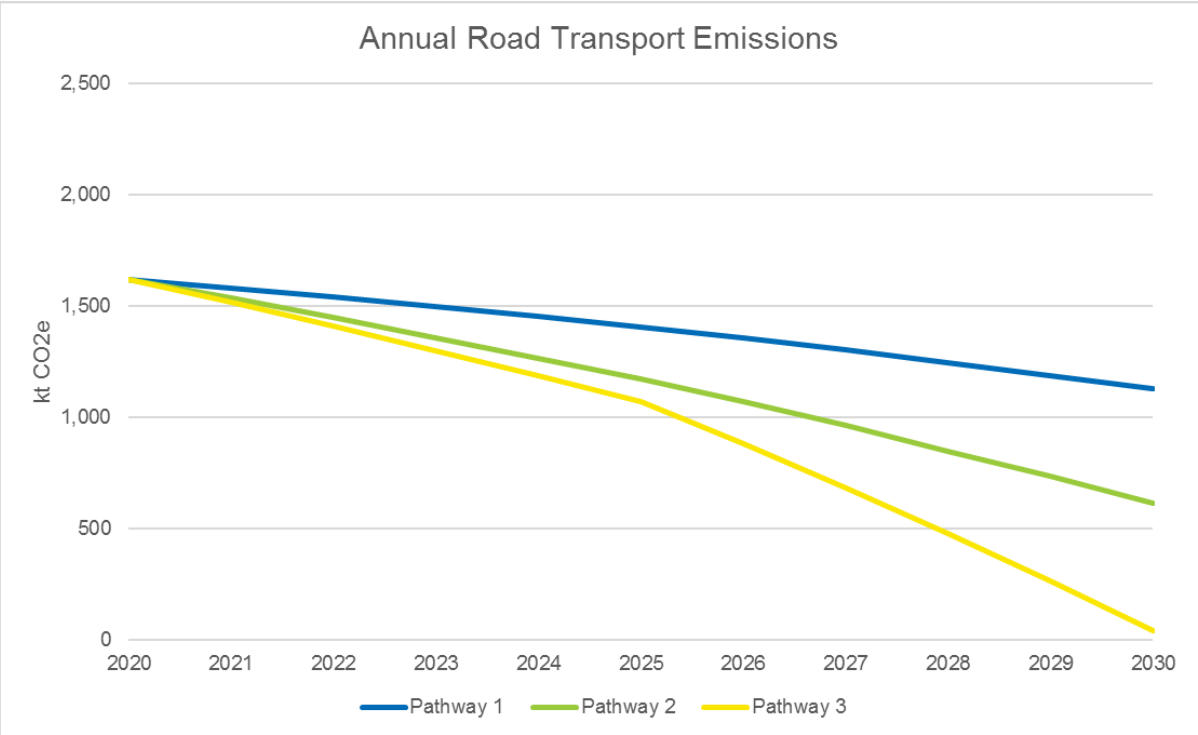
Pathway 3

- Pathway 3 has the same levels of modal shift as pathway 3, but a more ambitious level of electrification - **100% ZEVs by 2030.**
- This pathway builds on Scatter Level 4 to reach net zero by 2030.

In each pathway, an assumption has been made that efforts in the first 5 years (2020-2025) will focus on modal shift, while efforts to electrify the fleet will be prioritised in the 5 years leading up to the 2030 target year. This attempts to reflect the relative difficulty of implementing initiatives over the next 10 years as well as recognising the importance of first looking to ‘avoid’ or ‘shift’ road transport, before ‘improving’ the remaining fleet by encouraging the uptake of zero emission vehicles.

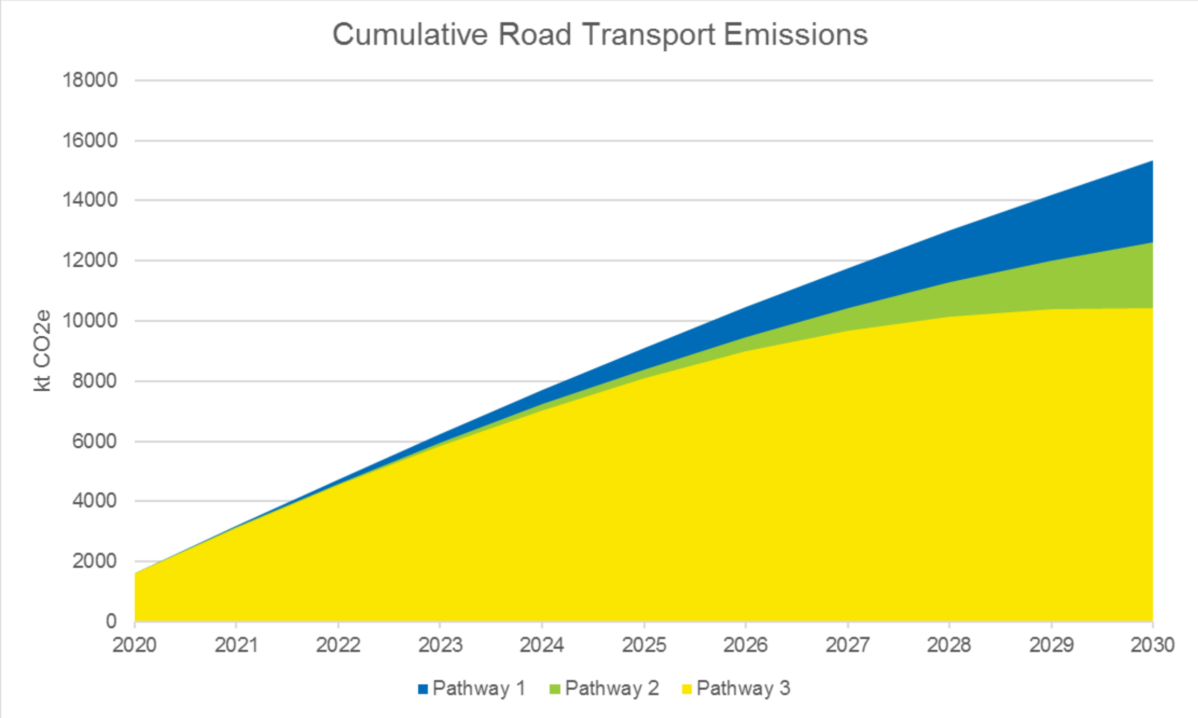
Figure 14 below shows that each pathway results in an emission reduction from the 1,618kt CO_2e emissions in 2020. Up to 2025, when modal shift is prioritised, the difference between Pathway 1 and Pathways 2 and 3 is largely explained by the greater levels of modal shift. From 2025 to 2030, the divergence of the three pathways is mainly the result of the different levels of fleet electrification achieved, with only Pathway 3 achieving final emission levels in-line with a net zero target.

Figure 14: Annual road transport emissions in the three pathways



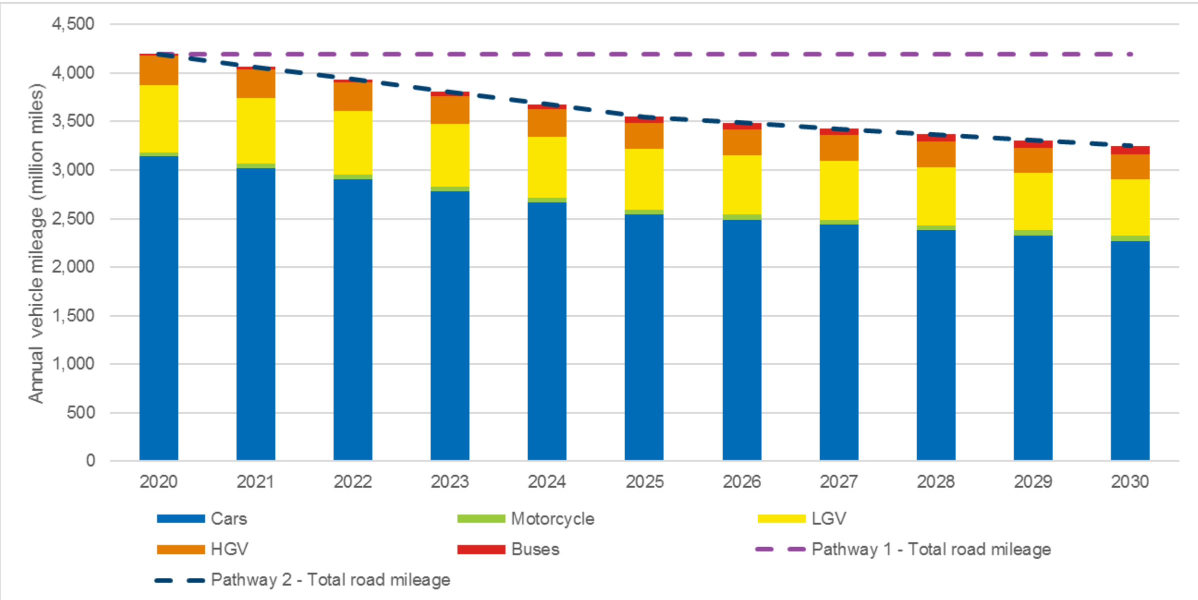
An important consideration when assessing emission reduction pathways is the cumulative emissions, not just the emissions in the target year. Figure 15 shows that cumulative emissions in Pathway 3 are around 15% lower than Pathway 2 and 30% lower than Pathway 1.

Figure 15: Cumulative road transport emissions in the three pathways



The annual and cumulative figures above demonstrate that until meaningful levels of electrification take place (from 2025), there are not considerable difference in emissions. However, the impact of modal shift can be seen more clearly when we consider the development of total road mileage. As shown in Figure 16 below, the high level of modal shift seen in Pathways 2 and 3 result in significant road mileage reduction in the first 5 years. On the roads, this would be reflected by fewer cars and commercial vehicles resulting in a smaller fleet to electrify, but also significant co-benefits from reduced congestion and improved air quality and accessibility.

Figure 16: Annual road mileage in the three pathways



4.2.3 Modal share sensitivity pathways

Only Pathway 3 delivers a net zero transport sector and so this pathway is the focus of the following analysis. Two sensitivity pathways were developed to compare against Pathway 3. In each pathway, the fleet is 100% zero emission by 2030 to deliver net zero in transport, but there are different levels of modal shift in each.

Box 7. Sensitivity pathways

Sensitivity 1

- No modal shift - **travel demand is constant.**
- **100% ZEVs by 2030**

Sensitivity 2

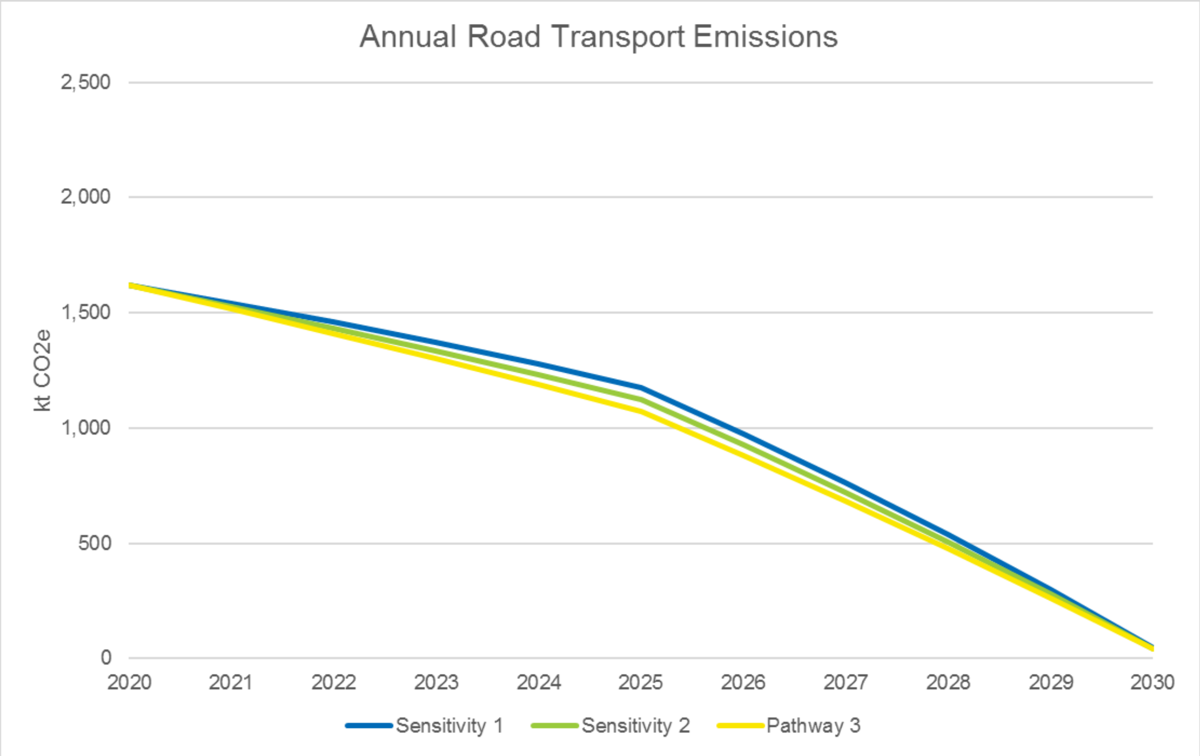
- Modal shift roughly halfway between Sensitivity 1 and Pathway 3.
    - **Around 13% reduction in passenger travel demand and 8% reduction in road freight.**
- **100% ZEVs by 2030**.

Pathway 3

- Same as Pathway 3 defined in 6.
    - **Around 25% reduction in passenger travel demand and 15% reduction in road freight.**
- **100% ZEVs by 2030**.

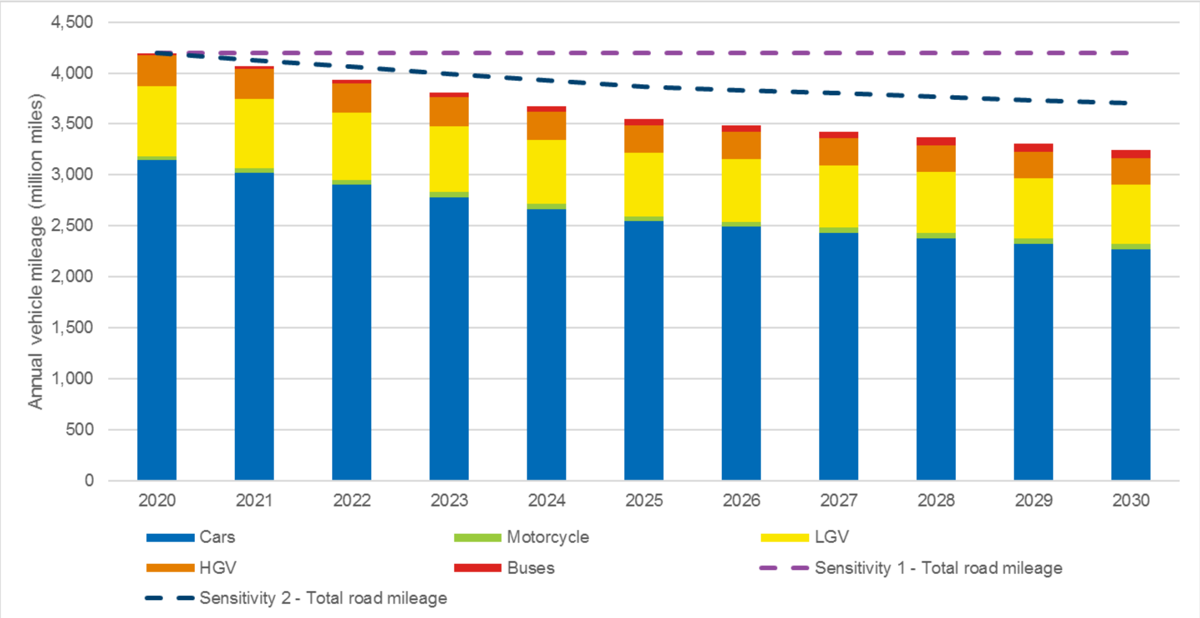
Figure 17 below shows a small difference between the annual emissions of the two sensitivities with lower modal share and Pathway 3. Cumulative emissions over the 10-year period are only 6% lower in Pathway 3, compared to Sensitivity 1 with no modal shift.

Figure 17: Annual CO2e emissions from road transport in the sensitivity pathways



There are more pronounced differences between the pathways when we consider the reductions in total road vehicle mileage (Figure 18). As expected, total mileage is constant in Sensitivity 1, while Pathway 3 achieves a total road mileage reduction of 23% by 2030 – returning to mileage levels last seen in Suffolk around 1996 (3,250 million miles).

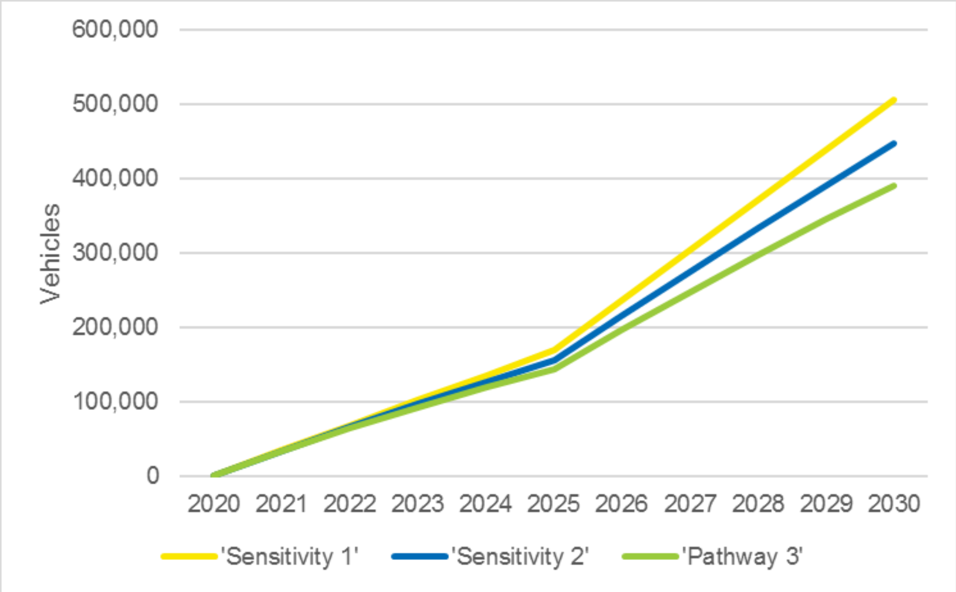
Figure 18: Road vehicle mileage between the sensitivity pathways



Using an assumption that average vehicle mileage per mode will remain constant over time, mileage values can be translated back into numbers of vehicles, which can be useful for considerations around electric vehicle charge points. Fixing average vehicle mileage per mode is a simplification, as in reality, a reduction in total mileage is likely to be partly achieved by fewer and shorter car journeys, rather than simply fewer vehicles. Nevertheless, the outputs from the calculations below demonstrate the relative differences between the pathways that we would expect in terms of vehicle numbers.

Figure 19 shows the number of zero emission vehicles that would be active within the fleet each year. Sensitivity 1 predicts a constant fleet size (~500,000), with a transition to 100% zero emission vehicles in the fleet by 2030. The levels of modal shift assumed in Sensitivity 2 and Pathway 3 result in a decreasing fleet size and therefore fewer zero emission vehicles in 2030 – 50,000 and 100,000 fewer, respectively.

Figure 19: Zero emissions vehicles in each sensitivity pathway



As discussed in previous sections, aside from the myriad of co-benefits achieved by modal shift away from private cars, it also reduces the burden on switching the road vehicle fleet to zero emission, which will ultimately decide whether you achieve a net zero transport sector. There are several components of this 'burden' to consider:

- The cost of switching public and private fleets to zero emission vehicles.
- The private cost for off-street charge points in the home and at businesses.
- The cost of public charger provision.
- The electricity demand of the EV fleet

The total annual electricity demand can be estimated from the projected size of the EV fleet operating, presented in Table 4-1 below. As expected, the smaller size of the EV fleet in Pathway 3 demands less electricity compared to the fleets in the sensitivities. However, in each of the scenarios, the electricity demand in 2030 represents a significant increase (~30%) on current electricity demand in Suffolk, which was around 3,400 GWh in 2017[19].

Electricity demand via private chargers comes from the vehicles with access to off-street charging, including a share of private cars, motorcycles and LGVs, while all HGVs and buses are assumed to charge privately on business premises and at depots. Therefore, demand for electricity via public

[19] Sub-national total final energy consumption in the United Kingdom (2005 – 2017), BEIS. Accessed 19/03/20.

chargers comes from the remaining cars, motorcycles and vans that are assumed to not have access to private chargers[20].

Table 4-1. Annual Energy demand from public and private chargers (GWh)

		Sensitivity 1		Sensitivity 2		Pathway 3	
	Unit	2020	2030	2020	2030	2020	2030
Private	GWh	3	1,134	3	1,030	3	933
Public	GWh	1	144	1	125	1	108
Total	**GWh**	**4**	**1,279**	**4**	**1,156**	**4**	**1,041**

By considering the share of charging delivered by each charger type, the average charger utilisation and power delivery, the number of chargers required to deliver the total power demand can be estimated. Of these considerations, the 'share of charger type' required is the variable with the greatest uncertainty, and there is no single 'ratio' that can be applied to every situation. What is clear is that the stock of public chargers must continue to increase to support and encourage EV uptake and usage, while the location and type of chargers must match the demand and requirement from all use cases and user groups across the region. This study has assumed the following shares for public chargers:

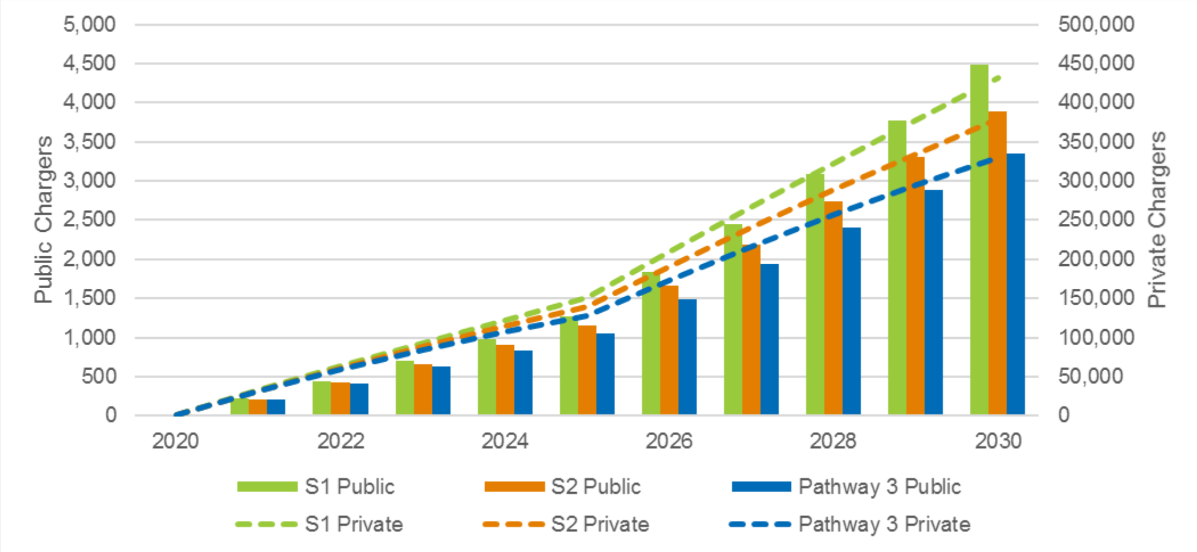
Table 4-2. Share of public charger types.

Charger Type	Share	Comment
Standard	60%	At present, 93% of EV owners across the UK have access to private off-street charging. However, based on the information provided in Section 5.1.1, we can estimate that around 35% of properties in Suffolk do not have access to off-street parking[21] and so as EV penetration increases, a significant proportion of public charger deployment should focus on giving people the ability to access on-street standard chargers near their homes to use overnight. Charging at the workplace is also a convenient solution for many EV owners, as demonstrated by the secondary peak in weekday electricity charging demand when people arrive at work in the morning. This is followed by a small peak in the afternoon that corresponds to lunch breaks at work when chargers are typically swapped over (Element Energy, 2019).
Fast	30%	Trip destinations such as supermarkets, car parks and high streets should offer fast or rapid charging options that allow people to charge up over a short period of time. Shops with car parks above a particular size could be required to have a percentage of parking spaces with fast or rapid EV chargers.
Rapid	10%	Several rapid electric vehicle (EV) charging hubs have been opened or announced across the UK[22]. These operate in a similar way to traditional petrol stations, characterised by a small number of charge points that offer rapid charging.

The figure below shows the estimated number of public and private chargers required in each pathway. As expected, considerably fewer chargers are required in Pathway 3, although the overall number are still very large. Over 300,000 private chargers would be required to be installed across houses and business, while over 3,000 public chargers would be needed to support the EV fleet without convenient private charging.

[20] The share of EV owners without off-street parking is assumed to increase from 7% to 15% in 2030. While there is a larger share of properties in Suffolk without access to off-street parking, it is assumed that EV ownership is weighted towards the properties that do have access to off-street parking.
[21] Assumed that all Mid-terrace, Flat, End-terrace, and Unknown properties have no access to off-street parking.
[22] For example, the rapid EV charging hubs in Bristol, Stratford, and Milton Keynes.

Figure 20: estimated number of electric charging points under the sensitivity scenarios



Considering the typical costs of different charger types[23], the cumulative cost for installing the chargers can be estimated (Table 4-3). In line with the number of chargers required, costs are lowest in Pathway 3. It is worth noting that only a third of the private costs relate to residential charge point installation, with the majority of the cost falling on bus operators and business for the more expensive fast and rapid chargers that would be installed in depots.

Table 4-3. Cumulative cost of charge point installation

Pathway	Charger Type	Cumulative Investment by 2030 (£)
Sensitivity 1	**Public**	50,635,521
Sensitivity 1	**Private**	551,186,750
Sensitivity 2	**Public**	44,012,812
Sensitivity 2	**Private**	531,905,007
Pathway 3	**Public**	37,855,205
Pathway 3	**Private**	514,615,454

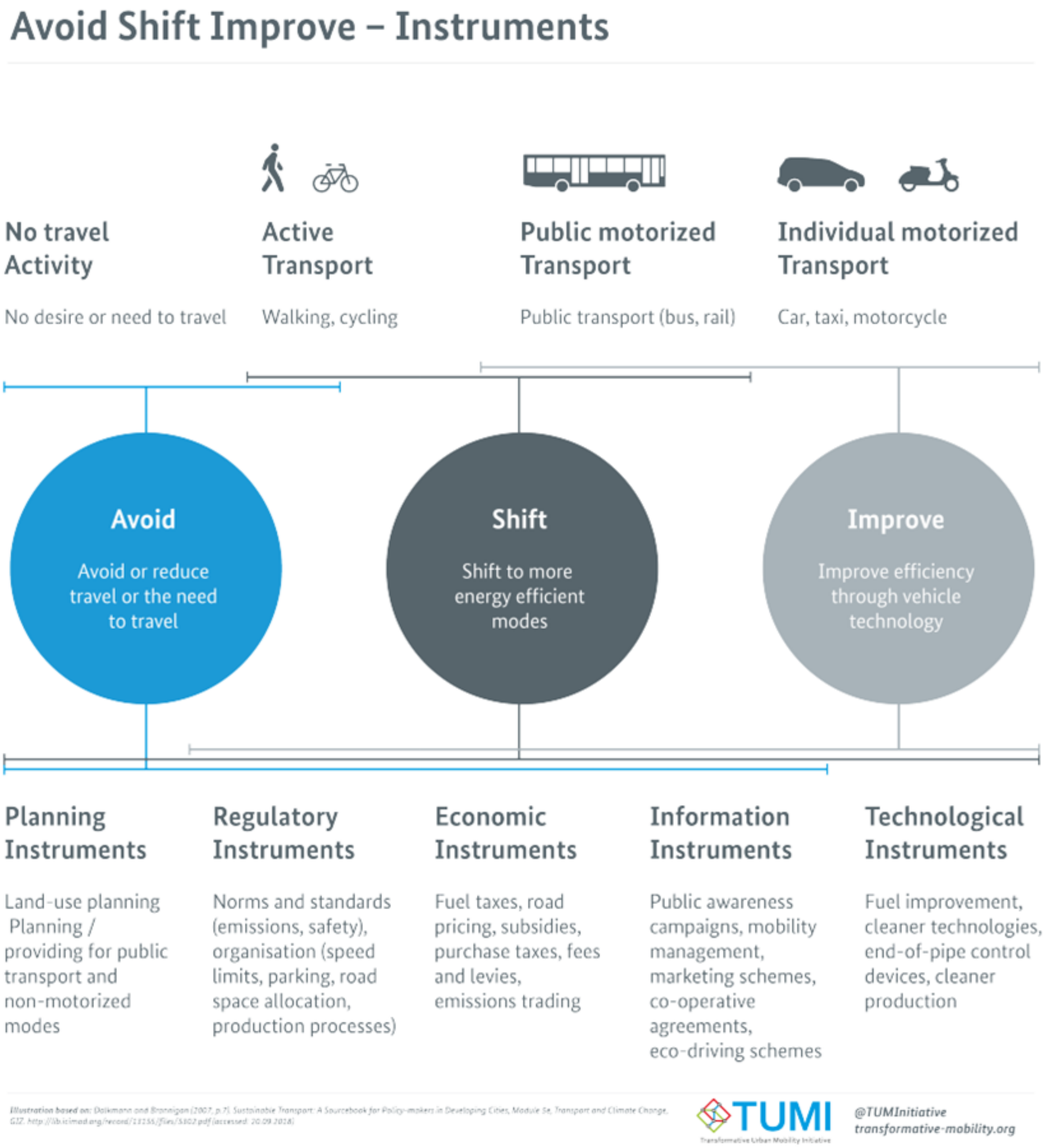
4.3 Policy options

4.3.1 Overview of options

Policy options for reducing emissions from transport are often described in terms of the Avoid-Shift-Improve (ASI) framework (see Figure 21). Avoid measures are ones that seek to reduce peoples' need for travel, shift measures are ones that seek to encourage people to use lower emitting modes of transport and improve measures are ones that improve the efficiency of both vehicles and transport networks. It is effectively a hierarchy in that it makes sense to manage demand as much as possible first, then shift people onto less carbon-intensive modes and then improve what cannot be avoided or shifted. That said, it clearly won't be possible to avoid or shift all travel, so zero emission vehicles are a prerequisite for achieving carbon neutrality.

[23] Standard public (7kw) – £10,000, standard private - £500 (including grant), Fast public - £12,000, Rapid public - £34,000. Taken from: The Committee on Climate Change, *Plugging the Gap: An Assessment of Future Demand for Britain's Electric Vehicle Public Charging Network*. 2018

Figure 21: Avoid-Shift-Improve concept for reducing transport emissions (illustration commissioned by Transformative Urban Mobility Initiative)



As outlined in previous sections, it makes sense to go hard on modal shift in the next few years, both because it is a logical order to do things and because the shift measures may be more easily implementable in the shorter term, whereas increasing ZEV numbers is likely to take time to ramp up. The best policies for demand management and modal shift are likely to be on-demand rural buses, car sharing and investment in local public transport infrastructure. At the same time, it will be necessary to introduce both push and pull policies for ZEVs, e.g. vehicle charges (access and parking), preferential lanes, and preferential access to urban areas. For ZEV charging, there must be a focus on supporting EV owners to charge as conveniently as possible. This may be though grants for off-street charging, or installing public on-street chargers across residential areas. Support for business should also be provided.

The following sections give more details on the options and their pros and cons.

4.3.2 Modal shift and demand reduction

As discussed above, modal shift has an important role to play in achieving net zero transport emissions although shifting people out of cars will be a particular challenge in Suffolk. There must be measures and initiatives that dissuade people to use cars, often referred to as '**push measures**'. Concurrently, there must also be measures that create attractive alternatives to car travel, also called '**pull measures**'. Push measures can include parking and access restrictions, and congestion charges, while pull measures will typically include investment in infrastructure and services, and policies that prioritise alternate modes – ensuring that journeys by public transport and active modes (walking and cycling) are convenient, reliable and cost effective.

Beyond modal shift to public transport and walking and cycling, actions that aim to encourage car-sharing and car-pooling can also be effective in reducing vehicle kilometres and car ownership rates.

1. Investment in bus services

An improved bus service across Suffolk will be vital. This means investing in more buses to support routes and an increased frequency of services. Buses should also be given priority in congested areas to improve reliability. These actions are complemented by 'services' that improve the usability of public transport (see measure 4), and any new bus procurement needs to be electric (see measure 5).

In the absence of legislation to give Suffolk County Council powers to reshape bus services, partnerships with the bus operators must be pursued to influence procurement activities and support bids for available funding. As well as purchasing new electric buses, operators and the council need to deliver innovative services for rural areas with fewer users. For example, Kent are trialling electric minibuses to help disabled and vulnerable people[24], while on-demand buses are also emerging as a viable model for services in rural areas. As part of the Government's £170m package for buses, £20m will be put towards trials of on-demand buses and £30m of funding will go to English local authorities outside of London to help them improve or restore bus services that have been cut.

Research undertaken by FutureGov in Essex and Suffolk concluded that flexible transport solutions will be an important part of future transport provision. A report by Better Transport presents challenges and recommendations for implementing Demand Responsive Transport services[25].

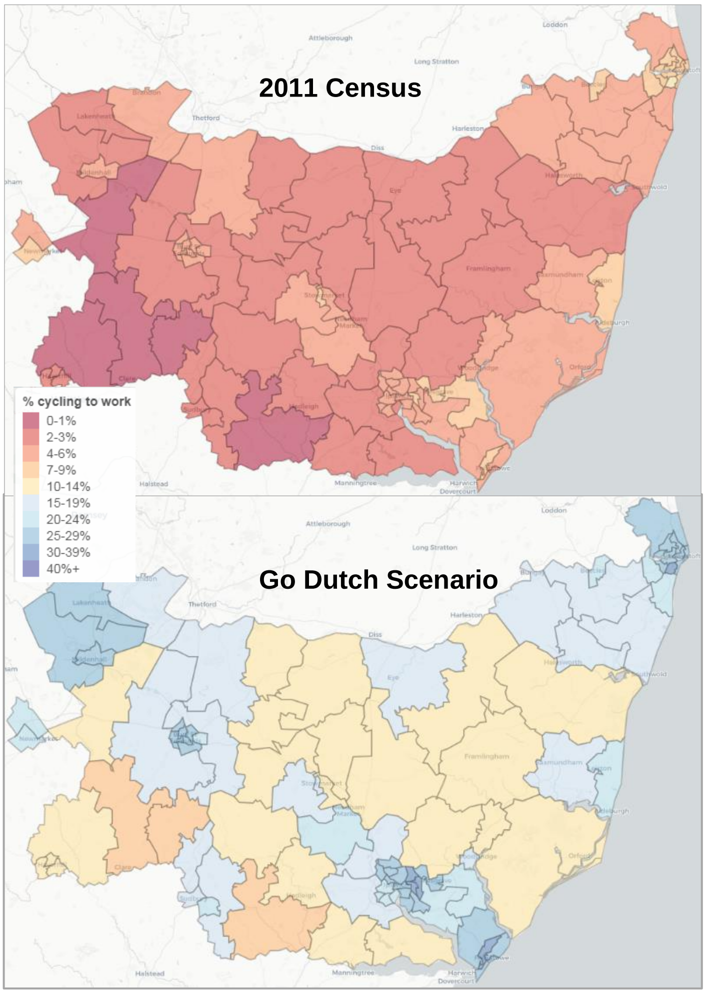
Suffolk recently bid for over £500k in funding from the Government's "Better Deal for Buses" scheme[26].

2. Cycling and micromobility

The 2011 UK census on cycling, which is presented in the Propensity To Cycle (PCT) tool[27], shows that the proportion of commuters who cycled to work in Suffolk (4.4%) is slightly higher compared to the national average for England and Wales (3.1%). Suffolk has a wealth of public rights of way that can be used for walking and cycling. While Suffolk is a rural county, it is not particularly hilly and as Figure 22 shows, there is scope to increase cycling across the county with particularly high cycling potential in the larger towns and across the districts of Forest Heath, Waveney and Ipswich. Under the Go Dutch scenario (a pre-set scenario in the PCT), commuter modal share for cycling increases from 4.4% to 20.1%, while car drivers reduce from 70% to 60%. This would be a significant contribution in the effort to reduce travel demand.

[24] https://kccmediahub.net/electric-minibus-comes-to-kent745
[25] https://bettertransport.org.uk/sites/default/files/research-files/The-Future-of-Rural-Bus-Services.pdf
[26] https://www.eadt.co.uk/news/suffolk-bus-funding-bid-1-6565268
[27] https://www.pct.bike/

Figure 22: Commuter cycling potential in Suffolk, Go Dutch scenario



Cycling potential across Suffolk increases still further when e-bikes are considered. While Suffolk is not particularly hilly, E-Bikes would be an effective solution to support longer journeys that would usually be considered too far to walk or cycle. More broadly, motor assisted small vehicles (commonly described as micromobility) are emerging as a popular mode in the transition away from private car, especially in more urban areas. They can also be effective at supporting increased public transport use by providing a first and last mile solution. In March 2020, a new proposal from the Department for Transport looks set to allow electric scooters to be used on public roads for the first time[28].

When considering which specific actions would be suitable for Suffolk, there are a number of important considerations including, existing level of cycling, topography, population and available resources. The European Commission guidance for cycling projects in the EU[29], is an invaluable tool to explore practical measures that could be suitable for Suffolk. As a region with relatively low cycling modal share – the most effective measures would focus on improving the actual and perceived safety of cyclists as well as the directness of cycle infrastructure. In the Netherlands, an 80km cycle highway was implemented to stimulate cycling over longer distances and increase regional accessibility. Usually, up to 10 km is the maximum cycling distance, but with a fast cycling highway, cycling distances can increase to 20 km and still further with e-bikes. Other examples of practical measures

[28] https://www.theguardian.com/politics/2020/mar/16/electric-scooters-get-green-light-to-go-on-britains-public-roads
[29] https://ec.europa.eu/transport/themes/urban/cycling/guidance-cycling-projects-eu_en

that Suffolk could introduce include, free cycle maps, information and awareness raising campaigns, multimodal integration and bicycle sharing schemes.

3. Car Sharing

In Suffolk, there is already a car share service in operation (Suffolk Car Share, powered by Liftshare) with over 3000 members. This is great example of a way to consolidate car travel and move away from the reliance on individual car ownership and usage. A further action that should be considered in Suffolk is the deployment of an electric car-share scheme in the urban areas of Suffolk. Across the UK, a range of new products and services are appearing that cater for short term vehicle rental, which are often in direct partnership with vehicle manufactures who are exploring alternative revenue streams. They include Zipcar, Getaround, hiyacar, Ubeeqo, DriveNow and Virtuo. The Suffolk local authorities should explore how they can attract these schemes, including public-private partnerships, priority parking and incentives around EV charging.

4. Integrated transport solution (ticketing and journey planning)

A lack of clear and accessible information about available transport services, costs and methods of payment can be a barrier to their use, making private car travel appear to be the easiest or most appropriate option. The Integrated Transport Strategy for Norfolk and Suffolk recognises the importance of an integrated transport network with clearer information and integrated ticketing:

> *"Make public transport the 'go to' option for our Priority Places by encouraging a consistent, affordable, smart-ticketed, integrated public transport network (including the use of innovative and community solutions where appropriate) with high quality, multi-modal interchanges, real-time, predictive and personalised information and more frequent services."*

We echo these existing ambitions and recommend that Suffolk County Council implements an integrated ticketing solution along with a single access point where residents can access comprehensive and reliable service information and plan their journey door to door. This would help to overcome the barriers highlighted above and encourage a shift towards public transport use. Beyond public transport (buses and trains), modes such as taxis, car-share, cycle-share and micromobility should also be integrated, creating a truly connected transport system that cuts out private car use.

System integrators such as Citymapper and Whim offer platforms that combine available transport modes in an app and can even offer fixed subscriptions to users. Many operators are also taking the initiative and leading on developing their own multimodal planners. In Norway, the national train operator is building a multimodal journey planner covering Scandinavia. They are integrating the train and bus services tightly together with first-mile and last-mile offerings so that their customers can easily find and book door to door journeys in the same place – either through the website or an app[30].

Suffolk County Council can play an integral role in coordinating partnerships between transport operators and developing the solution.

4.3.3 Electrification

As described above, you can't get away from the fact that a shift towards ultra-low and zero emission vehicles is a prerequisite for achieving net zero targets, especially in the timeframe of 2030.

5. Zero Emission Bus Procurement

As explained in Section 4.2, reaching net zero transport ultimately relies on a nearly fully electrified fleet, including buses. Therefore, it is important that as Suffolk explores actions to manage private car

[30] https://www.railwaygazette.com/technology-data-and-business/cost-time-convenience-and-carbon-emissions-to-be-included-in-journey-planner/55604.article

use and encourage public transport use, a shift to zero emissions buses is considered. There are numerous examples across the UK of electric bus deployment, including London, Manchester, and the West Midlands. Recently a £170m package was announced by the UK government to promote buses, within which there may be opportunities for Suffolk to apply for funding - there is a 50mn plan to create first all-electric bus town. Suffolk County Council has, at the time of writing, submitted three bids to this package.

A challenge in Suffolk is the number of bus operators on the roads. As discussed in the Action 1 above, without powers to directly influence procurement activities, Suffolk council could pursue partnerships by helping coordinate joint working across the Suffolk Local Authorities.

6. EV Charging

There are currently 120 charge points across the county but as demonstrated in Section 4.2.3, a significant increase in the number of chargers is required to support an EV fleet in a net zero pathway. To support a fleet of just under 400,000 EVs in Suffolk in 2030 (a 20% reduction on today's fleet size), an estimated 3,300 public and over 300,000 private chargers will be required. Grants to support private investment in home chargers would typically come from the national government, although Suffolk council may have a role to play in supporting installation of chargers at bus depots and business sites.

Suffolk Council has already made important strides (together with EO Charging & Bulb) in establishing 'Plug in Suffolk' – the UK's first truly open public electric vehicle fast charging network. This initiative has established a viable partnership and business model for rolling out public charge points across the county, and importantly, using the charge points has been made easier through a simple pay-as-you-go model. This is in line with what EV drivers want and the emerging ISO 15118 'Plug&Charge' protocol.

All new homes should also have access to an EV charge point, which should be covered under the 2019 Parking Strategy that requires new developments to provide sufficient electric charging infrastructure to cater for the growing demand of electric vehicles in Suffolk. Leicester has recently been awarded almost £100,000 to trial the use of on-street charging points in residential areas, where off-street parking is not available. The city wants to support the uptake of EVs and are trialling the provision of on-street chargers as a way of doing that. The scheme will specifically be looking to gauge the impact of installing standard charging points in residential locations[31].

4.3.4 Other measures

Clearly, the six measures highlighted above will not be able to deliver net zero transport in Suffolk on their own. Furthermore, there are many factors beyond the direct control of Suffolk County Council – such as national policy, market developments and the actions of businesses in Suffolk. However, the Council must attempt to lead by example wherever possible, setting ambition for other parts of the UK to follow and creating conditions that support the engagement of local businesses and the public. A number of other supporting measures are recognised below:

Modal shift and demand management

- Supporting freight consolidation and the use of low emission delivery vehicles.
- Free public transport initiative.
- Redistribution of highway and parking space to prioritise public transport, electric vehicles and active transport modes.

- Parking and access charges for cars in urban areas (e.g. ULEZ or congestion charge).

Electrification

- Financial support for EVs and EV charging.
- Vehicle scrappage schemes.

Cross cutting

- Information and awareness raising campaigns to champion public transport use, active travel and electric vehicles.

4.4 Conclusion

When considering the measures above, it is important to recognise that criteria beyond the scale of emissions reduction will need to be considered. At the highest level, any action undertaken by Suffolk County Council will need to assess the cost efficiency. While other factors such as acceptability from the public and businesses, timing and capacity of the council are also important. With certain topics such as autonomous vehicles – the technology readiness and feasibility should also be carefully looked at. However, considering the relatively short time-scales over which net zero is aiming to be achieved in Suffolk, the measure identified in this document only include those that are possible to implement today.

Timing has already been discussed in Section 4.2; 'efforts in the first 5 years (2020-2025) will focus on modal shift, while efforts to electrify the fleet will be prioritised in the 5 years leading up to the 2030 target year.' This recognises that modal shift may be easier to influence in the short term, while the uptake of EVs is something that will take time due to the natural turnover of vehicles, roll out of charging infrastructure and further performance improvements by the automotive industry. This timing also recognises the importance of first looking to 'avoid' or 'shift' road transport, before 'improving' the remaining fleet by encouraging the uptake of zero emission vehicles.

The most expensive actions are those that involve investment in infrastructure or provision of fiscal support. This could include investment in the highway space to improve priority for public transport and cyclists, and investment in charging infrastructure. As described in Section 4.2, the provision of over 3,000 public chargers across Suffolk would cost up to £40 million. Financial support provided to bus operators, businesses or citizens for the purchase of EVs or installation of chargers can also quickly become very expensive. In contrast, a number of the measures are much lower cost, including any measure supported by legislation or local policy, such as introducing work-place parking charges, low emission zones or EV taxi licensing. In several measures the Council could take a more collaborative role, engaging the private sector to invest in and operate activities. Examples include car sharing, micromobility solutions and the development of an integrated transport system.

As described in the pathways above, the most effective measures at reducing carbon emissions will be those that ultimately support the transition to a vehicle fleet that is zero-emission. While fiscal incentives can be effective at supporting EV adoption, as shown in Norway[32], restrictions and disincentives on petrol and diesel vehicles may also be needed to stimulate the high rate of EV uptake that is required. However, considering there is a high private cost associated with purchasing a new vehicle, these measures can be unpopular and need to be managed carefully.

[32] Over 60% of new registrations are plug-ins and almost 10% of the total fleet is now BEV or PHEV (The Road Traffic Information Council (OFV), Norway. https://ofv.no/)

5 Buildings and industry

Key messages for buildings:

- To achieve carbon neutrality in Suffolk, emissions from buildings will need to be near zero.
- To achieve this, the supply of heat needs to fully decarbonise by 2030, with three main options available – individual heat pumps, low carbon heat networks and/or addition of biomethane to the gas grid. It is assumed that the use of zero carbon hydrogen in the gas grid is not viable in the next 10 years.
- Alongside this, ambitious roll-out of energy efficiency retrofits will be needed, to both reduce emissions and to prepare the building stock for large-scale heat pump roll out (as heat pumps are more effective when installed in thermally efficient buildings). Other energy saving measures such as efficient appliances and energy efficient light bulbs will help manage the increased load on the electricity grid.
- According to SCC data, there are currently around 330,000 residential buildings in Suffolk. From the Local Plan and data of dwellings currently under construction, it is expected that this will increase by approximately 15% to over 380,000. It is highly likely that the actual number of dwellings will be higher than this by 2030 as there are further land parcels allocated for residential and mixed-use development in the Local Plan.
- EPC data has been used for the non-domestic buildings in Suffolk although it should be noted that this under-represents the number of non-domestic buildings in the region. According to the EPC data, there are currently over 10,000 non-domestic properties spread across different business use classes. It is not possible to quantify the number of future non-domestic buildings, however the Local Plan provides for land allocation for different development types including mixed use, employment use, community and leisure, retail and education.
- Currently 73% of residential buildings have a gas grid connection and are heated by natural gas boilers.
- Supply of biomethane is likely to be limited and the scope for low carbon heat networks is relatively limited (for example compared with more densely populated areas). Heat pumps for individual properties are therefore likely to be the main source of low carbon heat.
- A scenario has been modelled that assumes that around 85% of buildings in 2030 will have heat pumps, resulting in approximately 330,000 heat pumps being installed by 2030.
- Installation rates of heat pumps would not be expected to rise in a straight line over the next 10 years. One barrier is costs – there may need to be a policy to bring down costs and incentivise uptake. Another barrier is lack of installers so there needs to be a big training programme.
- 5% of buildings in 2030 are assumed to be connected to heat networks, resulting in approximately 20,000 heat network connections by 2030.
- Heat network development and connection would not be considered to rise in a linear fashion over the next 10 years. The feasibility and potential for such schemes needs to be considered and studied, and business cases developed to incentivise investment in these schemes. There also needs to be engagement of potential consumers to boost confidence and gain commitment to connection.
- It is therefore advised that efforts in the next few years focus on energy efficiency retrofits, with as many properties being insulated to as high a standard as possible. In the

meantime, a training programme should be developed for installers and consideration given to a policy that can, in a few years' time, incentivise much greater levels of heat pump uptake. Materials about heat pumps could also be developed for homeowners and landlords that may be first movers – those with an ability to pay and interested in the environment.

- Hence a reasonable heat pump installation trajectory might be around 12,000 a year from 2020 to 2025 and around 50,000 a year from 2025 to 2030.
- The aim should be that that from 2025, no new gas boilers are being installed to replace existing boilers, for existing buildings as well as new buildings. In addition, incentives will need to be developed to encourage homeowners and landlords to scrap gas boilers that have not yet reached the end of their lifespan, to be replaced by heat pumps.

Key messages for industry:

- The CCC assumes significant reductions in GHG emissions in industry by 2050 (90% compared to 1990 levels).
- This assumes:
  - Energy efficiency and resource efficiency improvements.
  - Carbon capture and storage (CCS) in sectors with non-combustion process emissions (cement, lime, ammonia and glass) and sectors which use 'internal' fuels produced by their feedstock (the iron, petrochemicals and refining sectors).
  - Industrial bioenergy carbon capture and storage[33] (BECCS) was only considered to a very limited extent, in sectors where biomass is already used.
  - Widespread deployment of hydrogen, electrification or bioenergy for stationary industrial heat/combustion in those manufacturing sectors not treated with CCS as identified above.
  - Widespread deployment of hydrogen or electrification for off-road mobile machinery to 90% of the fleet by 2050.
  - Reduced methane venting and leakage through gas recovery.
- Delivering this sooner than 2050 would be challenging, as the options relating to CCS and hydrogen are not likely to be viable to an earlier timeline.

5.1 The current picture

5.1.1 Domestic buildings - Existing

According to SCC data, there are currently around 330,000 residential buildings in Suffolk. The building stock is dominated by houses with the following breakdown of dwelling types.

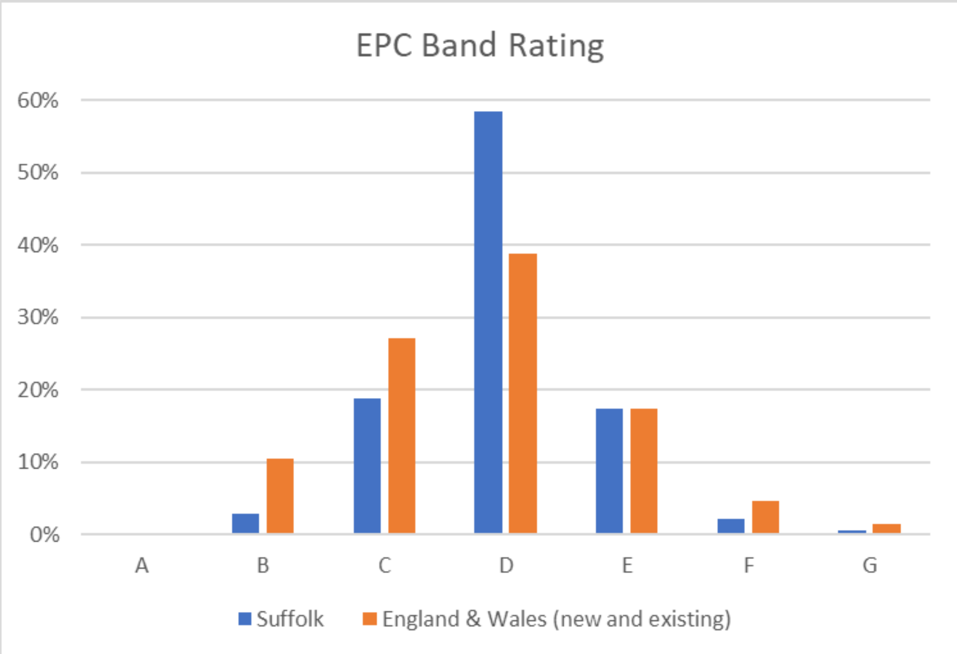
Dwelling Type	Number	% of total dwellings
Detached	116,453	35%
Semi-detached	102,727	31%

[33] The process of growing plants, crops or trees, harvesting them for energy generation and then capturing the carbon given off so it can be stored underground - https://www.crescendoproject.eu/wp-content/uploads/2018/06/BECCS_Infographic_Final.pdf

Mid-terrace	71,446	22%
Flat	19,227	6%
End-terrace	18,651	6%
Unknown	1,822	1%
Total	**330,326**	**100%**

The majority, 58%, of these dwellings have an EPC Band D rating with 20% Band E and below, 19% Band C and 3% Band B. This general trend is similar to that across all buildings rated in England and Wales since the introduction of the scheme as shown in the chart below.

Figure 23: EPC band ratings in Suffolk and England/Wales



From the chart, it can be observed that a significantly higher proportion of dwellings, 16%, are classed as Band D or worse compared to new and existing dwellings in England and Wales which indicates that there is likely more scope in improving the energy performance in domestic buildings in Suffolk compared to the England and Wales average.

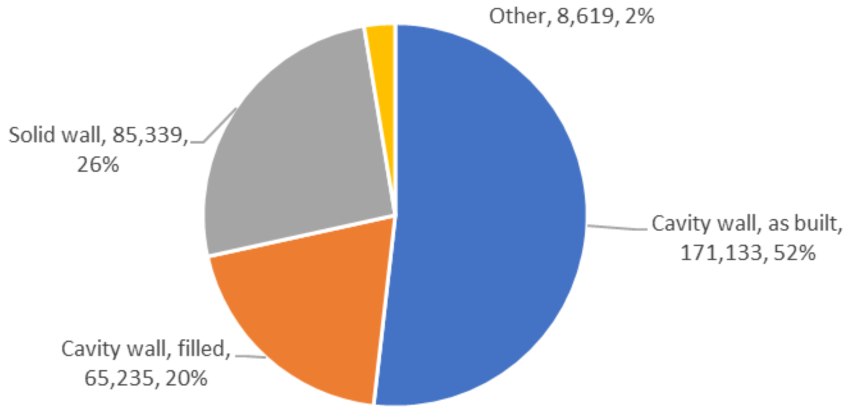
Energy performance improvements are not simply quantifiable from EPC ratings alone as they account for a range of factors which impact the energy costs associated with a dwelling from heating and appliances through to fabric energy efficiency measures. General key opportunity areas considered include the heating and energy source, insulation, glazing, LED lighting and some small scope for building mounted renewables.

To understand the baseline existing energy efficiency measures in place in dwellings in Suffolk, a combination of publicly available EPC data and data for all households provided by SCC has been used. As only 72% of dwellings accounted for in SCC household data have EPCs, the breakdown of existing energy efficiency measures from EPC data has been scaled up by the same proportion to apply to all households in the Suffolk region.

Wall type and insulation

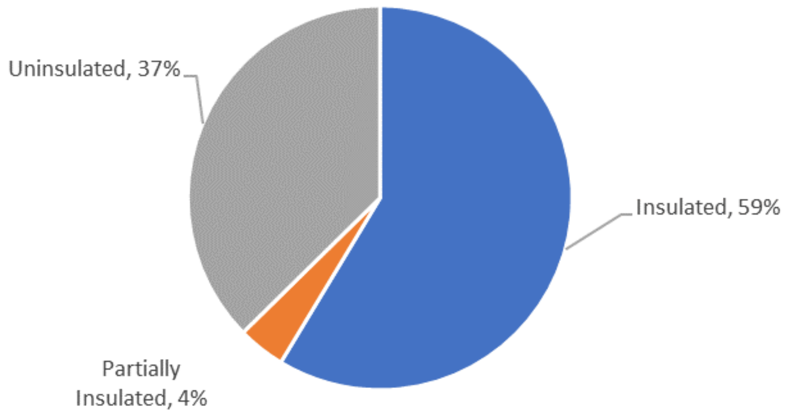
Most, 72%, of the domestic dwelling builds have cavity walls either as built or filled. Solid walls account for just over a quarter of all building walls.

Figure 24: wall types in domestic buildings in Suffolk



As it is not possible to infer the number of dwellings with wall insulation from the SCC data shown in the chart above, EPC data has been used. The proportion of dwellings with insulation, those that are partially insulated and those which have no insulation is shown below for all wall build types.

Figure 25: types of wall insulation in domestic buildings in Suffolk



Most dwellings in the Suffolk region have wall insulation according to the EPC data however a significant proportion of dwellings, more than a third of the total, do not have any wall insulation. The following proportions and numbers of dwellings with different wall insulation types are shown in the following table.

Wall Type	Insulation Level	EPC Dwelling Numbers	% EPC Dwelling Numbers per wall type	SCC Total Dwellings
Cavity	Full	112,042	78%	183,397
	Partial	7,256	5%	11,877
	None	25,105	17%	41,093
Solid	Full	4,448	9%	7,327
	Partial	158	0%	260

	None	47,204	91%	77,752
Timber*	Full	6,078	52%	3,178
	Partial	927	8%	485
	None	4,640	40%	2,426
System Built*	Full	1,941	47%	983
	Partial	148	4%	75
	None	2,035	49%	1,031
Other (sandstone, cob, park, granite)*	Full	125	22%	98
	Partial	3	1%	2
	None	434	77%	341
Total		212,544[34]		330,326

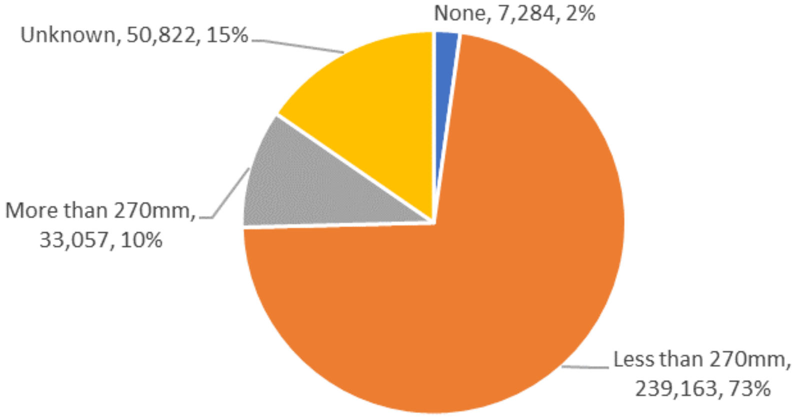
** It is clear that there is a discrepancy between the total numbers of properties with wall types classed as timber, system built and other types between the EPC data and SCC data leading to fewer "scaled" up properties. While this highlights a potential conflict in the data, it is not considered to be significant at this stage as these wall types account for less than 3% of the total dwellings in the region and not considered to be significant in determining indicative energy efficiency measure deployment.*

Roof/ loft insulation

SCC data provided the level of roof insulation for each of the households in the region. From this data it was determined that only 11% of dwellings that have roofs (i.e. not flats with properties above) currently have insulation with thicknesses equal to or exceeding 270mm.

The insulation levels of 15% of dwellings are unknown. However of the known dwellings 94% have insulation of 100mm or greater with only 3% of dwellings that have no roof insulation at all.

Figure 26: roof insulation levels in domestic buildings in Suffolk



Floor insulation

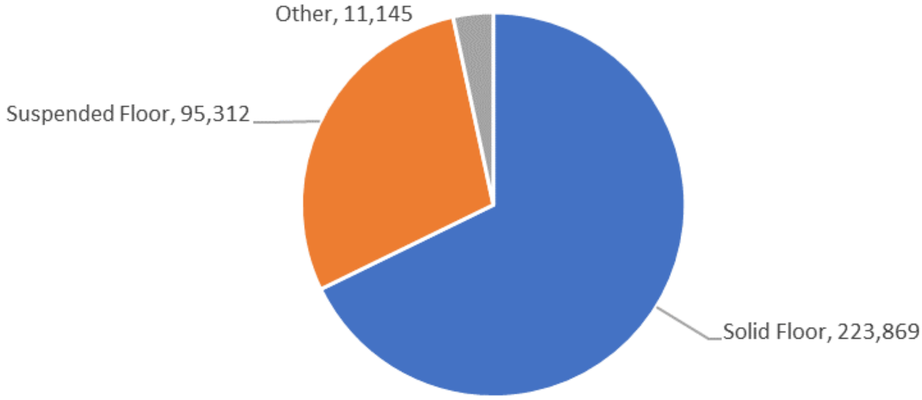
There is very limited data available on the levels of floor insulation in the EPC data for Suffolk. Only 9% of the dwellings included in the EPC data have a "Very Good", "Good", "Average", "Poor" or "Very Poor" rating. Of the floor insulation that has been rated, 98% is classed as "Good" or "Very Good".

[34] Total number of EPC dwellings in SCC region = 238,426. Assumed that the 25,888 dwellings with unspecified wall build and insulation type are cavity walls as this is the most significant class of known wall build type- assumed insulation associated with unspecified wall build type has the same proportion of insulated, partially insulated and uninsulated walls as known cavity wall build types.

This is considered highly unlikely to represent the existing levels of floor insulation in Suffolk, therefore this data is disregarded for the purposes of identifying potential energy efficiency measures.

Instead, the breakdown of floor types within this region from SCC data is shown in the chart below. Later commentary on floor insulation measures is qualitative only on this basis.

Figure 27: floor types in domestic buildings in Suffolk



Windows glazing

98% of all dwellings in the Suffolk region have double glazing with 157 dwellings reported as having triple glazing installed. Of the 2% of buildings with single glazing, only 8% of these are either Grade 1, Grade 2 or locally listed buildings.

Heating Fuel Types

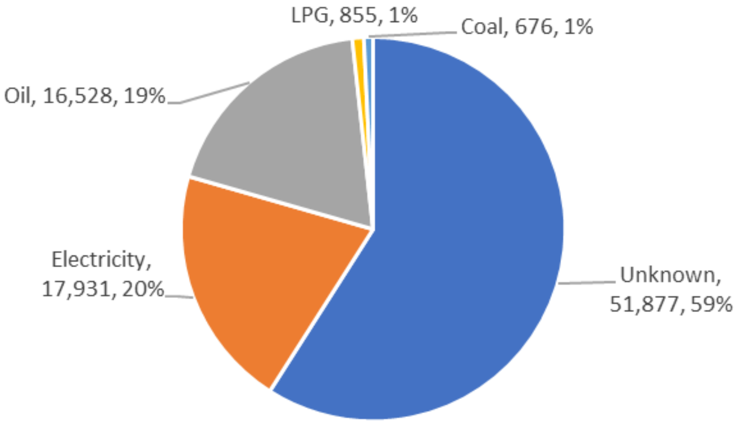
There are a range of heating types installed within existing dwellings in Suffolk. 73% of the existing domestic dwellings in Suffolk have natural gas connection and most (98%) of these are defined as heated by boilers, less than 1% is community heating and most of the remaining 1% is ambiguous e.g. warm air/ room heaters. It is noted that based on the data, there are only 6 heat pumps associated with on-gas grid dwellings (although it is understood that the actual number is greater).

Just over a quarter, 27%, of dwellings in Suffolk are categorised as off-gas grid, which is significantly more than the national average of 14.1% in 2018[35]. From the data available, the main heating system for 63% of these off-gas dwellings is boilers (most oil-fired with a small LPG, coal and biomass contribution of around 2%[36]) and 31% heated by electric storage heaters. Over 4.5% of dwellings have ambiguous heating system categories while the remaining 1% of dwellings without gas connection have no heaters. According to the data, there is only a single heat pump currently installed in an off-gas grid dwelling in Suffolk (although again, it is understood that this is likely to be an under-representation).

[35] Official Statistics: LSOA estimates of properties not connected to the gas network https://www.gov.uk/government/statistics/lsoa-estimates-of-households-not-connected-to-the-gas-network

[36] Although the main heating fuel for these dwellings is not known with 60% of off-grid dwellings returning "unknown" fuel type, it is very likely that most off-grid gas boiler heating systems are fuelled by oil.

Figure 28: main heating fuels in off-gas grid domestic buildings



5.1.2 Domestic dwellings - under construction

According to data received from the Council there are currently 15,472 dwellings under construction in the Suffolk region. It is assumed that these will be constructed before 2030. Most of these new builds, 9,485 (61%) are being constructed in West Suffolk, with 2,655 (17%) in East Suffolk and 1,500 (10%) in Mid-Suffolk.

The number of domestic dwellings under construction is anticipated to increase the total number to 345,798, an increase of nearly 5%.

5.1.3 Domestic dwellings - future

From the Local Plan and data of dwellings currently under construction, it is expected that the total number of domestic dwellings will increase by approximately 15% to over 380,000 although it should be noted that this is approximate as there are further land parcels with the potential for residential development that have not been fully specified and there is likely to be movement in anticipated dwelling numbers set out in the Local Plan. Also this does not account for destruction of existing dwellings.

80% of all proposed dwellings, 29,000 dwellings, are covered within 85 development areas with more than 100 dwellings, within the Local Plan for Suffolk. The 18 largest dwelling development areas account for nearly 45% of total proposed dwellings in the Local Plan and are as follows:

District	Dwellings	% of Total Local Plan	Site Ref	Policy	Allocation
East Suffolk	2000	5.5%	DC/17/1435/OUT(SCLP12.19)	DC/17/1435/OUT(SCLP12.19)	Housing
East Suffolk	1,440	4.0%	SCLP12.3	SCLP12.3	Housing
West Suffolk	1300	3.6%	SA4(a)	SA4 & SA17	Mixed Use
East Suffolk	1300	3.6%	SSP8	SSP8	Housing
East Suffolk	1250	3.4%	WLP2.8	WLP2.8	Housing

Ipswich	1100	3.0%	N/A	CS10	Strategic Allocation
Ipswich	912	2.5%	N/A	CS10	Strategic Allocation
East Suffolk	900	2.5%	WLP2.15	WLP2.15	Housing
Ipswich	800	2.2%	N/A	CS10	Strategic Allocation
East Suffolk	800	2.2%	SCLP12.29	SCLP12.29	Housing
Babergh	600	1.7%	LA013	LA013	Residential
Mid Suffolk	600	1.7%	LA034	LA034	Residential
Mid Suffolk	570	1.6%	LA035	LA035	Residential
Babergh	520	1.4%	LA055*	LA055*	Residential
Babergh	500	1.4%	LA042	LA042	Residential
Mid Suffolk	500	1.4%	LA095	LA095	Residential
Babergh	500	1.4%	LA028	LA028	Residential
Babergh	500	1.4%	LA013*	LA013*	Residential
Total	**16,092**	**44.3%**			

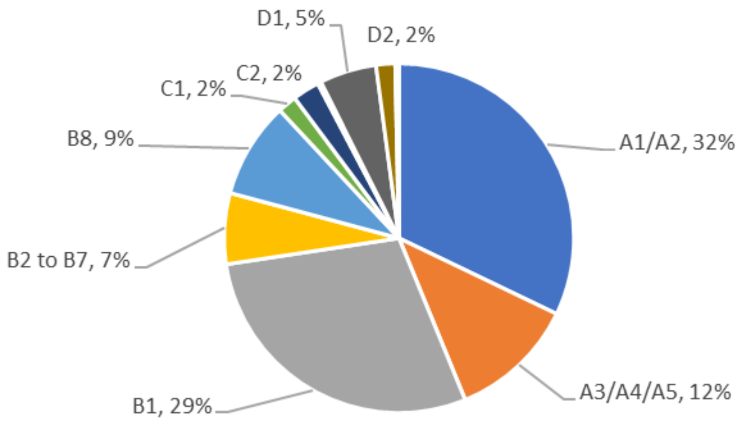
5.1.4 Non-domestic properties

Existing Properties

There is limited data available on the number of non-residential properties in the Suffolk area, so in the absence of more accurate and reliable data, EPC data has been used. It should be noted that this is under-representative of the total number of non-domestic buildings in the region as it does not cover all buildings.

According to the EPC data, there are currently over 10,000 non-domestic properties spread across different business use classes. 85% of these properties are commercial in nature while 15% are industrial. The breakdown of properties by business use class is shown in the chart below:

Figure 29: breakdown of non-domestic properties by business use class



It can be seen that the majority of non-domestic buildings in the Suffolk region, as identified through EPC data, are associated with retail, financial and professional services (32%) with the next most significant sectors being office space (29%) and restaurants, cafes and drinking establishments accounting for the third largest sector (12%). Industrial and warehouse space together accounts for

16% while the remaining 11% of properties are a mix of residential facilities, education and entertainment centres.

The majority, 30%, of these buildings have an EPC Band D rating with 35% Band E and below, 25% Band C, 8% Band B and 2% Band A. This general trend is similar to that across all buildings rated in England and Wales since the introduction of the scheme as shown in the chart below.

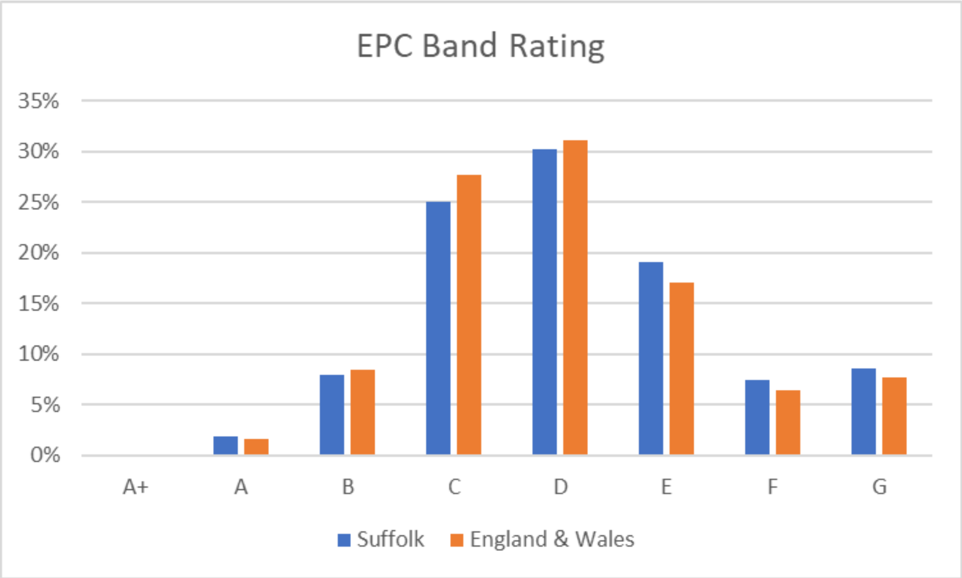
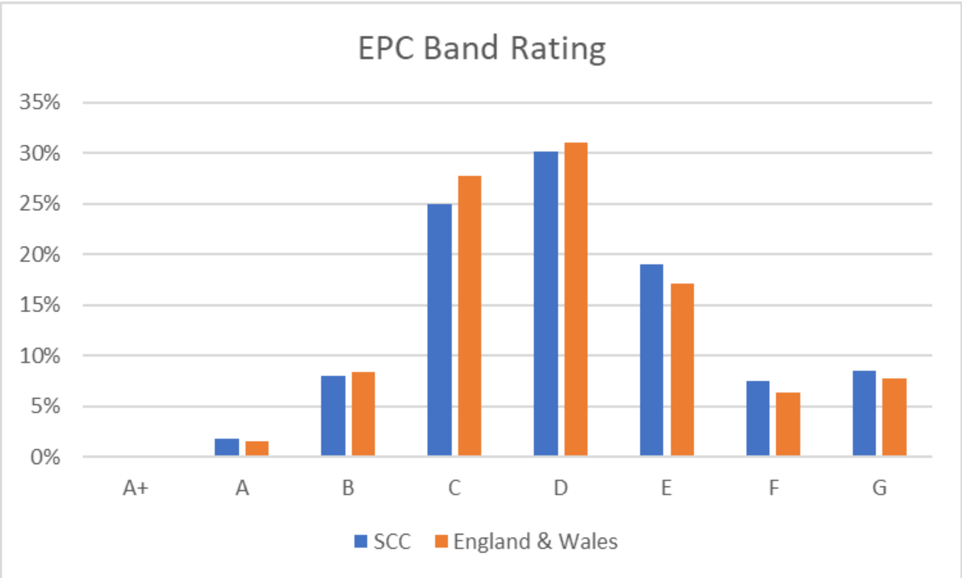


Figure 30: EPC band rating for non-domestic properties in Suffolk and England/Wales

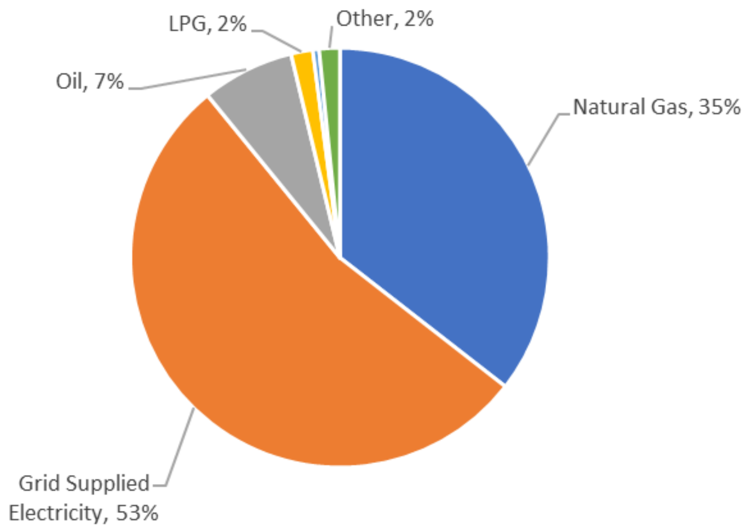


From the chart, it can be observed that 3% more non-domestic buildings in Suffolk are classed as Band D or worse compared to the proportion of total non-domestic building stock in England and Wales which indicates that there is likely more scope in improving the energy performance in non-domestic buildings in Suffolk compared to the England and Wales average.

Energy performance improvements are not simply quantifiable from EPC ratings alone as they account for a range of factors which impact the energy costs associated with a non-domestic building, from heating and appliances through to fabric energy efficiency measures. General key opportunity areas considered include the heating and energy source, insulation, glazing, LED lighting and some small scope for building mounted renewables.

Based on publicly available EPC data, it has not been possible to quantify the baseline energy efficiency measures associated with this stock, therefore further work would be required to assess this; however, the heating type is understood from the information available. From EPC data, the main heating fuels are shown below.

Figure 31: main heating fuels for non-domestic properties in Suffolk



It can be seen that the main heating fuel used across the existing properties is electricity as used in over half of the properties identified, followed by natural gas (35%). Based on the EPC data available, it is not possible to confirm which properties do not have a gas connection, however it is reasonable to assume that those with the main heating fuel as oil or LPG are not likely to be connected to the gas grid as these are relatively expensive fuel sources compared to natural gas.

It is determined based on this assumption that 8% of commercial properties are off-gas grid and 12% of industrial properties are off-gas grid. It should be noted that there may be a significant proportion of electrically-heated properties that are off-gas grid, however it is not currently possible to confirm this.

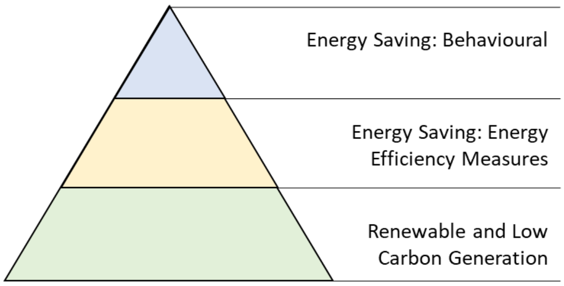
Future Properties

It is expected that the total number of non-domestic properties will increase over time by 2030 however it has not been possible to quantify the number of likely future non-domestic buildings. Data provided by the Council from the Local Plan has provided an indication of the land area allocated for different development types - 36 ha has been allocated for employment use, 16 ha for community and leisure space, 3 ha for retail and around 1 ha for education space.

5.2 Key interventions for carbon reductions from building sector

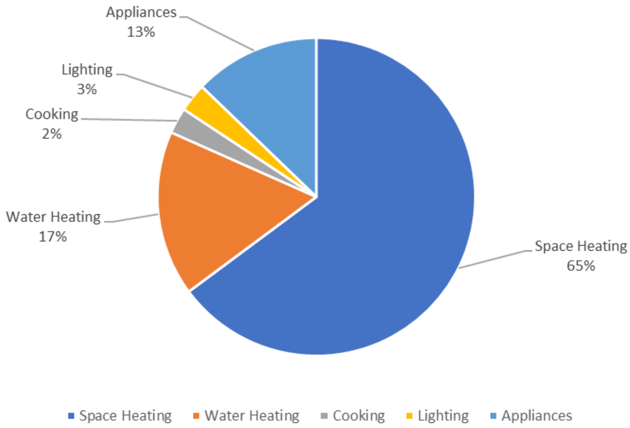
To achieve net zero emissions in Suffolk by 2030, ambitious actions are required to reduce the emissions associated with the buildings sector. There are three main areas considered for the reduction of emissions from buildings: reducing demand, improving efficiency of energy consumption and reducing the emissions associated with heat supplied and consumed in buildings through renewable and low carbon energy supplies. This is shown in the energy hierarchy in the image below.

Figure 32: Energy hierarchy



Energy consumption in 2018for the average domestic dwelling in the UK, broken down by end use, is shown in the chart below[37].

Figure 33: Energy use breakdown for average UK dwelling (2018)



It is clear from this chart that most of the energy consumed is associated with heating, whether this is space heating or water heating. In order to reduce emissions associated with the building stock in Suffolk, reducing emissions from heating is key to meeting the net zero target by 2030. Appliances are the second largest end user of energy in a home, with lighting and cooking making up a much smaller proportion.

While there are opportunities to reduce energy consumption across all end users, relatively small improvements in heating efficiency or reductions in carbon associated with heat generation will have a much greater overall impact on the carbon intensity of the domestic building stock compared to the other end users. Due to this, the main focus of interventions and pathways to net carbon neutrality are focussed on building thermal efficiency and heat decarbonisation than on cooking, lighting and appliances which make up less than a fifth of the annual energy consumption of the average UK household.

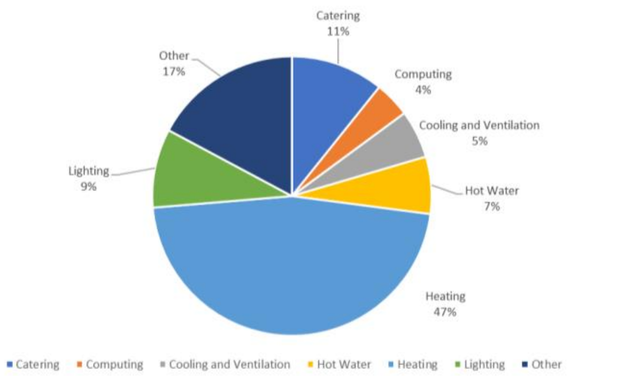
In 2018, the energy consumption breakdown by end use for the UK service sector (excluding agriculture) is shown in the chart below[38]. It should be noted that this average includes the following non-domestic purposes:

- Community, arts and leisure
- Education
- Emergency services

[37] ECUK: End uses data tables. https://www.gov.uk/government/statistics/energy-consumption-in-the-uk
[38] ECUK: End uses data tables. https://www.gov.uk/government/statistics/energy-consumption-in-the-uk

- Health
- Hospitality
- Military
- Offices
- Retail
- Storage

Figure 34: Energy use breakdown for average UK service sector building (2018)



Heating and hot water are the most significant end users accounting for 54% of energy consumption across the service sector with other, undefined uses accounting for the next largest proportion (17%). Catering and lighting are greater consumers than within the average UK domestic dwelling (20% compared to 5%), with computing, and cooling and ventilation accounting for less than a tenth.

Due to the varied nature of non-domestic buildings based on building use and purpose, the energy consumption breakdowns vary significantly. For the purposes of identifying and prioritising interventions, it is recommended that the energy hierarchy is followed with regards to the general improvement measures such as behavioural energy efficiency, thermal and appliance efficiency measures and heat decarbonisation as discussed below but to note that there will be nuances specific to different types of businesses.

The relative cost effectiveness of measures can be used to provide indicative prioritisation for non-domestic buildings. However, the costs and magnitudes (where present) are specific to the domestic sector as this information is more readily available and considered more likely to reflect the building stock in Suffolk due to the much greater number of data points available and baseline information availability.

Further work would be required to provide a comprehensive intervention analysis for both the non-domestic and domestic sector which is outside the scope of this project.

Energy Saving: Behavioural

This element of the hierarchy is concerned with the elimination of unnecessary energy consumption and concerns behavioural energy use. Depending on the consumer type, the impact of interventions associated with reducing energy use can have varying potential for carbon emissions reductions. From an individual or business perspective, interventions associated with eliminating unnecessary energy use are typically low or no-cost and the benefits are typically realised over short timescales with reductions in energy bills the key motivation for improvement.

Reducing consumer energy demand in buildings requires engagement of domestic and non-domestic building users to take steps to reduce the energy use. Interventions could include public messaging encouraging people to:

- Switch off appliances when not in use
- Reducing the frequency with which large energy consuming appliances are used
- Introduce and optimise control settings for lighting and other electricity consuming equipment
- Introduce and optimise thermostat control settings for heating and/or cooling

An enabling measure associated with reducing energy use is increasing the visibility of energy use through household smart meters and non-domestic energy sub-metering systems. These systems provide individuals with real-time visibility of their energy consumption and can help them to understand the impact of their current energy behaviour and make informed decisions on how to reduce energy use and costs and, where environmental impact is a driver, reduce their carbon footprint through day-to- day activities. According to BEIS' most recently published smart meter statistics, there were 14.9 million smart and advanced meters in operation in homes and businesses in the UK at the end of June 2019[39].

Energy Saving: Energy Efficiency Measures

There are a wide range of different energy efficiency measures that can be considered for reducing energy demand and associated carbon emissions within the building sector. These include fabric energy efficiency measures, window glazing and use of efficient appliances.

The following matrix provides an overview of some key thermal measures considered for buildings in Suffolk and gives an indicative scale of emissions reductions, cost, technical feasibility and public acceptability.

The potential emissions reduction and cost effectiveness is taken from "Review of Carbon Savings from Residential Efficiency", published in December 2013 by Element Energy and the Energy Saving Trust. This report has been referenced in the Committee on Climate Change report "UK housing: Fit for the Future" published in 2019 and it does not appear as though the data referenced in the below has since been updated or superseded within publicly available resources.

The Cost Effectiveness of the measures has been determined by Element Energy and Energy Saving Trust through energy modelling across the UK building stock therefore the relative costs should be considered to provide an indication of their potential effectiveness in Suffolk only. It should be noted that the costs used in determining Cost Effectiveness do not account for potential discounts from bulk orders or cost reductions over time and were reported in 2013 and have not been adjusted to current costs due to the greater significance placed on relative cost effectiveness for this report.

39 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/827813/2019_Q2_Smart_Meters_Statistics_Report.pdf

Measure	Potential Emissions Reduction	Type	Fixed Costs[40]	Variable Costs[41]	Cost Effectiveness (CAPEX + Fuel Savings) [42]	Technical Feasibility	Acceptability
Cavity Wall Insulation	50%	Easy-to-treat	£250	£5/m^2	-£136/tCO_2	Easy-to-treat (standard): brick-brick/ brick-block with cavities >50mm.	High
		Hard-to-treat	£2,240	£5/m^2	-£30/tCO_2	Hard-to-treat (unconventional): timber, concrete or steel frame, too high (>3 stories) or with cavities <50mm.	
Solid Wall Insulation	49%	Internal	£2,400	£66/m^2	£79/tCO_2	Internal or external wall insulation technically feasible for any solid wall type	High (internal) Medium (external - impacts aesthetic properties of building exterior)
		External	£6,000	£111/m^2	£3,185/tCO_2		
Loft insulation	50%	Easy-to-treat	£160	£0.01/mm*m^2	50-124mm: -£97/tCO_2 125-199mm: -£24/tCO_2	DECC classification of hard-to-treat: *"lofts which are hard to insulate. For example properties with a flat roof or very shallow pitch (to make the loft space inaccessible)"*.	High
		Hard-to-treat	£990	£23/m^2	50-124mm: £406/tCO_2 125-199mm: £1,101/tCO_2		
Heating Controls	50% (full)	TRV only	£169	£0/dwelling	-£50/tCO_2	Technically feasible however radiators would require rebalancing once fitted.	High
		Full	£452	£0/dwelling	£37/tCO_2		
Double Glazing	28%	Single to double	£1,684	£109/m^2(window area)	£202/tCO_2	Technically feasible for all single glazed windows.	High
Floor Insulation	28%	Suspended Timber Floor	£0	£9/m^2	-£93/tCO_2	Technical feasibility depends on type of floor however floor insulation is feasible for suspended and solid floors.	High
		Solid Floor	£0	£29/m^2	£121/tCO_2		
Draught Proofing	25%	Window/Door	£0	£3.60/m(perimeter)	-£50/tCO_2	Technically feasible to install draught proofing strips on all single glazed window units.	High

[40] Rounded fixed costs only are shown, this is the median cost between low and high fixed costs. All sources and references included in: https://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf

[41] Rounded variable costs only are shown, this is the median cost between low and high fixed costs. All sources and references included in: https://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf

[42]Across total UK housing stock. Assumptions and methodology in https://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf

Based on the matrix of thermal energy efficiency measures, the clear priority based on relative cost-effectiveness is to introduce cavity wall insulation to easy- to-treat buildings with uninsulated cavity walls. Broadly based on this assessment, the priority would be:

1. Cavity wall insulation for easy-to-treat properties
2. Floor insulation for suspended floors
3. Loft insulation for easy-to-treat properties
4. Thermostatic radiator valve heating controls
4. Draught-proofing of single glazed windows
5. Cavity wall insulation for hard-to-treat
6. Full heating controls
7. Internal wall insulation
8. Floor insulation for solid floors
9. Single to double glazing
9. Loft insulation for hard-to-treat
10. External wall insulation

It should be noted that this prioritisation is based on relative cost effectiveness across the UK building stock and does not account for the variation present in Suffolk, where the baseline is different to the national baseline. Nonetheless it still gives a useful insight into the kinds of measures possible and how they might be prioritised.

Energy Efficient Appliances

Improving the energy efficiency of appliances in buildings in Suffolk would be driven principally by end of lifetime replacements, tightening of appliance energy efficiency standards as set by the EU, and the availability and cost of energy efficient replacement appliances. Raising awareness of the cost and environmental implications of lower energy efficiency appliances amongst the public and considering the introduction of a scrappage scheme within Suffolk local authorities for low efficiency appliances once they reach end of life could be used to encourage Suffolk residents to opt for high efficiency appliances at the point of replacement.

Appliances considered can be categorised as cold, wet, cooking and consumer electronics as shown below. The 2013 cost per unit and Cost Effectiveness of replacing existing units based on assumptions made by Element Energy and Energy Saving Trust is also shown in the table. As discussed previously, the relative cost effectiveness should be viewed as an indicator for prioritisation rather than the value itself as this data is for the whole country and may not be fully representative of the building stock in Suffolk.

Appliance Type	Description	Cost per Unit[43]	Cost Effectiveness (CAPEX + Fuel Savings)[44]
Cold Appliances	A++ Chest freezer	£270	-£350/tCO_2
	A++ Fridge freezer	£278	-£348/tCO_2
	A++ Refrigerator	£276	-£344/tCO_2
	A++ Upright freezer	£442	-£350/tCO_2

[43] Rounded fixed costs only are shown. All sources and references included in: https://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf
[44] Across total UK housing stock. Assumptions and methodology in https://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf

Wet Appliances	A+++ Washing Machine	£321	-£294/tCO_2
	A Tumble Driers	£236	£166/tCO_2
	A+ Dishwasher	£365	-£294/tCO_2
Cooking	A+ Electric Ovens	£382	-£357/tCO_2
Consumer Electronics	Televisions	£542	-£331/tCO_2

Replacement of cold and cooking appliances are considered to be the most cost-effective in terms of emissions reductions. There is greater variation in the impacts associated with replacing wet appliances while the replacement of consumer electronics such as TVs is also considered to be cost effective, similar in magnitude to cooking and cold appliances.

Energy Efficient Lighting

Replacement of lighting in buildings is considered to be one of the lowest cost/ highest impact methods of reducing energy consumption. According to the modelling undertaken by Element Energy and Energy Saving, switching from

- Incandescent light bulbs (GLS) to compact fluorescents (CFL) at a cost of £5.52/ unit has a Cost Effectiveness of -£357/tCO_2
- Halogen light bulbs to LEDs at a cost of £9.80/ unit has a Cost Effectiveness of -£253/tCO_2

Although lighting typically represents a small proportion of the overall energy consumption of domestic and non-domestic buildings, there are significant reductions that can be made through replacement of conventional light bulbs with more efficient alternatives at end of life. Based on the information above, from a cost/emissions reduction perspective, the switch from incandescent bulbs to compact fluorescents should be prioritised over halogen replacement.

Renewable and low carbon energy generation

As previously shown in the breakdowns of energy consumption by end use, the most significant user of energy in both domestic and non-domestics is heating. While energy efficiency methods should be considered in the first instance to reduce demand as per the energy hierarchy, there will be residual heat demand which will need to be decarbonised to reduce emissions from the building sector to enable Suffolk to achieve net zero emissions by 2030.

The Committee on Climate Change Net Zero Technical Report considers heat pumps and heat networks to provide the main opportunities for reducing the carbon emissions associated with heat generation with a potential role for hydrogen and gas grid decarbonisation in reducing emissions associated with residual demand for gas.

Heat Pumps

Heat pumps can provide low carbon heating for homes and non-domestic buildings.

The efficiency of heat pumps is a key determining factor of cost-effectiveness as this impacts the running costs which offset higher capital costs relative to conventional heating technologies such as gas boilers, oil boilers and electric heating.

The efficiency of heat pumps is the ratio of heat output to electricity input and is referred to as Seasonal Performance Factor (SPF). The SPF is typically around 2-3 for Air Source Heat Pumps (ASHP) and around 4 for Ground Source Heat Pumps (GSHP). This is important as the electricity required to operate the heat pumps is more expensive than gas. Without policy intervention, SPFs in excess of 3.5 would be required to provide operating cost savings compared to gas boilers.

Heat pumps can be installed to provide heating for any building with some retrofitting, however they are most efficient where the temperature difference between the collector and emitter of heat is minimised. They therefore produce heat at lower temperatures than conventional heating systems. As heat is produced at lower temperatures, it is recommended that buildings considered for heat pumps are first well-insulated with good thermal properties and with a high standard of air tightness. Larger areas are required for heat distribution, therefore typically larger, heat pump compatible radiators are required than conventional central heating radiators and ideally underfloor heating. The costs of additional work required to make the heating system compatible with heat pumps can vary significantly depending on the extent of works required. Furthermore, back-up or supplementary heating systems may be required to provide additional heat capacity to meet peak demand or for buildings where the heat demand profile is not typically gradual.

Heat pumps would initially likely be most suited to buildings that have undertaken thermal energy efficiency measures such as cavity wall, loft and/or floor insulation and already have wet heating systems and underfloor heating in place. Once energy efficiency measures have been more widely rolled out, then larger numbers of heat pumps can be installed. It is also recommended that heat pumps be installed in new build properties that have been designed to high thermal efficiency standards.

The type of heat pump suitable for a property can be determined based on the space available, capital cost and operating cost savings against conventional heating systems which is, as previously discussed, dependent on system efficiency.

GSHPs require space for the installation of vertical or horizontal collectors and are therefore not considered suitable for individual flats but could be installed within a communal heating system installed to supply multiple flats within a building. ASHPs do not have the same space requirements and the units can be relatively small depending on capacity however they must be mounted in a position of good air flow. This means that ASHPs can be installed on individual flats and houses which do not have the space available for either vertical or horizontal ground loop installation as required for GSHPs.

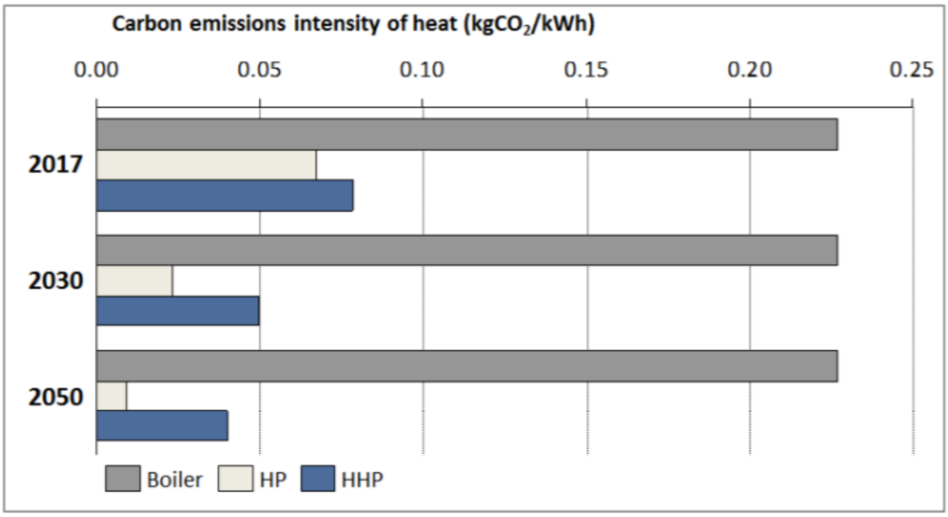
As previously mentioned, GSHPs are typically higher efficiency than ASHPs so will compare more favourably in terms of operating cost savings, however capital costs are higher at around £8,000-£23,000 dependent on the type of GSHP and extent of works required compared to £5,000-£15,000 for ASHPs.

Hybrid heat pumps (HHP) are considered to play a role as transitional technologies, as they combine a heat pump with a gas boiler, and can eventually combine heat pumps with hydrogen boilers should a hydrogen network be developed in the area in the long-term. Gas boiler/heat pump systems can offer upfront cost savings of £450-2,800 compared to standalone air source heat pumps[45] however the saving reduces significantly for buildings that are highly energy efficient and are not considered likely to be cost competitive for new build 'zero carbon standard' homes. Hybrid heat pumps are therefore considered suited to existing buildings that are connected to the gas grid that have not had extensive thermal energy efficiency measures carried out.

[45] Based on typical standard semi-detached house. Element Energy "Hybrid Heat Pumps Study *Final Report*" https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700572/Hybrid_heat_pumps_Final_report-.pdf

The following graph shows the projected carbon intensity of heat for boilers, heat pumps (air source) and hybrid heat pumps and is taken from the Hybrid Heat Pumps study undertaken by Element Energy and published by BEIS in 2018.

Figure 35: Projected carbon intensity of heat for HHP, HP and boiler heating systems (typical semi-detached, DHW met by the boiler component of HHP) - measured over 15 year lifetime[46]



Despite the clear benefits in terms of emissions reductions compared to fossil fuelled boilers, the main financial and non-financial barriers associated with heat pumps are:

- High upfront costs relative to conventional heating systems. This is partially offset by incentive mechanisms such as the Domestic and Non-Domestic Renewable Heat Incentive schemes, however these are due to close to new applicants after 31st March 2021 and replacement/ alternative schemes are yet to be announced.
- Consumer confidence and awareness is currently relatively low although it has grown in recent years
- Unsuitability of current housing stock requiring energy efficiency improvements and retrofitting of heating systems that would be compatible with heat pumps.
- Lack of installer capacity in UK.

Heat Networks

Heat networks can play a part in decarbonisation of heating of non-domestic and domestic buildings through single or multiple centralised heat generation plants (energy centres) feeding heat into a network of pipes connected to buildings.

The carbon emissions reduction potential for heating from a heat network rather than through individual heating technologies such as gas boilers or electric heating is dependent on the technology used to generate heat for the network.

Gas CHP has provided the heat source for the majority of heat networks deployed in recent years in the UK. This is due to the reliability and relatively low price of gas, maturity of technology in the market with significant installer and maintenance experience and the income from electricity sales either to the grid or to private wire customers. There are carbon emissions reductions compared to

[46] Figure 1-5 in Element Energy "Hybrid Heat Pumps Study *Final Report*" https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700572/Hybrid_heat_pumps_Final_report-.pdf

individual gas boilers and electrically heated properties for systems that are effectively sized with limited distribution heat losses however the source of heating supplying these networks will need to change over time to reduce emissions further against conventional individual heating systems.

Biomass boilers and biomass CHP heated networks have been increasingly installed since the introduction of the Renewable Heat Incentive in the UK which provides additional income to offset the costs associated with renewable heating technologies at different tariff levels depending on the size and type of technology installed.

Heat pumps, ground, air and water-source, provide some of the most promising potential in terms of decarbonising heat networks and can provide lower cost networks due to the lower flow temperatures produced in efficient heat pump systems. However consumer-side retrofitting is required and thermal efficient buildings are most suited to these systems as they are for stand-alone individual heat pumps. While higher temperature heat pumps are commercially available, uptake has typically been lower than conventional heat pumps systems.

Generally, heat networks can be considered technology agnostic with the potential to replace more conventional technologies such as gas CHP with renewable technologies over time. To ensure that heat networks can be decarbonised over time, consideration should be given to future-proofing the network infrastructure as much as possible as this can have a lifetime which significantly exceeds the operating life of the heating technology which feeds the network.

Heat networks are most feasible for areas of high heat density to ensure sufficient revenue from heat sales to pay back costs associated with the network and energy centre. The size of heat networks can vary from communal networks which can serve a small number of buildings through to large district sized schemes which typically are located in urban areas where there are large numbers of high density housing and mixed use developments.

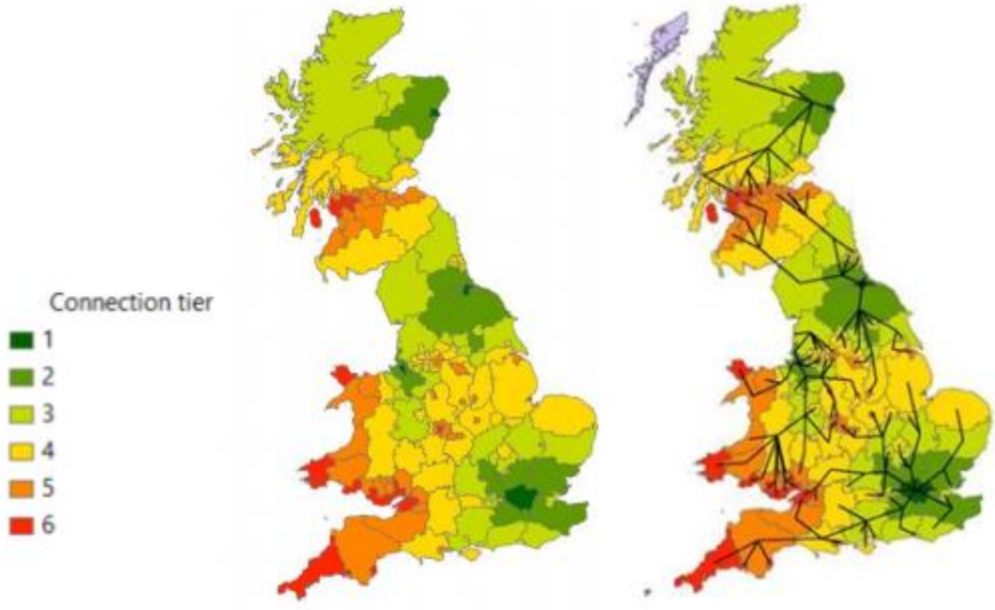
Investment and deployment of heat networks has been relatively low in the UK and there have been two main UK Government schemes to provide funding into the investigation, development and deployment of heat networks as part of a package of measures introduced to aid in the decarbonisation of heat required to meet the legally-binding carbon budgets and the 2050 net zero emissions target. Investor confidence influenced by strong policy is required to help meet the high upfront costs associated with heat network interventions and consumer assurance is also required to increase public awareness and improve perception of heat networks.

Hydrogen

Hydrogen is not considered likely to provide a short-term pathway to carbon neutrality, particularly for Suffolk, as it is not anticipated that there will be an active, widespread hydrogen grid by 2030 across the UK. While there is increasing interest and strategy developed at a national level around the importance of hydrogen in meeting the net zero target, the most likely rollout of hydrogen networks would initially target high density demand centres where there is the infrastructure required to support the generation and distribution of hydrogen.

It is widely considered that there are 4 key priority areas for hypothetical hydrogen rollout in the UK: Liverpool, Aberdeen, Stockton-on-Tees and London. Any potential network expansion will then follow the most viable routing which will likely account for scale of demand and density of potential consumers. The following figure was produced by Element Energy and E4Tech as part of their future costs of heating modelling scenario. From this figure it is clear that most of Suffolk sits within a hypothetical intermediate connection tier which is unsurprising given the relatively sparse demand density outside of the main urban areas and the number of existing properties that do not have connections to the current natural gas grid.

Figure 36: Visualisation of hypothetical hydrogen rollout scenario[47] (Element Energy & E4Tech, 2018)



5.3 The pathway to carbon neutrality

According to the CCC Net Zero Technical Report, buildings which are easier/ less costly to decarbonise are those which are new, those off the gas grid, buildings suitable for district heating and buildings currently connected to the gas grid which do not have space or heritage constraints.

The "Core Scenario" involves a combination of heat networks and heat pumps to meet building heat demands and energy efficiency measures including fabric efficiency, and appliance and lighting efficiency improvements for domestic and non-domestic buildings.

The "Further Ambition" Scenario within the CCC report deploys low carbon heating and energy efficiency measures for buildings, principally considered domestic buildings, that are more difficult to decarbonise through converting residual gas demands to hydrogen and biomethane through the gas grid. The emphasis on "Further Ambition" for non-domestic buildings is a switch to hydrogen in meeting peak heat demand for buildings served by heat networks.

5.3.1 Pathway to Carbon Neutrality: Energy Efficiency

As noted in the Net Zero Technical Report prepared by the CCC

"Energy efficiency remains an important facilitator of low-carbon heat, alongside reducing emissions and energy bills, improving competitiveness and asset values for business, improving health and wellbeing and helping tackle fuel poverty."

[47] https://www.nic.org.uk/wp-content/uploads/Element-Energy-and-E4techCost-analysis-of-future-heat-infrastructure-Final.pdf

Different low carbon measures for buildings should not be considered in isolation and to enable Suffolk to realise net zero carbon for the buildings sector by 2030, energy efficiency must be considered in combination with heating and energy supplies to domestic and non-domestic buildings.

New buildings are considered to be the simplest of the building stock to decarbonise from both a heating and energy efficiency perspective according to the CCC report, which recommends that all new build homes by 2025 be built with “ultra-high” levels of energy efficiency. Research undertaken by Currie and Brown and Aecom identified an opportunity to tighten building standards for non-domestic buildings by reducing carbon emissions compared to Part L Building Regulations by 15% in 2020 with a total of 20-25% reduction economically feasible by 2020 to 2025 depending on the existing heating system and building archetype.

Potential energy efficiency improvements to be implemented are broadly approximated for the domestic dwellings based on data provided by SCC, the CCC Further Ambition Scenario and Scatter tool developed by Anthesis Group. These approximations of deployment of different measures are intended to provide an indicative scale only and it is recommended that further work be carried out to more accurately reflect the changes required.

Energy efficiency opportunities associated with non-domestic properties are considered on a qualitative basis only and it is recommended that further data collection and analysis be carried out to better identify areas for targeting measures within this sector.

5.3.1.1 Domestic Energy Efficiency

As previously discussed, energy efficiency improvements are considered in combination with decarbonising heat and energy supplies to domestic properties to reduce the carbon impact of this sector. Improving domestic energy efficiency is a vital step in reducing the energy requirements of properties and improving the efficacy of heating systems such as heat pumps.

In our pathways analysis, five key areas associated with dwelling energy efficiency are considered, these are:

1. Roof insulation
2. Wall insulation
3. Floor insulation
4. Window glazing
5. Additional draught-proofing

To quantify potential levels of deployment of each of the above energy efficiency measures within Suffolk, a combination of publicly available EPC data and data for all households provided by SCC has been used. As only 72% of dwellings accounted for in SCC household data have EPCs, the breakdown of existing energy efficiency measures from EPC data has been scaled up by the same proportion to apply to all households in the Suffolk region.

The three main carbon reduction scenarios considered for domestic dwellings in Suffolk are as follows. It should be noted that whilst each of these scenarios refers to a target of 2050, to meet a net zero target by 2030, the target year is assumed to be brought forward by 20 years.

Scenario A: CCC Further Ambition

More challenging and/or more expensive than Core options but which are likely to be required to meet a net zero target by 2050. The Core options highlighted by the CCC report are low-cost and low-regret options which are needed to meet the previous 80% reduction on 1990 levels by 2050. It is considered that the Government has already made commitments or begun to develop policies which cover these options although it is acknowledged that policy is likely to need strengthening in some of these areas.

Scenario C: SCATTER Level 4

By 2050, 60% of homes to be insulated, average thermal leakiness decreases by 75%.

Scenario B: Middle

This is an interpolated scenario determined as the midway point between the less ambitious CCC Further Ambition Scenario and SCATTER Level 4 Scenario.

Based on the baseline energy efficiency measures data identified from the publicly available EPC data and data provided by Suffolk Council, discussed in an earlier section, the following table shows the current measures associated with existing buildings in the region and the total deployment required by 2030 under each of the three scenarios. Please note that it is assumed that only 96%, 317,113, of total dwellings in Suffolk could be insulated as there will be a small proportion of buildings that will be considered very hard to treat from both an ease of implementation and cost/ benefit perspective.

	Additional draught proofing	Triple glazing	Loft Insulation	Floor Insulation	Cavity wall insulation	Solid wall insulation
Existing Dwellings	Unknown	157	35,129 (>270mm)	Unknown[48]	195,275	7,587
Scenario A CCC Further Ambition	Not specified	Not specified	194,000	Not specified	0	65,000
Scenario B Middle	161,000	169,000	238,000	85,000	20,500	71,500
Scenario C SCATTER Level 4	287,000	269,000	282,000	317,000	41,000	78,000

Assuming a linear trajectory of deployment over the next 10 years, the annual rate of uptake of each of the measures within existing buildings to meet these targets is presented below:

	Additional draught proofing	Triple glazing	Loft Insulation	Floor Insulation	Cavity wall insulation	Solid wall insulation
Scenario A	Not specified	Not specified	19,400	Not specified	0	6,500

[48] As noted previously, although there is some data on existing floor insulation levels it is not considered representative enough of the Suffolk region as only 9% of all EPCs for the region display the floor insulation level and 98% of these ratings are “good” or “very good”. It is not possible to infer from the data that those dwellings which are not rated for their floor insulation levels do not have floor insulation.

CCC Further Ambition						
Scenario B Middle	16,100	16,900	23,800	8,500	2,050	7,150
Scenario C SCATTER Level 4	28,700	26,900	28,200	28,900	4,100	7,800

Energy efficiency improvements can be limited by the build-type of the dwelling considered, age, listing status and cost/ benefits associated with the different measures. Some measures such as roof insulation are less intrusive with a much higher ease of implementation compared to wall or floor insulation therefore for illustrative purposes, the deployment of energy efficiency measures can be prioritised in terms of ease or implementation and/or payback as follows:

1. Roof insulation: should be a key target as relatively straightforward and cost-effective provided there is sufficient ease of access. Should aim to top up roof insulation for all dwellings that have 270mm or less.
2. Cavity wall insulation: typically these provide good paybacks for dwellings where this is an option.
3. Additional draught-proofing measures: these can be varied in complexity and cost.
4. Solid wall insulation, floor insulation and triple glazing: costs, benefits and ease of implementation can vary greatly depending on build type, historical/ architectural importance and specialist installer availability where this is required.

Lighting and Appliances

It should be noted that lighting, cooking and appliance energy efficiency also have a significant impact on the overall energy efficiency of a dwelling however as opportunities for improvement can vary widely, limited analysis has been conducted.

From SCATTER, it was identified that 53% (175,073) of cooking appliances in dwellings in Suffolk are gas fired. It is recommended that these cookers are replaced with electric appliances at end of life and/or during refurbishments. To achieve SCATTER Level 4 Ambition (Scenario C) with regards to home cooking, there would be no fossil-fuelled cooking appliances by 2030 as this demand is entirely electrified. Approximately 17,500 gas cookers would need to be replaced with electric models annually over the next 10 years.

SCATTER Level 4 Ambition (Scenario C) requires that energy demand for domestic lights and appliances decreases by 60% by 2050. If net zero carbon is to be achieved in the Suffolk region by 2030, this target would need to be brought forward by 20 years. This would be met through a concerted effort from residents to replace all lighting fittings and fixtures with high energy efficiency alternatives such as LED lighting and controls and purchase of high-efficiency appliances such as white goods at end of life.

Further, more detailed work would be required to fully quantify opportunities associated with improving energy efficiency for this category of energy consumers.

Behavioural Energy Efficiency

Beyond tangible, physical energy efficiency improvements, behaviour change in the way that domestic energy consumers use energy needs to be considered in fully decarbonising this sector.

The benefits and costs associated with improving behavioural energy efficiency are much more difficult to quantify than material improvements, however engaging owners and tenants of domestic properties to understand the impacts that they have on energy efficiency is essential in realising holistic energy efficiency improvement.

5.3.1.2 Non-Domestic Energy Efficiency

Similar to domestic building energy efficiency improvements, fabric energy efficiency measures should be considered and implemented in combination with low/ zero carbon heating systems to decarbonise this sector. However there is much greater variation in other energy consumers than present in dwellings depending on the purpose, use and occupancy of non-domestic buildings.

Based on the high-level, publicly available data, it has not been possible to quantify the deployment of energy efficiency measures that could be applied to non-domestic properties in the Suffolk region therefore the following recommendations are areas to be considered. Further work would be required to reflect the deployment of different measures required to achieve net zero carbon from this sector by 2030.

Key areas for energy efficiency improvements as identified from EPC recommendations for non-domestic buildings in Suffolk include:

Energy Efficiency Measure Category	Options
Lighting	Switching conventional lights to LEDs where possible and where not possible, replacing conventional with more efficient alternatives such as retrofitting T5 fluorescents in place of T8s. Installing motion sensors or timer controls where appropriate.
HVAC	Replacing existing heating systems, improving efficiency of existing AC systems and introducing/ improving controls of HVAC.
Insulation measures	Improve/ introduce solid wall, roof, floor and cavity roof insulation. Insulation of hot water storage tanks and heating and hot water distribution pipework.
Window glazing	Upgrades to double and ideally triple glazed windows.
Commercial chiller	Energy efficiency and control improvements, inspection for leaks and repairs. Potential change of refrigerant as appropriate where feasible.
Building (Energy) Management Systems (B(E)MS) and metering	Controls for HVAC, lighting and other energy consuming appliances. Considered most effective/ feasible for complex operations/ larger buildings/ multi-tenanted properties. Sub-metering of key energy consumers would provide enabling step rather than an opportunity to optimise building EE by better understanding use of energy.
Renewable energy	Building mounted solar PV/ wind turbines

As considered for domestic dwellings, improving behavioural energy efficiency is essential in decarbonising non-domestic buildings although depending on the building use, purpose, occupancy and nature of energy consuming assets, opportunities within this category are much more wide ranging than those associated with domestic energy efficiency.

5.3.2 Pathway to Carbon Neutrality: Heat Decarbonisation

This section has been split into three main sections considering the options for decarbonising off-grid and gas-grid connected dwellings separately with a single section considering options for non-domestic properties. This approach has been taken to account for the extent of the data available for the different building types. All numbers should be treated as indications of the scale of deployment only. A more detailed analysis through further work would be required to more accurately identify and quantify potential costs and benefits associated with the different heat decarbonisation pathways.

5.3.2.1 Off-Gas Grid Dwellings

The CCC report has identified buildings off the gas grid as low-regrets opportunity for the deployment of low-carbon heat, in particular heat pumps.

For the purposes of illustration, it is considered that all existing and future off-gas grid dwellings have low heat demand density and would not be suited to heat networks in the short-term future.

Heat Pumps

In the Suffolk region, a significant proportion of dwellings are off the gas grid (27%). As many of these dwellings (63%) are currently heated with oil, it is considered that the installation of heat pumps within these properties would provide net cost savings to the average consumer. These savings would be due to the current and forecast effective cost of heating with oil compared to electricity costs and very high efficiencies of commercially available heat pumps for the domestic and non-domestic market. It is assumed that a further 5% of off-grid dwellings identified as being heated through a wide range of different fuels including LPG, coal, wood, anthracite etc. are also heated through wet heating systems and would also benefit from conversion to heat pumps.

The remaining 32% of domestic off-gas grid dwellings that are currently heated with electric storage heaters/ electric heating would also likely realise net cost savings through conversion to heat pumps due to the high efficiency of heat pumps. It should be noted that in this instance, greater retrofitting is likely to be required to install wet heating systems to deliver heat generated by heat pumps in dwellings where these are not currently in place. Therefore this will impact potential cost savings over the lifetime of the system.

To enable Suffolk County Council to achieve net zero carbon by 2030 it is assumed that all off-grid domestic dwellings that are currently heated by boilers (oil and other fuel types) will have heat pumps installed by 2030 however it should be noted that there is likely to be cost benefits to converting the electrically heated properties so the levels of heat pump deployment could be higher than those displayed in the table below.

	Current	2030	Assumptions
Number of dwellings off-gas grid	88,680	102,576	27% of all future dwellings will be off-grid as per split of existing dwellings.

Heat pump deployment across the off-gas grid dwellings is assumed to progress at a relatively slow rate until 2025 with around 3,500 heat pumps installed in these dwellings with a greater deployment post-2025 of around 10,500 per year as more existing heating systems reach the end of their useful life and any required retrofits to existing heating systems have been carried out.

Year	Heat Pump Deployment	Total No. Heat Pumps	Heat pumps installed/ year
2020	0%	1	
2021	5%	3,504	3,503
2022	10%	7,007	3,503
2023	15%	10,511	3,504
2024	20%	14,015	3,504
2025	25%	17,519	3,504
2026	40%	28,030	10,511
2027	55%	38,541	10,511
2028	70%	49,052	10,511
2029	85%	59,564	10,512
2030	100%	70,075	10,511

Other Decarbonisation Options

One of the key constraints associated with heat pump retrofits for existing off-gas grid dwellings in Suffolk is likely to be due to the significant proportion of older properties. Although only 1% of off-gas grid dwellings are currently classed as Listed (Grade 1, Grade 2 and Locally Listed), there may be barriers associated with other older properties.

The breakdown of off-gas grid properties by age bands is as follows:

Age Banding	Total number existing off-gas grid buildings	% existing off- gas grid buildings
Post 1980	18,298	21%
1955 - 1979	26,729	30%
1946 - 1954	52,79	6%
1920 - 1945	8,311	9%
1871 - 1919	5,314	6%
Pre 1870	24,737	28%
Unknown	12	0%

While heat pumps are considered to be the main opportunity for decarbonising the heat demand associated with off-gas grid dwellings for , it should be noted that there is opportunity to consider alternative options although these will likely have less of an impact over the total number of dwellings in the county. Alternative options include:

- Biomass boiler installations.
- Biogas from anaerobic digestion of agricultural waste could be used to provide a heat source for dwellings where this resource is available.
- Roof or ground mounted solar thermal in combination with heat pumps or other non-grid gas low/ zero carbon heat generating technology could provide an option for domestic dwellings.

5.3.2.2 Gas Grid Connected Dwellings

The CCC report identified that for buildings connected to the gas grid, there is a higher cost barrier relative to gas heating therefore there is likely to be a requirement for additional levers or incentives for those currently using gas heating to switch to low carbon heating technologies.

73% of the dwellings in the Suffolk region are currently connected to the gas grid and are heated through conventional boiler systems.

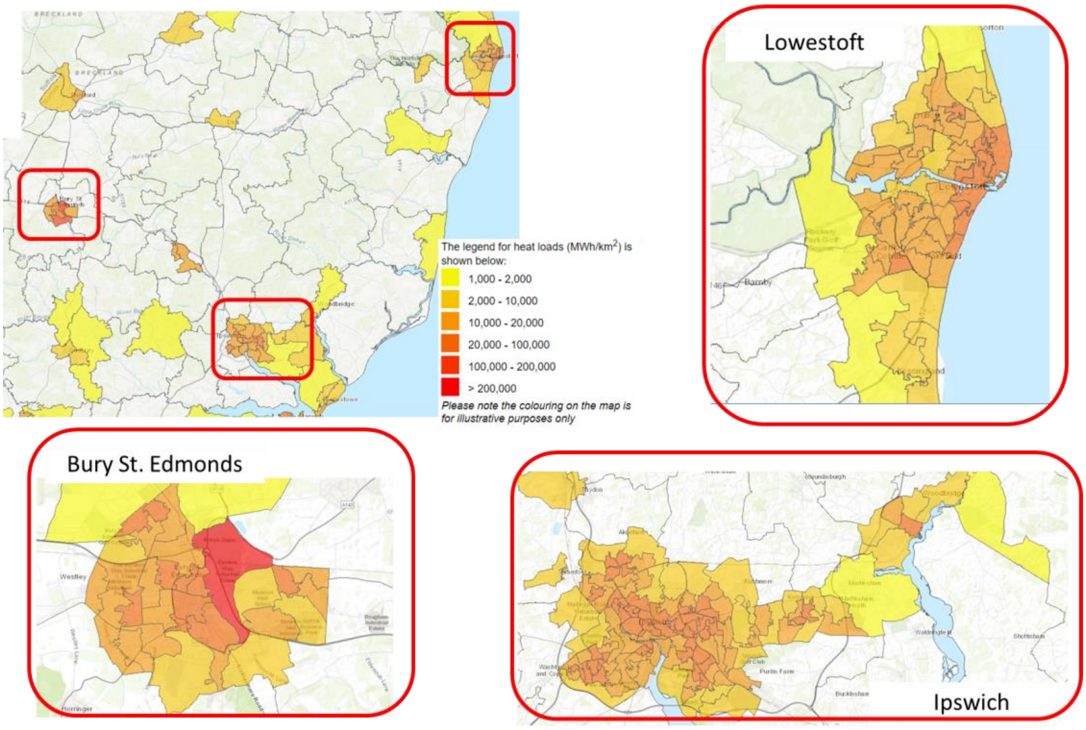
There are considered to be two main opportunities for reducing emissions associated with the heating of grid-connected dwellings as part of Suffolk's net zero by 2030 ambition: heat networks and electrification of heating through heat pumps.

Heat Networks

Heat networks are considered a key component of heat decarbonisation in the UK and an important means with which the UK can work towards achieving net zero carbon by 2050. Heat networks have the greatest potential and are most viable in areas with significant heat demand density and are therefore mostly considered in urban areas.

There is generally limited potential in Suffolk for widespread deployment of heat networks as there is relatively low heat demand density across the county. The main areas which may have scope for networks are in the built-up areas of Ipswich, Bury St. Edmonds and Lowestoft as indicated by the following screenshots of the UK CHP Development Map. There are also parcels of relatively high demand density in Stowmarket, Sudbury and Beccles.

Figure 37: Heat demand density at presented on UK CHP Development Map (https://chptools.decc.gov.uk/developmentmap)



According to the UK CHP development map there are currently no heat networks in operation in Suffolk although from research, it appears as though there have been studies carried out, funded by the Heat Network Delivery Unit (HNDU) administered by BEIS (formerly DECC).

Further investigation to fully assess the potential for heat networks in Suffolk from existing and future heat mapping and energy master planning exercises should be carried out to identify key areas for heat network development and consider strategic future developments. As part of this investigation, a heat supply technology options appraisal should consider appropriate technologies to deliver net zero heating for connected buildings.

Potential industrial sources of waste heat should also be considered within the scope of this work to decarbonise any future co-located heat networks over time, such as the feasibility of a heat connection from the British Sugar plant at Bury St. Edmonds and other significant industry and/ or waste processing facilities.

For existing dwellings with grid connections, a conservative estimate would be that 5% of existing dwellings in Suffolk with a gas grid connection could be connected to heat networks by 2030. As there are no currently operating schemes in the county, it is assumed that initial growth of heat network connections would be low up to 2025 with an increased steady take up from 2025 to 2030 as further investigation into feasibility and business case development translates into development and implementation of effective heat networks in areas of high heat demand.

Assumption		
Number of existing dwellings on-gas grid	241,646	5% of existing dwellings connected to gas grid will be connected to heat networks by 2030

Year	Growth of Heat Network Connections	Total No. Heat Network Connections	Heat network connections/ year
2020	15%	1,806	
2021	15%	1,806	-
2022	16%	1,959	153
2023	17%	2,111	152
2024	19%	2,264	153
2025	20%	2,416	152
2026	36%	4,350	1,934
2027	52%	6,283	1,933
2028	68%	8,216	1,933
2029	84%	10,149	1,933
2030	100%	12,082	1,933

Heat networks or community heating could be considered for new-build developments with sufficiently high heat demand density. They are particularly considered for mixed use developments of domestic and non-domestic buildings where there is likely to be significant “anchor” load(s) around which the network can be based.

High density new build areas have been determined from the Local Plan data where site area in hectares and dwelling numbers have both been provided. This accounts for just under half of all dwelling numbers indicated within the Local Plan, 3% of all dwellings assumed to be built by 2030. It should be noted that the dwelling densities indicated in the table below account for site area not residential development area.

Only developments with more than 100 dwellings have been included in the table below however depending on the relative locations of smaller developments and actual land allocation associated with domestic dwelling development, there may be scope either to consider smaller networks or community heating systems in isolation or in combination with other schemes over time as demand develops.

Dwelling densities available from Local Plan data have been ranked from the largest to smallest site areas and are shown in the following table. It is clear from this data that even if all these dwellings were to be served by heat networks, this would result in an additional 2.5% of the total domestic dwellings in Suffolk being connected to a heat network.

District	Address	Site Area	SITEREF	POLICY	ALLOCATION	DWELLINGS	Dwellings/ hectare
W. Suffolk	Land west of Mildenhall	97.69	SA4(a)	SA4&SA17	Mixed Use	1300	13
Ipswich	Ipswich Garden Suburb Phase N3	59.14		CS10	Strategic Allocation	912	15
Ipswich	Ipswich Garden Suburb Phase N2	50.01		CS10	Strategic Allocation	1100	22
Ipswich	Ipswich Garden Suburb Phase N1a	43.29		CS10	Strategic Allocation	800	18
W. Suffolk	North Red Lodge	27.4	SA10(a)	SA10&SA1	Mixed Use	300	11
Ipswich	Land at Humber Doucy Lane - Urban Edge of Ipswich	23.62	ISPA4.1	ISPA4	Allocation: future housing growth & infrastructure improvement	496	21
W. Suffolk	Land at north Lakenheath	22.33	SA8(b)	SA8	Mixed Use	375	17
W. Suffolk	Land east of Red Lodge: South	14.97	SA9(c)	SA9	Residential	382	26
W. Suffolk	Land South of Burwell Road	14.94	SA12(a)	SA12	Residential	205	14
Ipswich	Ipswich Garden Suburb Phase N1b	12.46		CS10	Strategic Allocation	456	37
Ipswich	St Clement's Hospital Grounds	11.85	IP116	SP3	Land with Planning Permission	196	17
W. Suffolk	Land off Turnpike Road and Coopers Yard	9.01	SA9(a)	SA9	Residential	132	15
W. Suffolk	North West Row	7.81	SA14(a)	SA14	Residential	152	19
Ipswich	Island Site	6.02	IP037	SP2	Land allocated for Residential Use	421	70
W. Suffolk	Land east of Red Lodge	5.5	SA9(b)	SA9	Residential	140	25
W. Suffolk	Land west of Eriswell Road	5.25	SA7(b)	SA7	Residential	140	27
W. Suffolk	Leaders Way/Sefton Way/Philips Close	4.26	SA6(c)	SA6	Residential	117	27
W. Suffolk	Land adjacent to the south of the caravan park, As	4.15	SA11(b)	SA11	Residential	117	28
W. Suffolk	Red Lodge Approach, Red Lodge	4.13	SA9(d)	SA9	Residential	125	30
Ipswich	Land south of Ravenswood (east)	3.60	IP150e	SP2	Land allocated for Residential Use	126	35

Ipswich	Arclion House and Elton Park, Hadleigh Road	2.97	IP059	SP3	Land with Planning Permission	103	35
Ipswich	Land at Commercial Road	2.86	IP047	SP2	Land allocated for Residential Use	103	36
Ipswich	Land bounded by Cliff/Toller/Holywells Road	2.06	IP045	SP2	Land allocated for Residential Use	148	72
Ipswich	Helena Road	1.87	IP226	SP2	Land allocated for Residential Use	337	180
Ipswich	Land between Cliff Quay and Landseer Road	1.78	IP042	SP3	Land with Planning Permission	222	125
Ipswich	Former British Telecom offices, Bibb Way	1.67	IP279	SP2	Land allocated for Residential Use	104	62
Ipswich	Bath Street (Griffin Wharf)	1.60	IP200	SP3	Land with Planning Permission	113	71
Ipswich	Waste centre & emp area north Sir Alf Ramsey Way	1.46	IP003	SP2	Land allocated for Residential Use	114	78
Ipswich	Regatta Quay	0.85	IP211	SP3	Land with Planning Permission	157	185
Ipswich	Cranfields	0.71	IP206	SP3	Land with Planning Permission	135	190
Ipswich	Burton's College Street	0.10	IP205	SP3	Land with Planning Permission	125	1250
Total						**9,653**	

For new dwellings with grid connections, a conservative order of magnitude suggestion is that 25% of new dwellings with a gas grid connection be connected to heat networks by 2030. As there are no currently operating schemes in the county, it is assumed that initial growth of heat network connections would be low up to 2025 with an increased steady take up from 2025 to 2030 as further investigation into feasibility and business case development translates into development and implementation of effective heat networks in new build areas.

		Assumption
Number of new dwellings on-gas grid	37,864	73% of new dwellings will have gas connection as per existing dwelling split 25% of existing dwellings connected to gas grid will be connected to heat networks by 2030

Year	Growth of Heat Network Connections	Total No. Heat Network Connections	Heat network connections/ year
2020	0%	0	
2021	0%	-	-
2022	5%	473	473
2023	10%	947	474
2024	15%	1,420	473
2025	20%	1,893	473
2026	36%	3,408	1,515
2027	52%	4,922	1,514
2028	68%	6,437	1,515
2029	84%	7,952	1,515
2030	100%	9,466	1,514

Heat Pumps

Full and hybrid heat pumps have been identified as a key enabler in reducing emissions from the buildings sector. The CCC report “UK Housing: Fit for the Future” indicated that 10 million hybrid heat pumps would be required to be deployed in the UK by 2035 to reach net zero by 2050, with a total of 19 million installed by 2050.

Due to the relatively low potential for heat network uptake in Suffolk due to the low heat demand density in the county and the building stock profile favouring detached and semi-detached properties over flats and other high density housing types, it is considered that heat pumps will have a much greater role to play compared to the UK national average.

Heat pumps would need to be rolled out to gas-connected dwellings in the region relatively quickly with new build dwellings likely to provide the simplest opportunity as retrofits would not be required to heating systems and thermal efficiency of this building stock would be at a relatively high level. Heat pumps in existing dwellings would likely deploy more slowly as existing gas boiler systems reach the end of their lifespan.

Based on the number of new builds assumed to be connected to the gas grid from now to 2030, it is assumed that 75% of these would be heated through full heat pump systems. The deployment is assumed to be slower from 2020 to 2025 with an increase from 2025 to 2030 as more dwellings are constructed.

It is assumed that 95% of existing grid-connected dwellings will have heat pumps installed by 2030. The rate of deployment of heat pumps in these dwellings is anticipated to be slower than would be feasible in new builds and it is considered that there will be more hybrid systems in these dwellings to reduce the retrofit requirements associated with full heat pumps in the short term, ensure peak heat demand is met and to offer a hydrogen-ready heating solution for the long term where hydrogen is a feasible prospect for decarbonisation of heating used in homes.

	Current	2030	Assumptions
Number of dwellings on-gas grid	241,646	279,510	73% of all future dwellings will be on-gas grid as per split of existing dwellings.

Year	Heat Pump Deployment (New Build)	Heat Pump Deployment (Existing)	Total No. Heat Pumps	Heat pumps installed/ year
2020	0%	0%	6	
2021	6%	3%	8,591	8,585
2022	12%	6%	17,182	8,591
2023	18%	9%	25,773	8,591
2024	24%	12%	34,364	8,591
2025	30%	15%	42,954	8,590
2026	44%	32%	85,955	43,001
2027	58%	49%	128,957	43,002
2028	72%	66%	171,959	43,002
2029	86%	83%	214,961	43,002
2030	100%	100%	257,962	43,001

Other Decarbonisation Pathways

For gas-connected dwellings, where heat pumps are not an option such as in buildings that cannot be retrofitted due to space or heritage constraints, residual gas demand conversion is likely to provide the only viable alternative decarbonisation pathway.

One of the key constraints associated with heat pump retrofits for existing dwellings with gas connections in Suffolk is likely to be due to the significant proportion of older properties Although only 1% of gas grid connected dwellings are currently classed as Listed (Grade 1, Grade 2 and Locally Listed), there may be barriers associated with other older properties.

The breakdown of off-gas grid properties by age bands is as follows:

Age Banding	Total number existing off-gas grid buildings	% existing off- gas grid buildings
Post 1980	57,015	31%
1955 - 1979	83,494	45%
1946 - 1954	19,806	11%
1920 - 1945	37,255	20%
1871 - 1919	29,263	16%
Pre 1870	14,758	8%
Unknown	55	0%

There are two main avenues for residual gas demand conversion: natural gas grid decarbonisation through injection of biomethane and/or hydrogen blending, and the development of a hydrogen network. It is not considered likely that gas grid decarbonisation or hydrogen deployment would be sufficiently developed by 2030 to have a significant impact in reducing the emissions associated with building energy stock in Suffolk however the following is provided for commentary.

Biomethane grid injection from lowest cost feedstocks such as municipal solid waste, landfill gas and waste sources has potential to offset a portion of the emissions associated with the existing natural gas grid although there is still significant uncertainty as to the availability of low cost biomethane resource and most appropriate use as municipal solid waste (MSW) can also be used as a feedstock for energy from waste (EFW) plants as well as for biomethane/ biohydrogen plants.

As previously discussed, it is not considered that hydrogen will be likely to provide a short-term pathway to carbon neutrality, particularly for Suffolk, as it is not anticipated that there will be an active, widespread hydrogen-grid by 2030 across the UK. While there is increasing interest and strategy developed at a national level around the importance of hydrogen in meeting the Net Zero target, the most likely rollout of hydrogen networks would initially target high density demand centres where there is the infrastructure required to support the generation and distribution of hydrogen.

5.3.2.3 Non-Domestic Buildings

As discussed in the previous section, there is currently limited information on the non-domestic buildings in the Suffolk area and only 10,000 non-domestic properties have been identified from the publicly available EPC data for the region.

It is considered that heat pumps and heat networks will provide the main heating options for non-domestic properties by 2030 however due to lack of data, an indicative order of magnitude deployment rate has only been provided for these heat supply options. As noted previously, the EPC data will not cover the entire non-domestic building stock for the county and the spatial distribution of these buildings is not explored at this level.

As discussed in the section on domestic dwellings, it is considered that there is likely less scope for heat network deployment in Suffolk compared to the UK national average due to the relatively low heat demand density in this area. Therefore it is considered that heat pumps will provide the majority of new heating systems as existing technologies reach end of life. This is opposed to recommendations in the CCC net zero technical report which indicate a 50/50 split between heat pump and heat network deployment for the non-domestic buildings sector.

It is assumed from the data available that 12% of industrial and 8% of commercial properties are off the gas grid as these are currently fuelled by LPG or oil. It is assumed that all of these off-grid non-domestic properties would have heat pumps installed by 2030.

Heat pump deployment across the off-gas grid non-domestic properties is assumed to progress at a relatively slow rate until 2025 with just under 50 heat pumps installed in these buildings with a greater deployment post-2025 of under 150 per year as more existing heating systems reach the end of their useful life and any required retrofits to existing heating systems have been carried out.

Year	Heat Pump Deployment	Total No. Heat Pumps	Heat pumps installed/ year
2020	0%	0	
2021	5%	45	45
2022	10%	91	46
2023	15%	136	45
2024	20%	181	45
2025	25%	227	46
2026	40%	363	136
2027	55%	499	136
2028	70%	635	136
2029	85%	771	136
2030	100%	907	136

To provide an order of magnitude indication of potential heating options for 2030, it is assumed that of the current <u>electrically heated</u> non-domestic properties 75% would be heated by heat pumps by 2030, assuming that some of these are off the gas grid and in low heat demand areas and would not be suitable for heat networks. It is assumed that 25% of these properties are in high heat demand, urban areas and would be suitable for a heat network connection by 2030.

Year	Heat Pump Deployment	Total No. Heat Pumps	Heat pumps installed/ year	Growth of Heat Network Connections	Total No. Heat Network Connections	Heat Network Connections Installed/ year
2020	0%	0		0%	0	
2021	5%	45	45	0%	-	-
2022	10%	91	46	5%	69	69
2023	15%	136	45	10%	138	69
2024	20%	181	45	15%	207	69
2025	25%	227	46	20%	276	69
2026	40%	363	136	36%	496	220
2027	55%	499	136	52%	717	221
2028	70%	635	136	68%	937	220

2029	85%	771	136	84%	1,158	221
2030	100%	907	136	100%	1,378	220

It is assumed that of the current natural gas heated non-domestic properties 50% would be heated by heat pumps by 2030, assuming some of these are in low heat demand areas and would not be suitable for heat networks. It is assumed that 50% of these properties are in high heat demand, urban areas and would be suitable for a heat network connection by 2030. It should be noted that these assumptions have been used for the purposes of illustrating the potential scale up required for heat network connections and heat pumps across non-domestic buildings across the Suffolk region. Actual required deployment would need to be assessed through future detailed studies focussed on the requirements associated with decarbonising non-domestic buildings and likely cost-benefit associated with the different building types, purpose and existing heating systems.

Year	Heat Pump Deployment	Total No. Heat Pumps	Heat pumps installed/ year	Growth of Heat Network Connections	Total No. Heat Network Connections	Heat Network Connections Installed/ year
2020	0%	0		0%	0	
2021	6%	110	110	0%	-	-
2022	12%	219	109	5%	91	91
2023	18%	329	110	10%	183	92
2024	24%	439	110	15%	274	91
2025	30%	548	109	20%	366	92
2026	44%	804	256	36%	658	292
2027	58%	1,060	256	52%	950	292
2028	72%	1,316	256	68%	1,243	293
2029	86%	1,572	256	84%	1,535	292
2030	100%	1,828	256	100%	1,828	293

Based on the information available on the future development of non-domestic buildings, it has not been possible to forecast the growth through to 2030 therefore it is assumed that the total number of non-domestic buildings does not change over time.

5.3.3 Policy options

Below is a selection of policy options for delivering the pathways set out in the sections above.

5.3.3.1 Energy efficiency

- Financing and investment to meet upfront costs, e.g. pay-as-you-save, Energiesprong etc.
- Information campaigns and awareness raising.
- Engagement with priority targets, e.g. housing associations.
- Pushing as strongly as possible on Council-owned properties.

5.3.3.2 Heat decarbonisation

- A combination of:
  - Sticks (e.g. rates increases for properties using fossil fuel, increase cost of fuel oil, ban oil/LPG boiler installation, presumption against planning for properties not using zero carbon heat etc)
  - Carrots (grants, incentives post RHI)
  - Awareness raising (example projects, engagement events, possibly a show home). This can often be a good place to start.
  - UK government intervention (e.g. ban oil/LPG boiler sales, incentivise energy efficiency improvements, provide grants for heat pump installation etc). Therefore dialogue with UK Government is really key. The electrification of heat demonstrator programme is due to kick-off in 2020.
- Council-owned properties are also a good place to start – for example procurement policy could be adapted to favour low carbon forms of heating.

6 Power

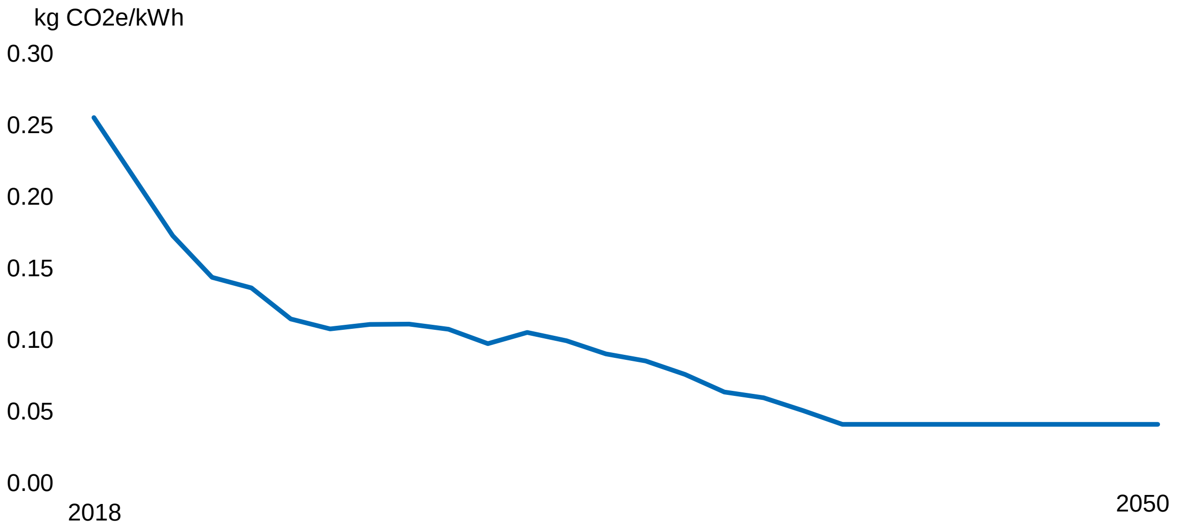
Key messages:

- The power supply needs to fully decarbonise by 2030.
- While energy efficiency has been reducing demand, the electrification of heat and transport will add to it in future. For example, one scenario that has been modelled suggests that electrification of the vehicle fleet alone could lead to a 30% increase in electricity demand.
- Grid electricity will be mostly powered by low and zero carbon technology by 2030 under current government projections but will not be fully zero carbon.
- Achieving a zero carbon power supply will require:
  - More renewable energy generation
  - The closure of fossil-fuelled power plants
  - A more flexible energy system that actively manages the grid & electricity demand with expanded energy storage capacity.
- Suffolk can encourage local generation of renewable electricity, particularly from wind and solar. There are nationally significant opportunities for offshore wind along the Suffolk coast.
- It can also look to use electricity procurement to bring forward new local renewable energy capacity.
- Suffolk must work with UK Power Networks, the distribution network operator (DNO), and the government to deliver a smart grid that is more flexibility and enables higher levels of renewable energy generation to be connected.
- There are things that can be done on the generation side – e.g. planning support for new renewables. And Suffolk could choose to do more on distributed renewables, e.g. rooftop solar. A downside of this is that it can be less cost effective than large scale grid-connected renewables. But it has the benefit that the more it does on distributed renewables, the less Suffolk is reliant on grid decarbonisation, so it lowers the risks of not meeting carbon neutrality by 2030. So a key question is how much Suffolk wants to do on distributed renewables.
- At the same time, need to focus efforts on the demand-side – energy efficiency in buildings and transport and decarbonisation of heat. See Sections **Error! Reference source not found.** and 0 for more details.

6.1 The current picture

The electricity supply in the UK has been decarbonising rapidly over the past 10 years and this trend is expected to continue. As a result, the emissions associated with electricity consumption are modelled by the government to fall from 277 to 41gCO_2e/kWh by mid-century, an 80% reduction. In 2030, the carbon intensity of grid is expected to be 100gCO_2e/kWh

Figure 38: Government grid electricity decarbonisation forecasts



There are no large fossil fuel power stations operating in Suffolk. Planning consent has been granted for a 300MW gas-fired power station at Eye Airfield in Suffolk, a Nationally Significant Infrastructure Project. Its operation would be inconsistent with net zero without carbon capture and storage technology fitted.

There is estimated to be around 1.29 GW of generating capacity in Suffolk, with sites shown in Figure 39 and the current split of generating type shown in Figure 40.

Figure 39: Renewable energy sites in Suffolk

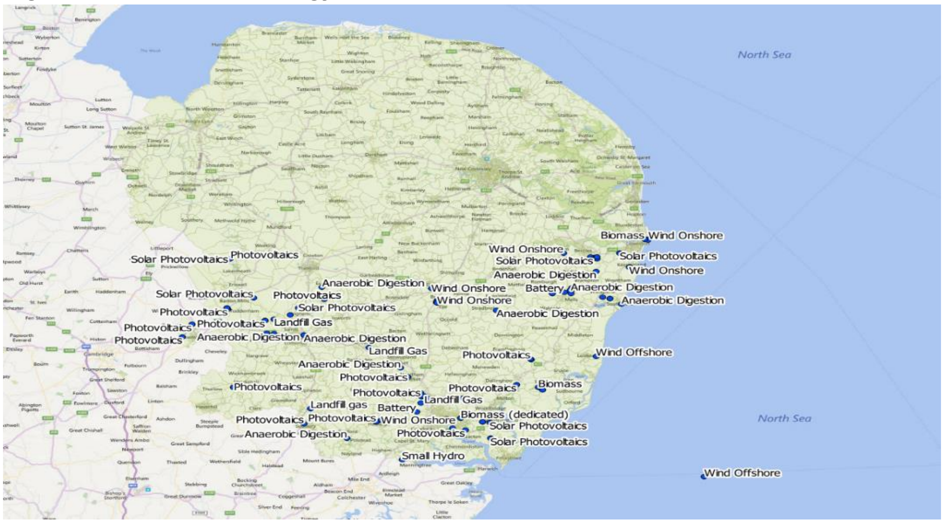
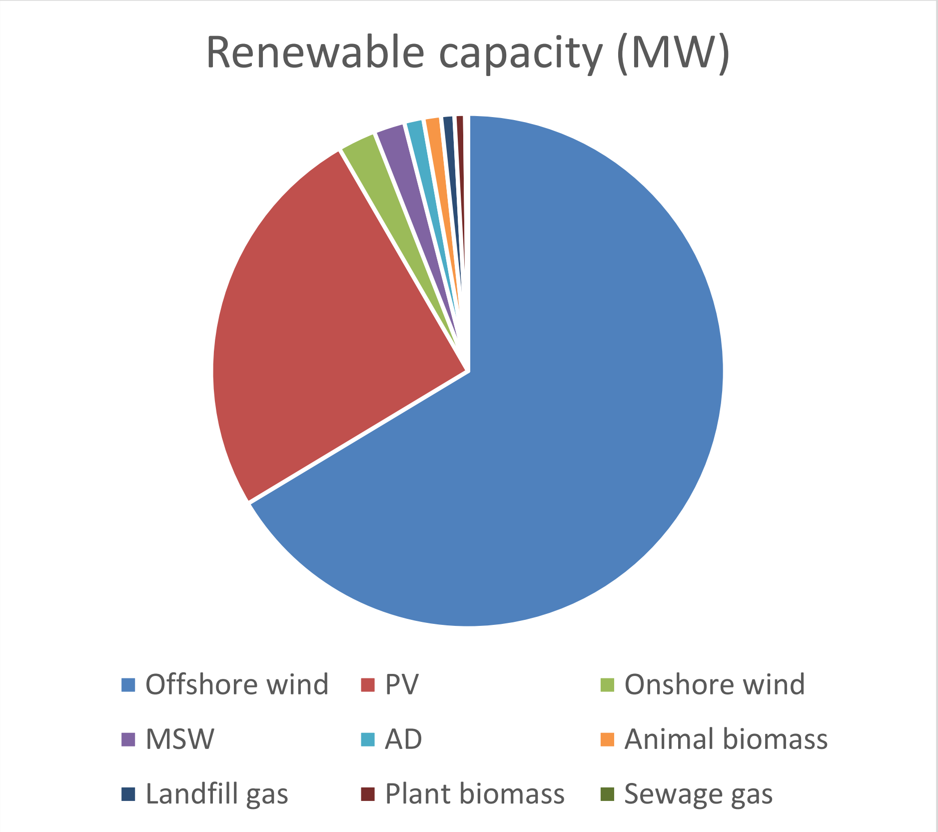


Figure 40: type of renewable energy generation in Suffolk



6.2 The pathway to carbon neutrality

While there is a continuing shift towards low and zero carbon electricity generation and uptake of flexible grid technology, these trends will need to be accelerated in order to meet the carbon neutrality 2030 target.

6.2.1 Electricity supply

A fully decarbonised electricity supply can be achieved by increasing the share of renewables, nuclear power and carbon capture and storage from around 50% today to around 95%, while meeting the additional demand for electricity from electric vehicles and heat pumps. All unabated fossil fuel power stations must close.

Renewable generation could need to be four times today's levels according to the Committee on Climate Change. A step change in the rate of deployment will be required by 2030.

An electricity system which is heavily reliant on variable renewable energy also needs dispatchable power to match supply and demand. Today, this is provided by fossil-fuel power stations. A zero carbon alternative could be hydrogen or gas with carbon capture and storage. However, this is unlikely to be available at scale in Suffolk by 2030.

6.2.2 Smart grids

Many parts of the power network are constrained and are unable to support additional renewable generation, without grid reinforcement. The cost of this often makes new renewable schemes uneconomic to take forward. Smart grid technology is therefore a fundamental pre-requisite for a net zero electricity supply.

UK Power Networks is the regional Distribution Network Operator (DNO) in Suffolk. The distribution grid has traditionally been a passive system. This has resulted in a crude approach to allocating new grid capacity connections and managing grid constraints.

Smart grid technology offers the DNOs the potential to actively manage power flows and voltage levels on the grid. The integration of communications infrastructure into the power system gives the ability to respond in real time. This can deliver improved network efficiency, a reduced need for new capital investment and, crucially for Suffolk, enables more distributed generation to be connected to the network at lower cost. DNOs are beginning a transformation to become Distribution System Operators (DSO), with expanded powers to make use of smart technology.

6.2.3 Demand response

Demand-side response means balancing the network by adjusting power demand to meet available supply, rather than the other way around. In demand-side response, electricity consumers are paid to reduce their consumption at peak times. Varying demand in this way is enabled by smart grid technology and it provides clean and relatively cheap flexibility to the system. Demand side response can empower electricity consumers to actively engage in decarbonising the power system.

6.2.4 Energy storage

Energy storage has a vital role to play in transforming the power supply. Storage, working in tandem with smart grid technology and demand response can make the grid more dynamic and resilient; both vital to deep decarbonisation. Energy storage permits higher levels of intermittent generation in the energy mix and allow more renewable capacity to connect to constrained distribution infrastructure.

6.3 Policy options

6.3.1 Electricity generation

Increase electricity generation from renewables, including solar, onshore wind and the nationally significant opportunities for offshore wind along the Suffolk coast. Measures the Council can take include:

- Creating a positive planning framework for renewables, with areas identified for possible development.
- Exploiting all opportunities for renewables on council owned land and property.
- Working with the government and energy suppliers to create stronger incentives for new zero carbon electricity generation.

The proposed gas-fired power station at Eye was given planning consent by the Planning Inspectorate, as a Nationally Significant Infrastructure Project. It has not been built yet and Suffolk and its strategic partners should not provide political support, funding or any enabling works (such as transport improvements, approval of related planning applications etc) which would allow construction to go ahead without carbon and capture storage technology.

6.3.2 Electricity purchasing

Not all ‘green’ or ‘100% renewable energy’ tariffs are created equal. The majority of these products are based on the purchase of Renewable Energy Guarantees of Origin (REGO) certificates. REGOs do little to encourage new renewable generation. The Council must avoid these ‘greenwashed’ tariffs and should use its energy procurement policy to actively bring forward new local renewable generation.

REGO certificates represent the carbon savings from renewable generation, not the electricity itself which is sold separately. These ‘green’ tariffs mean you are purchasing fossil-fuels and the equivalent number of certificates. The suppliers have no need to build or own renewables, or to buy power from renewable generators. They offer little additionality and will not help achieve the net zero target.

The Council should make use of peer to peer energy platforms which allow electricity to be bought from specific local installations. Commitments to purchasing energy through long term power purchase agreements with prospective new developments can stimulate the market and increase local capacity. The Council should encourage its strategic partners, local businesses and supply chain to adopt the same approach.

6.3.3 Networks and smart grid

Suffolk must work with UK Power Networks, the distribution network operator (DNO) and the government to deliver a smart grid that has more flexibility and enables higher levels of renewable energy generation to be connected.

7 Waste

Key messages for waste:

- Emissions from waste have already fallen drastically (70% at the national level between 1990 and 2017), and waste currently is a relatively small share of overall UK GHG emissions (4% in 2017).
- Waste emissions in Suffolk could be further reduced by 2030 in the following ways:
    - Ongoing funding of targeted behaviour change campaigns. Widespread small changes in behaviour can make significant differences to reducing carbon emissions.
    - Promote and support third sector and community reuse and repair activities.
    - Target reduction of carbon intensive materials such as textiles, aluminium, steel and plastics.
    - A continued focus on a reduction in food waste to achieve the Suffolk Waste Partnership's target of 20% reduction in food waste by 2025.
    - Increase the recycling rate from 47% household waste recycling rate to achieve at least a 65% municipal recycling rate by 2035 as a minimum.
    - Use enforcement, residual waste restrictions, financial incentives and potentially service design changes (informed by carbon metrics) to increase recycling and reduce residual waste generation.
    - Support businesses to introduce separate glass, metal, plastic, paper and card, and food recycling (expected to be legislated through the anticipated Environment Bill).
    - Use of anaerobic digestion for food waste treatment to help generate more biogas.
    - Front end removal of fossil fuel derived content (e.g. additional plastics and textiles) from residual waste feedstock to reduce emissions from waste sent to Energy from Waste.
    - Reducing biodegradable waste being sent to landfills located within Suffolk.
- Whilst it is important for the sector to achieve further emissions reductions as set out above, as part of overall efforts towards Suffolk's net zero target, achieving net zero emissions in the sector is challenging due to the difficulty of further reducing methane emissions from the landfills located within the County, and tackling emissions from waste water treatment.

7.1 The current picture

The Suffolk Waste Partnership produced 330,234 tonnes of municipal waste in 2018/2019 of which 47% was recycled.

The recycling rate has decreased over the period from 2015/2016 to 2018/2019. Decreases have been seen in the dry recycling rate (17% in 2015/2016 to 16% in 2018/2019) but more notably in the composting rate (25% in 2015/2016 to 20% in 2018/2019).

A number of Suffolk authorities have introduced chargeable garden waste which is very likely to have contributed to the decline in composting rate during this period – West Suffolk Council (formerly Forest Heath and St Edmundsbury) and Waveney District Council (half of the new East Suffolk Council) in April 2016, and Suffolk Coastal District Council (the other half of the new East Suffolk Council) in April 2018.

The waste generated per capita over the period 2015/2016 and 2018/2019 has not varied significantly remaining between 0.42 and 0.44 tonnes per capita per year.

Kerbside collection of waste is consistent across the Suffolk Waste Partnership. Residual, dry recycling and garden waste are all collected fortnightly in wheeled bins. All authorities, except for the former Suffolk Coastal area, collect garden waste separately. Recycling is collected commingled and includes the following material streams - empty aerosols, books, steel and aluminium cans, aluminium foil, paper, cardboard, plastic bottles, and plastic pots, tubs & trays. Glass is not collected at the kerbside but a bring bank service is provided across the county. The county has a network of 11 household waste recycling centres (HWRCs) that also collect municipal waste delivered by residents.

Residual waste from the kerbside collection and HWRC services is sent to an energy from waste (EfW) plant at Great Blakenham (or Masons landfill at Great Blakenham during EfW outages), dry recycling is sent to Masons materials recovery facility (MRF) at a separate site in Great Blakenham and garden waste is sent to three windrow composting sites and one in-vessel composting site across the county. Waste collected by West Suffolk Council and East Suffolk Council use a network of four transfer stations across the County. Other Suffolk authorities deliver directly to their respective tipping points (EfW, MRF and Composting). All materials delivered to the MRF are sorted into their individual material streams before onward sale and transport to reprocessors, both domestic and international.

Commercial and industrial (C&I) waste is also collected within the County. In 2018, approximately 587,000 tonnes[49] of C&I waste was produced in Suffolk. A quantity of this C&I waste, originating within Suffolk, will be taken outside of the county for onward processing, treatment and disposal; equally waste will be brought into the county for onward processing, treatment and disposal that originates from outside of Suffolk.

The Suffolk Waste Partnership currently only sends very small quantities of household waste to landfill (i.e. during EfW outages) but within the county of Suffolk 205,000 tonnes[50] of waste was sent to Masons non-hazardous landfill in 2018 (please note the vast majority of this waste is not from municipal sources). Within the county, there are approximately 128 closed landfill sites (closed since 1980 or later) and six landfills that accepted waste in 2018 (of these only Masons landfill accepted municipal or C&I waste) that have been identified from Environment Agency data. Of these landfills, those that have accepted biodegradable waste will be producing varying quantities of GHG emissions and will continue to do so for a period of time after waste placement[51].

The Government's Resource and Waste Strategy was published in December 2018. A number of consultations have been issued and the anticipated Environment Bill[52] is expected to legislate aspect of the Strategy.

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[49] Source: https://data.gov.uk/dataset/312ace0a-ff0a-4f6f-a7ea-f757164cc488/waste-data-interrogator-2018. Excludes construction and demolition waste and hazardous waste.

[50] Source: https://data.gov.uk/dataset/312ace0a-ff0a-4f6f-a7ea-f757164cc488/waste-data-interrogator-2018

[51] The time over which GHG emissions are still being emitted (and the amount being emitted) after waste placement varies according to landfill conditions. Modern inert landfills are expected to be producing very little or no GHG emissions.

[52] As of the end of April 2020, The draft Environment Bill passed up its second reading in the House of Commons on 26th February 2020, and subsequently moved to the committee stage for further scrutiny). The public bill committee subsequently issued a call for evidence in early March, and announced that its scrutiny of the Bill would be complete by 5th May 2020, with a report to parliament following shortly afterwards. The public

Further consultation is expected later in 2020 on Extended producer responsibility (EPR) , a plastics tax and consistent collections. The draft Environment Bill provides powers to introduce a DRS scheme (Part 3, Clause 51 and Schedule 9). It also stipulates a consistent set of materials[53] that must be collected from all households and businesses, including food waste (Part 3, Clause 54).

As such, the impact of the strategy is not yet wholly clear but some of the key aspects of the Strategy that are likely to impact on Suffolk Council's municipal waste services are:

- Introduction of a requirement to collect a consistent set of recyclables at the kerbside which would require the introduction of a kerbside glass bottle and jar collection by 2023;
- Separate weekly food waste collections to be implemented by 2023;
- Introduction of a deposit return scheme (reverse vending) for beverage containers (glass, plastic and metal containers up to 3 litres in size) which is likely to result in material moving away from kerbside collection schemes;
- EPR (i.e. producers being responsible for the costs of collection and processing of all materials they place on the market) resulting in potential changes to the way waste services are financed and potentially the tonnage and composition of waste collected; and
- 55% recycling rate by 2025, rising to 65% by 2035 from the 2018/2019 level of 47%.

The cost of these changes is anticipated by the Council to be substantial and the cost burden is likely to be greater on the waste collection authorities. In the Strategy the Government states it *"will, ensure that local authorities are resourced to meet new net costs arising from the policies in this Strategy, including up front-transition costs and ongoing operational costs."*

The Strategy and its objectives are supported by Suffolk Waste Partnership but the lack of clarity and detail in relation to the strategy ambitions bulleted above and the financial support available has led to a position where, like many other local authorities, the Suffolk Waste Partnership are waiting on further clarity from Government before making substantial changes to their waste management arrangements which are likely to incur a significant cost burden.

The most immediate changes potentially required to Suffolk Waste Partnership's waste collection services, arising from the strategy's ambitions, are the introduction of glass bottle and jar collections at the kerbside (in addition to or instead of bring banks) and the introduction of separate food waste collections.

Whilst clarity on how the significant additional cost of these changes will be met is awaited, the Partnership has introduced the food savvy campaign which seeks to reduce household food waste by 20% by 2025 in line with WRAP's national Courtauld 2025 ambitions; and continues to collect glass bottles and jars at bring banks (this achieved a 69% recycling rate in 2016) and enables the glass to be kept separate yielding high quality glass which can be sent for closed loop recycling in Suffolk.

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bill committee subsequently issued a call for evidence in early March, and announced that its scrutiny of the Bill would be complete by 5th May 2020, with a report to parliament following shortly afterwards.
Whilst the committee has stated that it is still able to accept written evidence on the Environment Bill, the timetable for the resumption of scrutiny is currently unclear, with the committee stating "a further announcement on the Environment Bill Committee will be made once a new timetable has been set."

[53] Glass, metal, plastic, paper and card, food and garden waste household waste (excludes garden waste from relevant non-domestic premises and industrial and commercial waste).

7.2 The pathway to carbon neutrality

As stated previously, emissions from waste have already fallen drastically (70% at the national level between 1990 and 2017), and waste currently is a relatively small share of overall UK GHG emissions (4% in 2017).

The waste section within this report has been limited to a high level review. As such, it does not incorporate any baseline modelling of carbon emissions from waste services or scenario analysis to understand how different systems could decarbonise this sector within the county of Suffolk. This high level review also only considers the management of household and C&I waste within the county. It does not consider, for example, the transition to an ultra-low emission or EV waste collection and haulage fleet.

Based on the limited data reviewed (compositional analysis and tonnage data for household waste and tonnage data for C&I waste), the following opportunities have been identified as ways in which Suffolk could seek to reduce waste emissions by 2030:

- Achieve social /behaviour changes that promote the reduction, reuse or recycling of materials. Widespread small changes in behaviour can make significant differences to reducing carbon emissions.
- Reducing waste produced and in particular more carbon intensive materials such as textiles, aluminium, steel and plastics, and reducing single use plastics (and not replacing these with other potentially more carbon intensive alternatives).
- A continued focus on reducing food waste to achieve the Partnership's target of 20% reduction in food waste by 2025. This matches the Committee on Climate Change's (CCC) 'Further Ambition' measure with respect to food waste as set out in Chapter 8 of the Net Zero Technical Report, May 2019.
- Increase the recycling rate from 47% household waste recycling rate to achieve at least a 65% municipal recycling rate by 2035 as a minimum as set out in the Resource and Waste Strategy and the EU Circular Economy Package, and preferably achieve the more ambitious 70% municipal recycling rate by 2030 at the latest, as set out in Chapter 8 of the CCC's Net Zero Technical Report.
- Front end removal of fossil fuel derived content (e.g. additional plastics and textiles) from residual waste feedstock to reduce emissions from waste sent to Energy from Waste.
- Reducing GHG emissions from waste by reducing emissions from (a) biodegradable waste in landfill, (b) wastewater treatment plants, (c) the biological treatment of waste (e.g. composting or anaerobic digestion) and (d) incineration of waste.

This can be achieved in Suffolk by:

- Undertaking ongoing communication and engagement to engender social /behaviour changes that promotes the reduction, reuse or recycling of materials to prevent emissions or substantially reduce them.
- Campaigns targeting residents and businesses that are not reusing and recycling materials currently collected for reuse and recycling, and those with higher material consumption, and therefore waste production, levels.
- Celebrate success and foster a culture where not reusing or recycling is socially unacceptable.
- Encouraging and supporting third sector and community reuse and repair initiatives.
- Providing kerbside glass, textiles and weekly food waste collections which make up nearly 48% (by weight) of the residual waste stream in Suffolk.

- Exploring options of closer working and supporting businesses to help increase recycling and the introduction of glass, metal, plastic, paper and card and food recycling (expected to be legislated through the anticipated Environment Bill) to help achieve the municipal waste recycling targets, to reduce residual waste and divert C&I waste from landfill.
- Increasing the capture rate of materials collected for recycling. This will be more challenging in an urban context where there is a high percentage of flats using communal bins and more challenging demographics. As such, some geographic and/or authority areas may need to overachieve to bring up the overall average municipal recycling rate.
- Considering alternative collection options that could enhance recycling and restrict residual waste generated e.g. twin stream, source separation, three weekly, reduced container size. Use of carbon metrics not weight based metrics to inform decision marking and for ongoing monitoring and evaluation.
- Exploring enforcement options to mandate recycling participation and reduce residual side waste.
- Supporting businesses to introduce separate glass, metal, plastic, paper and card, and food recycling (expected to be legislated through the anticipated Environment Bill) to help achieve municipal recycling targets, reduce residual waste and divert C&I waste from landfill.
- Ensuring new build houses are designed to accommodate the necessary waste containers needed and improve the recycling facilities for multi-occupancy properties to help achieve recycling ambitions.
- Improving facilities to enable reuse and recycling at all Council owned sites and facilities (at least glass, metal, plastic, paper and card, food and garden (where applicable) waste).
- Continuing to provide and promote sustainable waste handling, processing and reprocessing facilities within Suffolk or within the East of England region to maximise local and closed loop recycling.
- Sending weekly collected source separated food waste to anaerobic digestion for treatment when service rolled out to help generate more biogas. Assess potential for carbon capture storage or carbon capture usage of CO_2 from anaerobic digestion facilities.
- Continuing to divert waste sent to Masons landfill during EfW outages to an EfW contingency facility, where feasible to do so.
- Remove as much plastic from the residual waste stream as possible to increase the biogenic content and reduce the fossil fuel derived content of the feedstock to the Energy from Waste (EfW) facility. Recycle as much of this as possible. Note that EfW, which is reported under energy rather than waste in the UK national inventory, is often seen as a low carbon form of electricity generation. However, if this includes the combustion of plastic, this is effectively burning fossil fuels and therefore cannot be part of a zero-carbon strategy. It is therefore imperative to reduce waste generation and avoid plastic going to EfW in order to reach net zero.
- Working with businesses and their waste collection operators to divert biodegradable C&I waste from landfill.
- Improving, where possible, methane capture on closed and operational landfills.

7.2.1 Policy options

Suffolk County Council can influence alignment of national and regional waste and wastewater policy and strategies with the aims and objectives of the climate emergency to support the transition to net-zero. Examples which will help transition towards net zero include, but are not limited to:

- Standardisation of plastics to improve recyclability and encourage closed loop recycling;

- Providing the drivers to support UK and regionally based material reprocessing capacity and markets;
- Considering the adoption of pay as you throw;
- Differential pricing for sustainable options;
- Provision of central Government funding to support resident and business uptake of reuse, recycling and waste reduction;
- Transition from weight based to carbon metrics to ensure decisions on waste services are driven by the overall most beneficial carbon outcome;
- Support the ban of five key biodegradable waste streams (food, paper and card, wood, textiles and garden) from landfill by 2025, to reduce emissions from waste sent to operational landfills in the County of Suffolk.
- Engage with water companies operating in Suffolk to understand and support where possible measures to reduce non-CO_2 emissions from wastewater handling by at least 20% by 2050.

Suffolk can directly support the pathway to decarbonisation by implementing the following policy options:

- Allocation of funding to support ongoing and targeted behavioural change campaigns to reduce waste generation and increase reuse and recycling.
- Use public sector procurement to promote waste reduction, reuse and recycling, including encouraging and supporting third sector and community reuse and repair initiatives.
- Investigate opportunities for directing payment towards sustainable waste management activities e.g. Section 106, business rate and/or Council tax rebates/increases.
- 65% municipal recycling rate by 2035 as set out in the Resource and Waste Strategy and the EU Circular Economy Package, and preferably the more ambitious 70% municipal recycling rate by 2030 at the latest - as set out in Chapter 8 of the CCC's Net Zero Technical Report.
- Measure performance of waste services using carbon metrics alongside weight based metrics.
- Retain the ambition to reduce food waste to achieve the Partnership's target of 20% reduction in food waste by 2025 and consider further reductions by 2030.
- Mandate reuse and recycling at all Council owned sites and facilities (at least glass, metal, plastic, paper and card, food and garden (where applicable) waste).
- Explore enforcement options to mandate recycling participation and reduce residual side waste.
- Minimum mandatory waste infrastructure provision for new housing stock to accommodate necessary containerisation.

8 Agriculture and land use

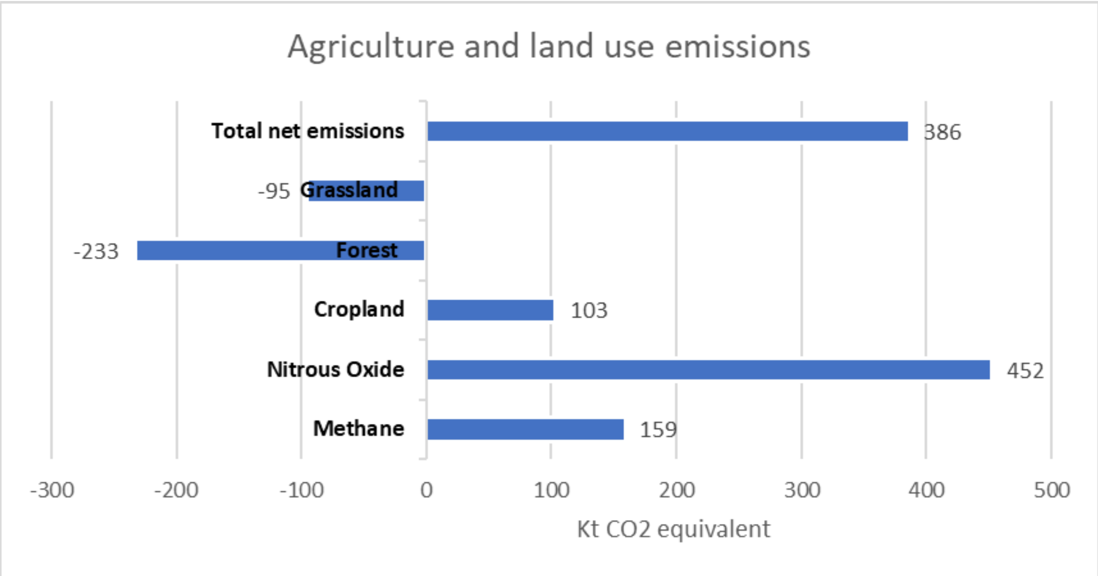
Key messages:

- It is not possible to fully decarbonise the agriculture sector but it is nonetheless important that Suffolk makes efforts to reduce GHG emissions from the sector as much as possible.
- Agriculture is very important for the area with arable production systems making up the largest land area. Emissions from arable production occur as nitrous oxide emissions arising from nitrogen in soils and carbon dioxide emissions from oxidation of organic matter.
- A number of ways to improve efficiency/mitigate emissions outlined in this report: https://ec.europa.eu/clima/sites/clima/files/forests/lulucf/docs/cap_mainstreaming_en.pdf
- Land use provides a means of removing carbon dioxide from the atmosphere through sequestration into soil and above ground biomass. Planting trees and adapting agricultural practices can enhance sequestration although tree planting can be a net emission for around 10 years after planting.

8.1.1 The current picture

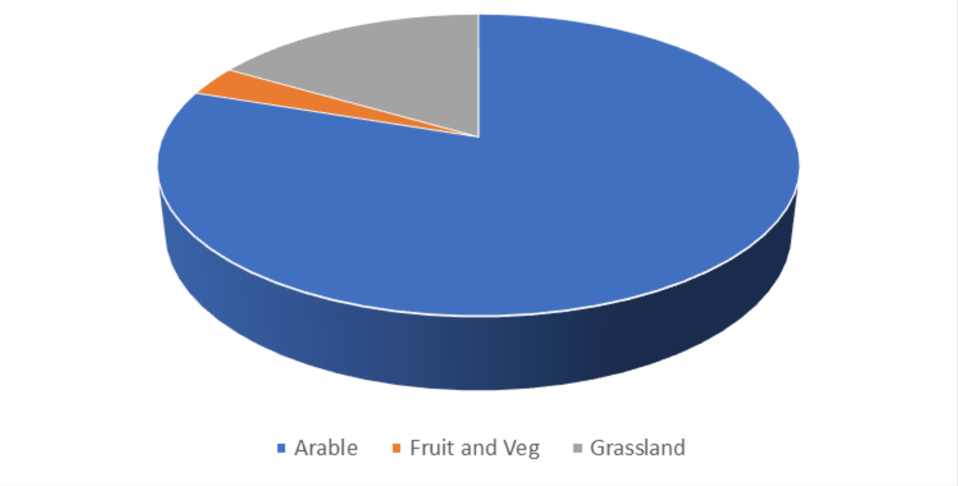
The bar chart below illustrates the GHG emissions and removals profile from agriculture and land use in Suffolk.

Figure 41: GHG emissions and removals profile from agriculture and land use in Suffolk



The dominate sources of emissions relate to crop production systems, (cropland and nitrous oxide emissions). This is due to 73% of agricultural land (292,364 Ha) in Suffolk being in arable or fruit and vegetable production as illustrated below.

Figure 42: Suffolk agricultural land use



The land use, land use change and forestry (LULUCF) sector is a net emissions sink (~170kt CO2 per year, total net emissions for Suffolk were 4,100kt CO2, approx. 5,000kt CO2e including CH4 and N2O in 2017). The sources of removals are grassland and forestry, both sequestering CO2 from the atmosphere. However, the total removals of carbon dioxide from the atmosphere is only 46% of the total emissions from land use and agriculture. This is similar to the national balance at 44%. This figure is indicative of the overall challenge we face in reaching net zero targets. The primary method of achieving sequestering carbon dioxide from the atmosphere is through land use. To enhance sequestration to a point the we are removing enough CO2 from the atmosphere to offset agricultural activities is demanding enough, let alone considering the option of the emissions removals offsetting residual emissions in other sectors. Hence the need to reduce emissions in energy-related sectors to almost zero (gross).

8.1.2 The pathway to carbon neutrality

Agricultural emissions are challenging to reduce as they arise from biological processes such as enteric fermentation in livestock and nitrification and denitrification in soils caused by additions of nitrogen fertilisers. These processes are necessary in both livestock and arable food production systems. There are also emissions that arise from cultivation of cropland through the oxidation of organic matter in soils. This is often overlooked but is an important emissions source in Suffolk due to the amount of arable crop production in the area.

In pursuit of net zero emissions, approaches for emissions reductions and enhancing removals need to be assessed. In the Suffolk situation the target areas for reducing emission are in relation to the cropping emissions. Nitrogen use is a key component of the emissions of nitrous oxide but also a critical element in production. There may be ways of reducing synthetic N use but this means making better use of organic nitrogen sources such as animal manures. With N use, it is essential it is used as efficiently as possible to reduce the losses to the environment and optimise crop utilisation. Reducing emissions of carbon dioxide from crops is difficult, the uses of minimum/zero tillage systems have little impact on the emissions from crop land. Using cover crops which introduce more organic matter can have a positive effect as can adding more organic matter such as manure and compost – however these impacts are variable and difficult to measure. Enhancing sequestration can be done through land conversion to either grassland or woodland/forestry but these bring challenges.

Risks and challenges: Suffolk is an agriculturally productive area, using good quality land for arable production. Changes to other land uses risk creating other emissions sources or displacing emissions to other parts of the country or world. For example, creating grassland will enhance removals through sequestration but will result in more livestock and associated methane emissions from enteric fermentation. Changing land use from agriculture to forestry means that land is no longer agriculturally productive and thus the production is likely to take place elsewhere (displacement).

Opportunities: Despite these challenges, there are undoubtedly opportunities to enhance carbon dioxide removals within productive agricultural systems. Incorporating more trees through agro-forestry systems, creating larger grass and woody margins and using less productive areas for woodlands can all make positive contributions while optimising the efficiency within agricultural production and enhancing biodiversity and other environmental outcomes. Changing agricultural policy frameworks in the future may accelerate these outcomes as we move towards a new Environmental Land Management Scheme for England.

The rates of sequestration achieved through woodland planting vary significantly depending on climate, tree species, soil type and the ongoing management of the wooded areas. For a broadleaved mix of Sycamore, Ash and Birch, sequestration rates are estimated to range between 3.0 to 5.7 t C ha-1 yr-1 over a 40-year period. This period incorporates the period of the fastest growth (15 – 40 years and factors in the 0 – 10-year period when tree plantations are calculated to have a net emission.

8.1.3 Policy options

The challenge of reducing emissions from agriculture and land use relates to the biological processes which are part of agricultural production. Mitigation activities are required that do not impact on the ability to continue to produce food, fuel and fibre otherwise we simply export the emissions to other geographic areas. The most relevant policy options for agriculture and land use in Suffolk relate to:

1. Measures to reduce emissions of nitrous oxide resulting from use of nitrogen fertilisers within the arable systems
2. Emissions from fuel usage from off road machinery
3. Measures to enhance land use sequestration

Fertilisers: the use of inorganic and organic fertilisers lead to nitrous oxide emissions. Using fertilisers in the most efficient way can reduce emissions while maintaining production and also bringing co-benefits in water quality and financial savings for farmers if they are not already doing it. Having a detailed nutrient management plan and using precision applications can help optimise nitrogen use efficiency.

Fuel: Fuel use in arable farming is a source of emissions and accounts for around 10% of emissions from farming activities. Ensuring fuel efficient practices are used can help reduce emissions. Alternative fuels are under development but not yet commercially available.

Enhancing Sequestration: Our land is the best tool available to increase removals of carbon dioxide from the environment. Tree planting has a major role in achieving this and encouraging this in areas where farmers are willing, such as on more marginal land, is a good way to increase levels of sequestration. Incorporation of trees into agricultural systems through agroforestry can provide multiple benefits and is reported to have some productivity benefits in certain circumstances.

Timing: tree planting is likely to deliver net removals of carbon dioxide around 10 years after planting and deliver annual sequestration through to when the trees start to decline. With 2030 targets in mind it is important to consider when the benefit will be realised.

Measures on fertiliser and fuels use can be adopted now and have immediate effects but there can be challenges relating to behavioural change and the time this takes to implement.

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