LEWES DISTRICT COUNCIL

Carbon Emissions Analysis and Pathways

July 2020

Anthesis

Lewes District Council

EXECUTIVE SUMMARY

Report Overview & Scope

This report was commissioned by Lewes District Council, who have committed to a net zero carbon emissions target by 2030 for the district.

The Council will use this work to help inform the nature and extent of actions as part of the new Climate Change and Sustainability Strategy due in early 2021.

- Section 1 of this report defines the current emissions profile in Lewes.
- Section 2 defines a carbon budget for Lewes, based on academic research at the Tyndall Centre for Climate Change Research.
- Section 3 shows a future emissions pathway defined by a range of measures across the energy system.

The scope of this report examines emissions resulting from solid, liquid and gaseous energy that provide fuels, heat and electricity to Lewes' buildings, transport and industry. An estimation is also made for the carbon sequestered due to the district's land use, as well as emissions from livestock. A more detailed analysis of agricultural, land use and sequestration emissions has also been commissioned and will follow this report as a separate document.

Objectives

1. Provide a better understanding of the district's carbon footprint using a location-based accounting approach;
2. Use this information to inform the urgency and scale of ambition required to remain in line with the Paris Agreement; and
3. Identify gaps in data where further work is needed.

Both the scale and ambition of the changes described in this report are transformational. As communities begin to recover from the COVID-19 pandemic, businesses, residents and local government all have a role to play in placing long-term sustainability and social well-being at the centre of the response.

Key figures at a glance

In 2017, gross emissions in Lewes were 458 $ktCO_2e$

Tyndall Centre analysis indicates that cumulative carbon emissions must not exceed 2,600 $ktCO_2$ before 2100

The largest sources of emissions are **Buildings** (56%) followed by **Transport** (37%) and **livestock** (4%)

Land use acts a net sink of carbon, equivalent to 38 $ktCO_2$ (c. 8% of gross emissions)

If Lewes' emissions continue along a "business-as-usual" scenario, they will come in almost four times "overbudget" by 2050

The highest ambition scenario demands that Lewes cut emissions by 65% by 2030, and 87% by 2050

Energy system: the consumption of fuel, heat and electricity across buildings, transport and industrial sectors, from solid, liquid and gaseous sources.

Science-based carbon budgeting

The concept of a carbon budget has been developed by the Tyndall Centre for Climate Change Research, whose research seeks to translate the targets set out in the Paris Agreement into an emissions limit for local authorities in the UK, setting a "budget" for each region. The fixed budget represents a scaled-down portion of the global budget which corresponds to a "well-below 2°C" temperature rise scenario.

The key message from this research is that emissions impacts are cumulative. Once emitted, carbon dioxide remains in the atmosphere for many years, contributing to the increase in average global temperatures. The carbon budget does not reset each year, so by "overspending" in early years, the remaining budget is diminished in later years. This underscores the urgent need for emissions reductions in the immediate term, rather than delaying action and making large cuts in a few years' time.

The *energy system* budget for Lewes is 2,600 $ktCO_2$ for the period 2020-2100. Remaining within this budget means that Lewes must achieve a 13.3% annual reduction rate. At current rates, the budget will be gone within seven years.

SCATTER: Setting a baseline and defining targets

The SCATTER Inventory tool defines an emissions profile for Lewes for the most recently-available year (2017) based on energy consumption datasets and locally-scaled figures.

The SCATTER Pathways tool is intended to help inform decision-making and target-setting at the local authority level. It does this by considering the effects of defined measures on energy system emissions, with a flexible level of ambition for each measure.

Measures vary across a broad range of activity, from improving the efficiency of lighting and appliances in people's homes, to electrifying rail networks, to changes in livestock numbers. Some relate to reducing the *demand* for energy, some relate to "greening" the *supply* of energy. Both types of measure have the potential to make a significant contribution to the reduction of emissions.
The effects of these activities on the emissions within Lewes are then calculated, enabling us to forecast the emissions profile up to the year 2050. For Lewes, this provides key indicators and targets for the Council to prioritise new projects ahead of the 2030 target.

The doughnut chart opposite shows the emissions profile for Lewes from 2017, compiled using the SCATTER Inventory tool (land use "sink" emissions have been excluded from the total).

The dominant sources of emissions are buildings (56%), transport (37%) and livestock (4%).

The chart below shows potential emissions pathways for Lewes, plotted to 2050. These have been calculated from the SCATTER Pathways tool and Tyndall Centre analysis. The blue line tracks national policies and "greening" of the energy supply as more renewable energy sources are installed. This is termed the "business-as-usual" or BAU trajectory. The green line tracks much more ambitious action, requiring significant and rapid improvements in terms of energy demand and energy supply. The green line represents the most ambitious trajectory for Lewes within SCATTER Pathways.

The red dotted line represents the recommended annual emissions reductions defined by the Tyndall Centre carbon budget. The carbon budget can be "spent" in a number of ways, but the pathway demonstrated here shows a consistent annual reduction rate in emissions.

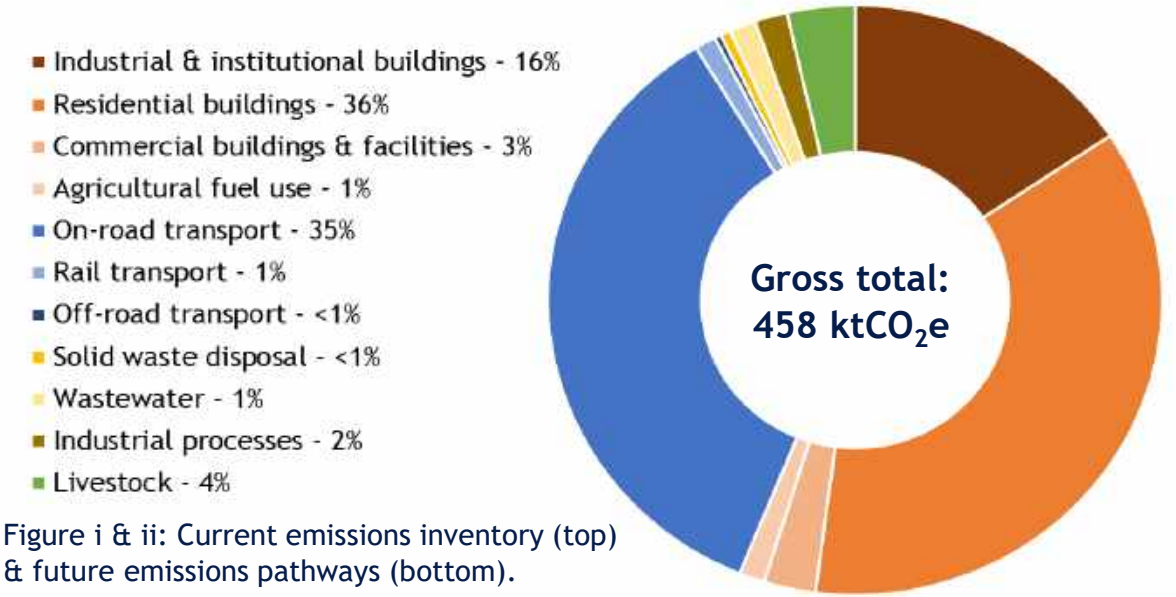
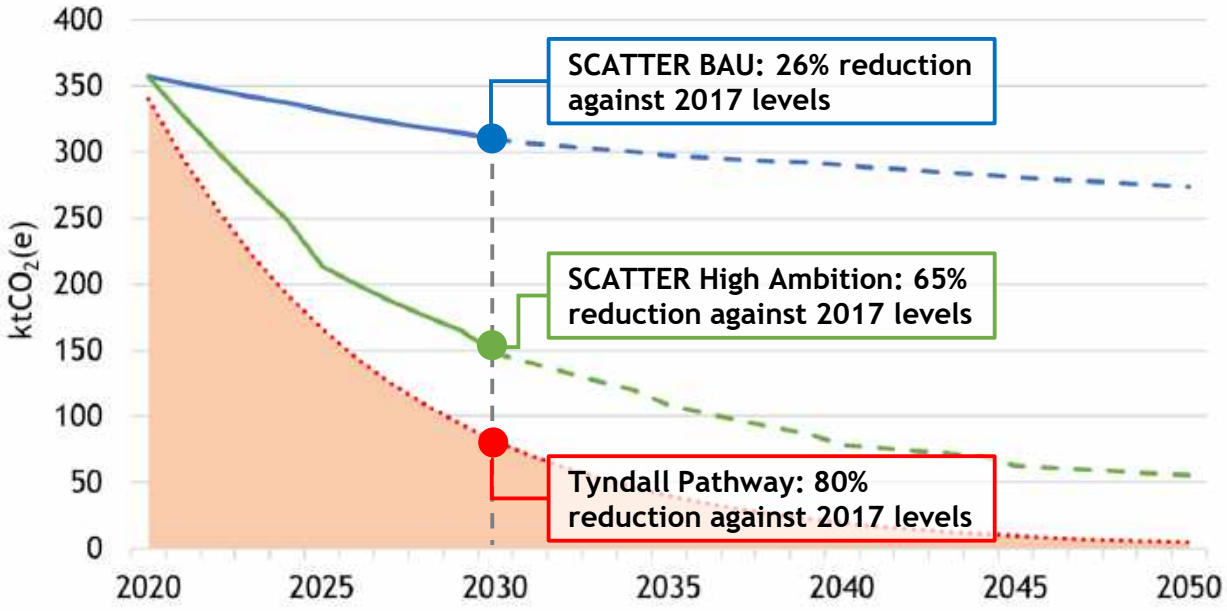


Figure i & ii: Current emissions inventory (top) & future emissions pathways (bottom).

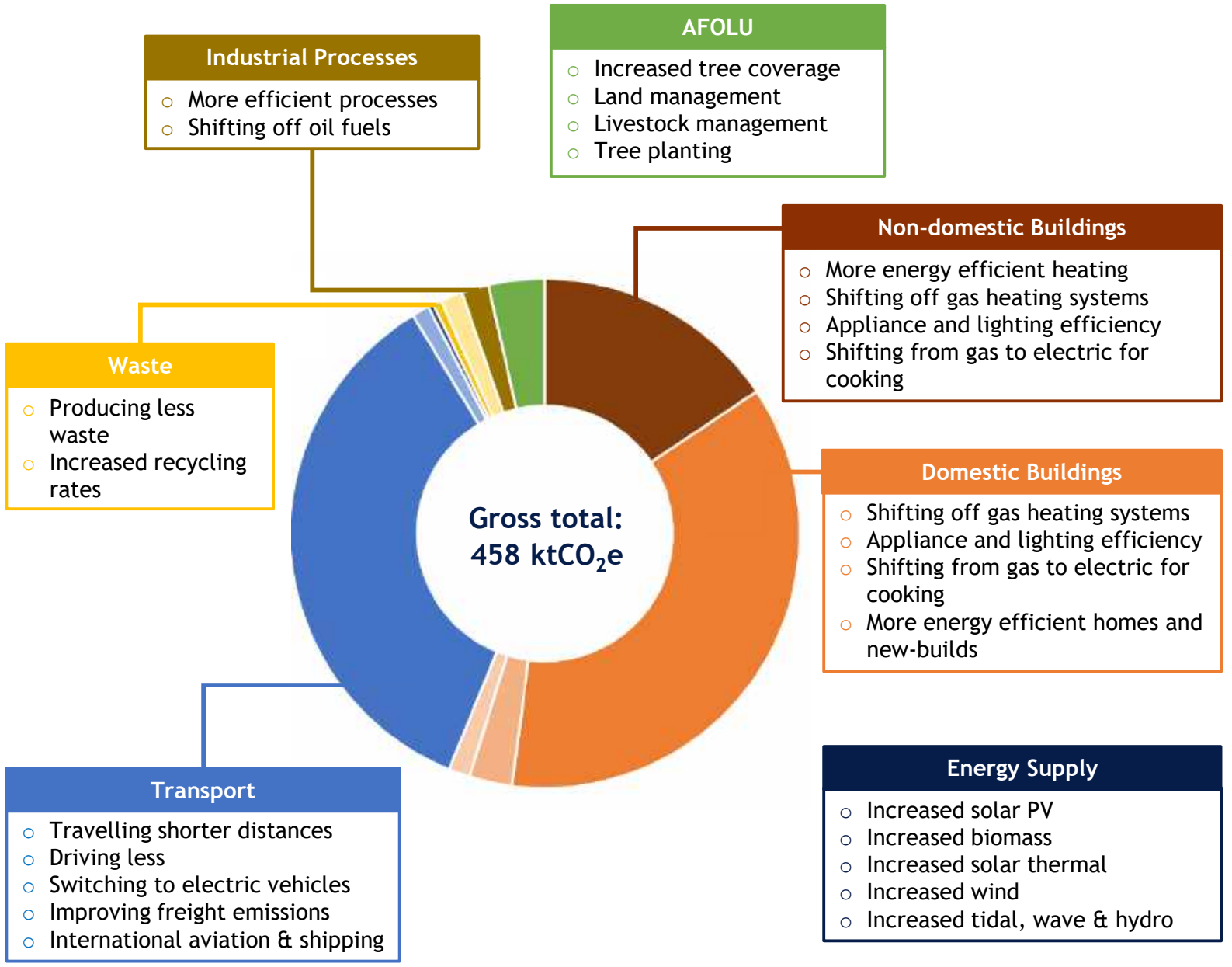


SUMMARY OF MEASURES

The range of measures considered as part of the SCATTER Pathways tool is summarised opposite. Activity in each of these areas underpins the forecast trajectories (i.e. the blue and green lines on the page prior).

Measures have been grouped into different sectors, which also link directly to the sectors described within the annual emissions profile (the doughnut chart). Each group of measures has some sort of activity focused on *demand-side* reductions, switching to electrified systems, or greening energy *supply*.

The SCATTER measures define the "what" rather than the "how"; this will be explored further in a planned stakeholder engagement programme.



Summary of Interventions to 2030

The following tables describe the 2030 interventions required to adopt the High Ambition Pathway (green line) for Lewes. All reductions are against a 2017 baseline except where stated otherwise:

Sector	Measure	2030 Intervention
Domestic buildings	More energy efficient homes & new builds	• 1,700 “medium” retrofit • 13,900 “deep” retrofit • 5,700 new builds to PassivHaus standard
Buildings	Reduced energy demand for heating, cooling & hot water	• Domestic: 21% reduction • Non-domestic: 17% reduction
Buildings	Reduced energy demand for appliances, lighting and cooking	• Domestic: 31% reduction • Non-domestic: 11% reduction
Buildings	Shifting off gas heating systems	• Domestic: 47% of heating systems are electrified • Non-domestic: 39% of heating systems are electrified
Buildings	Shifting from gas to electric for cooking	• Domestic: 29% increase in electric fuel usage for cooking • Non-domestic: 10% increase in electric fuel usage for cooking
Transport	Travelling shorter distances	• 25% reduction in the average number of passenger miles travelled per person
Transport	Driving less	Mileage share of different transport modes: • Active transport: 5% • Public transport: 20% • Private on-road transport: 80%
Transport	Switching to electric vehicles	• 88% of cars are EV or HEV • 100% of buses and trains are electric
Freight transport	Improving freight emissions	• 12% increase in waterborne freight mileage • 9% reduction in road freight mileage • 72% reduction in energy used per mile travelled • 148% increase in fuel use at UK ports

Sector	Measure	2030 Intervention
Waste	Producing less waste	• 24% reduction in the volume of waste
Waste	Increased recycling rates	• 65% recycling rate
Industry	Shifting off fossil fuels	• 14% reduction in oil fuel usage • 3% increase in electricity consumption • 10% increase in the use of natural gas
Industry	More efficient processes	Process emissions reduced: • 14% for chemicals • 10% for metals • 11% for minerals • 50% for other industries
Renewable energy supply	Wind	• Local wind: 37.1 MW installed capacity • Large onshore: 22 MW installed capacity • Large offshore: 34.1 MW installed capacity

Sector	Measure	2030 Intervention
Renewable energy supply	Solar PV	• Local PV: 118.1 MW installed capacity • Large scale PV: 5.4 MW installed capacity
Renewable energy supply	Biomass	• Declining usage having displaced fossil fuel sources in power stations
Renewable energy supply	Other renewables	• Local hydro: 4.4 MW installed capacity
Agriculture & land use	Forest coverage & tree planting	• 24% increase in forest coverage • Increase in lone tree coverage to around 47 lone trees per ha
Agriculture & land use	Land & livestock management	• 5% decrease in livestock numbers • 7% decrease in grassland • 1% increase in cropland

HIGH AMBITION PATHWAY: 2030 SUMMARY

Adoption of the High Ambition Pathway interventions delivers emissions reductions of around two-thirds by 2030.

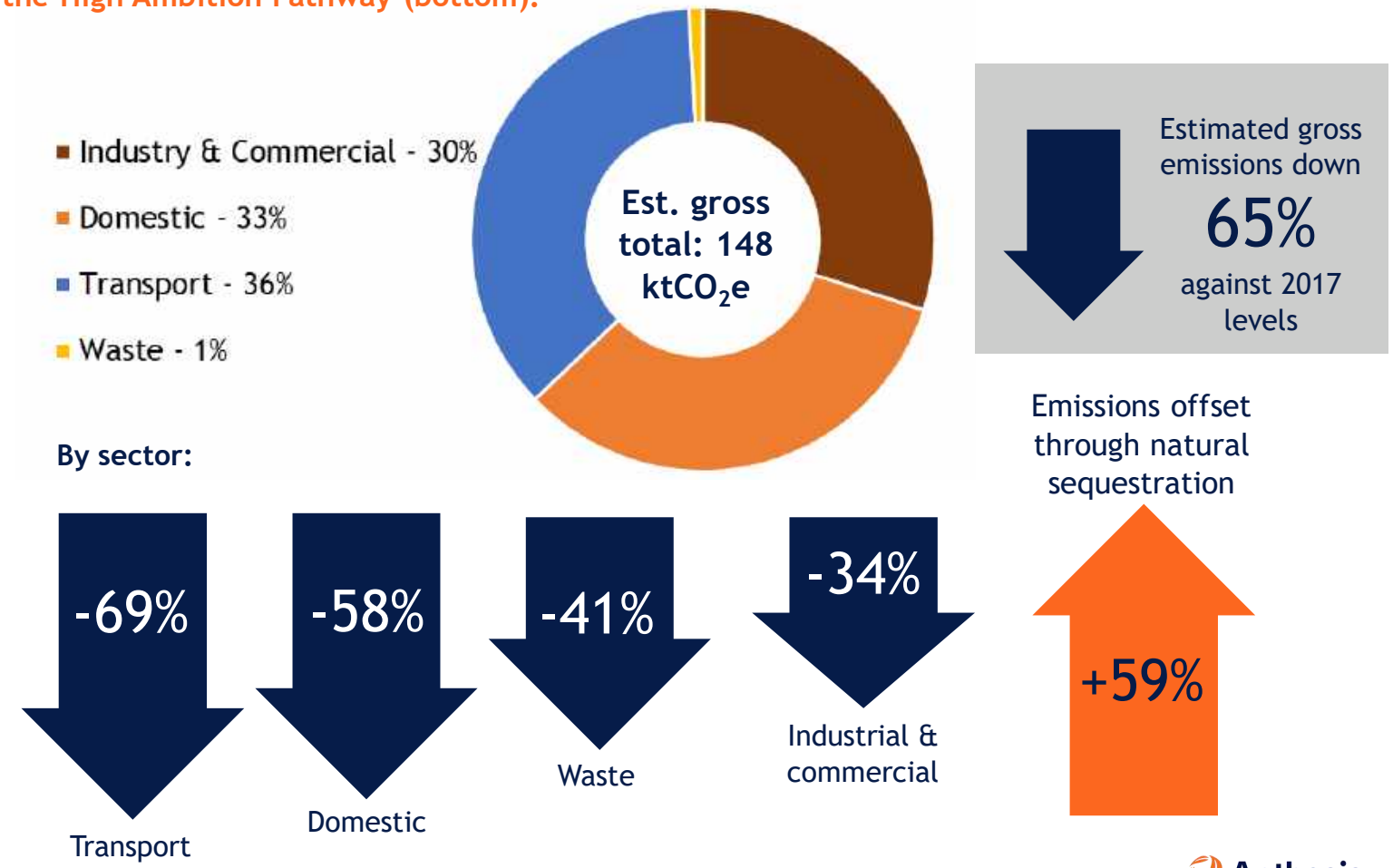
By 2030, the emissions profile for Lewes is predicted to look very different from today. Concerted local actions can have a significant effect on district emissions, making reductions of around 65%.

Tackling residual emissions – closing the gap to carbon neutrality

Despite the aggressive actions described, hard-to-remove emissions in industry and freight transport persist. Whilst emissions from the domestic and waste sectors are massively reduced, the scale of improvement is not enough to reach zero by 2030.

Offsetting strategies are recommended as a means of addressing these residual emissions.

Figure iii: Estimated 2030 emissions profile (top). Emissions reductions in key sectors under the High Ambition Pathway (bottom).



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GLOSSARY OF TERMS

AFOLU – Agriculture, forestry & land use.

BEIS – UK Government Department for Business, Energy and Industrial Strategy, the successor to the Department for Energy & Climate Change (DECC).

Carbon dioxide equivalent (CO_2e) – the standard unit of measurement for greenhouse gases. One tonne of CO_2 is roughly equivalent to seven months of commuting daily by car between Lewes & Brighton or burning 1-2 bathtubs' worth of crude oil. "Equivalent" means that other greenhouse gases have been included in the calculations.

Carbon Neutral/ Net Zero - these two terms typically mean the same thing in the context of CO_2-only emissions. Whilst emissions are reduced overall, those that remain (e.g. from industrial and agricultural sectors) are then *offset* through carbon dioxide removal from the atmosphere. This removal may occur through technology such as carbon capture and storage (CCS) technologies, or through natural sequestration by rewilding or afforestation.

Carbon sink – a process or natural feature that removes carbon from the local atmosphere (e.g. trees or wetlands). The carbon is said to be *sequestered* from the atmosphere.

Climate Emergency – a situation in which urgent action is required to reduce or halt climate change and avoid potentially irreversible environmental damage resulting from it.

Decarbonisation – the process of changing our activities and industry practices to create an economy that sustainably reduces emissions of carbon dioxide.

Energy system - the consumption of fuel, heat and electricity across buildings, transport and industrial sectors, from solid, liquid and gaseous sources.

Gross emissions – the emissions total before accounting for local carbon sinks.

IPCC – Intergovernmental Panel for Climate Change.

LULUCF – Land use, land use change & forestry.

SCATTER – the Anthesis-developed tool which is used to set emissions baselines and reductions targets. See the SCATTER website for more information.

A list of FAQs relating to SCATTER and this report can be found in Appendix 2.

INTRODUCTION & CONTEXT

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The scope of this report examines emissions resulting from solid, liquid and gaseous energy that provide fuels, heat and electricity to Lewes' buildings, transport and industry. An estimation has also been made for the carbon sequestered due to the district's land use, as well as emissions from livestock. A more detailed analysis of agricultural, land use and sequestration emissions has also been commissioned and will follow this report as a separate document.

Objectives

1. Provide a better understanding of the district's carbon footprint using a location-based accounting approach;
2. Use this information to inform the urgency and scale of action required to remain in line with the Paris Agreement; and
3. Identify gaps in data where further work is needed.

This will help Lewes by:

- Providing a more informed evidence base for future action plan development as well as a planned stakeholder engagement programme which will follow this work;
- Increasing confidence in the mandate for climate action, aiding development of a robust local strategy which can deliver objectives over a long term cycle.

Local and national policy

In 2015, the UK adopted the Paris Agreement as part of a joint pledge by members of the European Union, committing to:

- Strengthening the global response to the threat of climate change by keeping global temperature rise this century well below 2°C above pre-industrial levels.
- Encouraging efforts to limit the temperature increase even further to 1.5°C.

Tackling the climate crisis is a long-standing issue in the UK, reflected in the legally binding target in the 2008 Climate Change Act. This was updated in 2019 to reflect an updated target of net zero carbon by 2050.

In July 2019, Lewes District Council passed a Climate Emergency motion, acknowledging their duty to respond to the urgent call for action. A key aspect of the motion mandated the support for local stakeholders to work towards making the whole District zero carbon and climate resilient by 2030.

A call to action

Lewes' Climate Emergency declaration was issued following the Intergovernmental Panel on Climate Change (IPCC) special report on the impacts of global warming of 1.5°C above pre-industrial levels, published in October 2018. The report found that in order to remain within a 1.5°C increase, governments must cut greenhouse gas emissions by 45% by 2030 against a 2010 baseline. Since the first IPCC report was published in 1990, global emissions have increased 60%.

Another key finding of the report states that at current rates, it is likely that the Paris Agreement target of limiting warming below 1.5°C will be surpassed as early as 2030. In their 2019 Emissions Gap Report, the UN Environment Programme found that the current Nationally Determined Contributions were likely to result in a 3.2°C temperature rise by 2100.

In the 2018 Emissions Gap Report, the UN identified local action as a key driver for change: *"…non-state and subnational action plays an important role in delivering national pledges. Emission reduction potential from non-state and subnational action could ultimately be significant, allowing countries to raise ambition."*

COVID-19 & climate change

The global disruption and impacts of the COVID-19 pandemic have forced governors, businesses and citizens to radically reassess their policy decisions, operations and lifestyles.

The ongoing restrictions offer the chance to reflect on what is important to local communities. This time also presents the opportunity to shift our collective values and review the demands of "emergency action" in a climate context. Local and national commitments to emissions reductions have not changed as a result of the COVID-19 crisis and the cost of delaying action has been felt in many countries during the pandemic. Decisiveness will be required in the wake of this crisis, to lead a recovery which revolves around the resilience, health and sustainability of local communities.

The next few years will be pivotal for climate change mitigation as we enter the decisive decade for action. The urgency of the situation is growing as we approach planetary tipping points and are held to account as a nation against international climate targets.

A sustainable recovery

The evidence from the UN reports makes clear that immediate and drastic action is required to avoid global warming to dangerous levels, whilst encouraging sub-national policy measures and action as a necessary means of reducing emissions.

As of February 2020, 70% of local authorities have made Climate Emergency Declarations. Support for the Task Force on Climate-related Financial Disclosures has grown significantly in the past 18 months, with increasing numbers of global businesses setting science based targets.

The recognition of urgency to address the climate emergency is no longer solely the message from environmental groups. The response from government and businesses is growing, with emissions reduction measures forming a key component of the recovery from the COVID crisis; with UN Secretary General Antonio Guterres declaring in April that *"ensuring a future for the planet must be a core element in rebuilding society after lockdown measures are lifted"*.

02 Lewes' Current Emissions Profile

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CURRENT EMISSIONS PROFILE

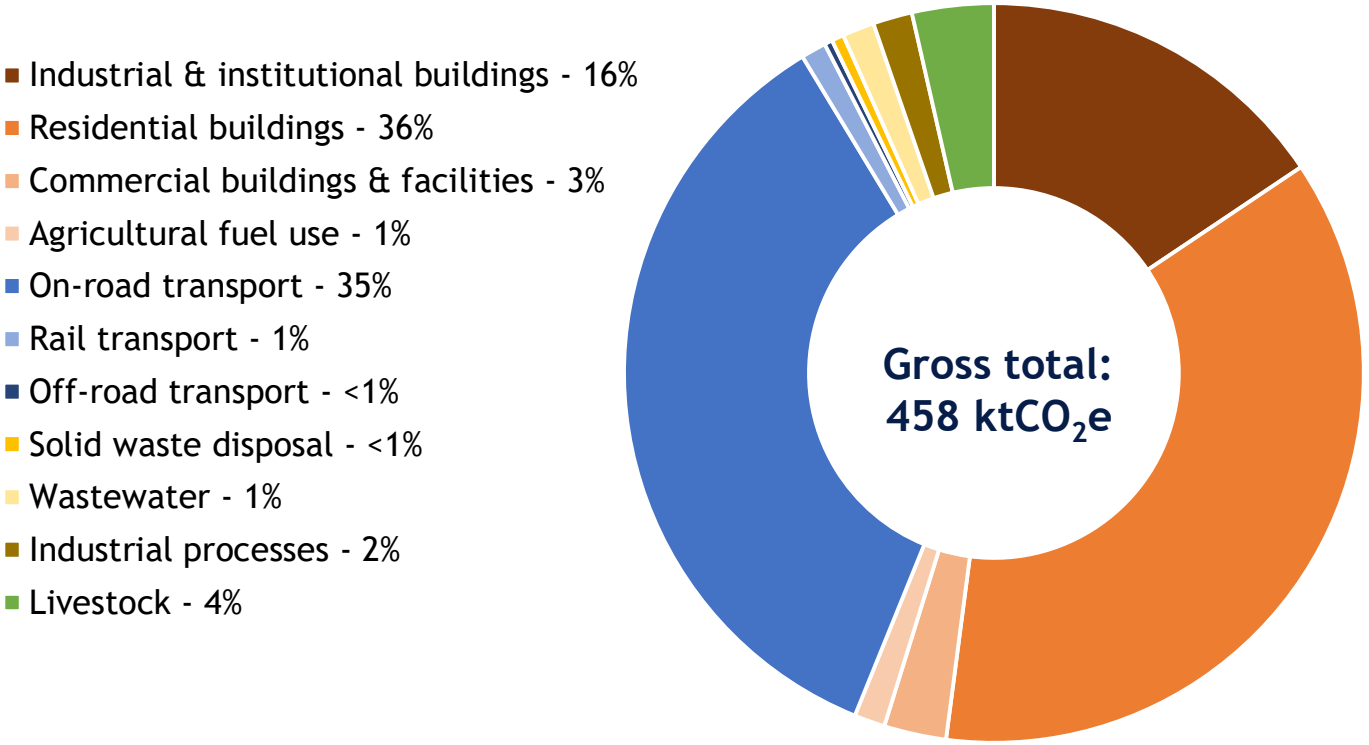
In 2017, Lewes' energy system was responsible for emissions totalling 458 $ktCO_2e$. The majority resulted from buildings (56%) & transport (37%), whilst land use acted as a net carbon sink of 38 $ktCO_2$.

The current emissions profile for the area administered by Lewes District Council is shown opposite. The profile has been compiled from the most recently available data, which is published two years in arrears.

Not all subsectors can be neatly summarised as a "slice" of this chart. Emissions from forestry and land use have been as these act as carbon *sinks* for the region, sequestering carbon from the atmosphere.

See Appendix 1 for the full data table, as well as the data table from the BEIS Local Authority CO2 inventory.

Figure 1: SCATTER emissions inventory for Lewes, 2017, excluding land use.



A more detailed analysis of livestock and land use emissions will be published as a separate report in due course.

Profile subsectors

56% of gross emissions in Lewes come from buildings, namely:

- Residential buildings: Domestic households of all tenure types.
- Industrial & institutional buildings: Larger industrial facilities including factories, warehouses, workshops as well as public sector buildings including schools, health centres, hospitals, leisure centres, Council buildings etc..
- Commercial buildings: Buildings from which commercial businesses operate e.g. shops, shopping centres, offices, restaurants etc.
- Agriculture: Fuel consumption from off-road transportation in the agricultural sector. Note that this does **not** include the direct emissions from livestock or fertiliser.

37% of gross emissions result from energy used for transport:

- On-road transport: Emissions from all forms of on-road passenger vehicle, including cars, vans, motorcycles, buses and taxis. Aviation and shipping fuels are excluded.
- Rail: Emissions from diesel-fuelled rail transport. Emissions from electricity consumption within the rail sector are included in the commercial and industrial sectors as it is not possible to separate these emissions.

2% of gross emissions are from waste disposal:

- Solid waste disposal: Incorporates various waste streams across commercial, industrial and municipal sources.
- Wastewater: Scaled directly from national wastewater data by population, using established emissions conversion factors.

2% of gross emissions are from industrial processes:

- Nationally-scaled processing emissions associated with heavy industry, such as minerals, iron & steel and chemicals.

4% of gross emissions are from livestock:

- Includes emissions from both dairy and non-dairy cattle as well as other farm livestock.

The equivalent of 8% of gross emissions were captured through Lewes' land use, sequestered into soils, crops and other sinks.

03 Lewes' Carbon Budget

The energy system carbon budget for Lewes between 2020-2100 is 2,600 $ktCO_2$

A consistent annual emissions reduction rate of 13.3% is needed to adhere to this budget

At 2017 rates, Lewes will exceed its carbon budget within 7 years

By 2030, emissions must reduce by >80% against 2017 levels to remain in budget

CARBON BUDGET

Between 2005 and 2017, the highest annual reduction rate for any year was under 9%, and the average annual reduction rate in that time was under 3%. The high demands of achieving annual 13.3% reductions again highlights the scale of ambitious action required to meet the Paris Agreement targets.

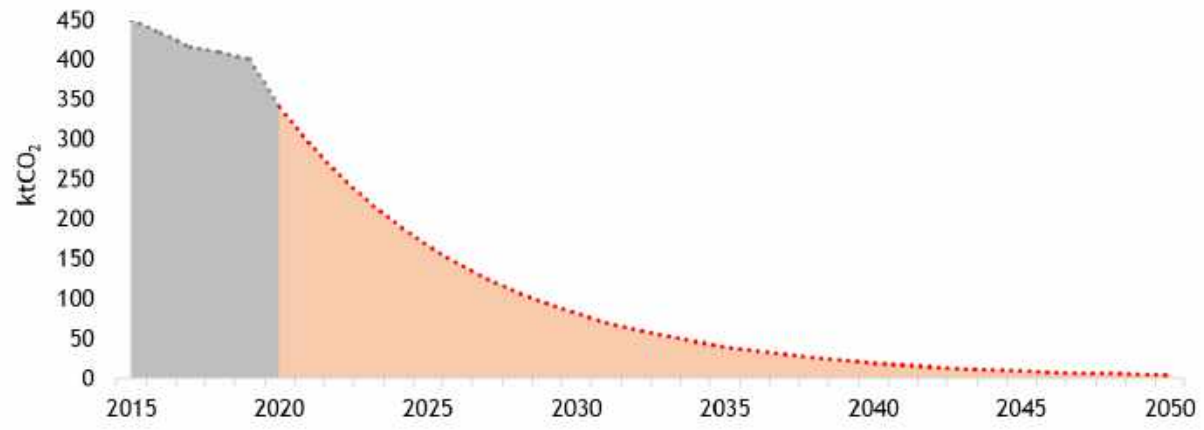
The Tyndall Centre for Climate Change Research, based at the University of Manchester, have translated the Paris Agreement targets of limiting temperature change below 1.5˚C into a fixed emissions 'budget' for each local authority. There are two key ideas underpinning their research:

The carbon budget is a fixed amount: A global budget represents the total emissions allowed before the 1.5˚C threshold for greenhouse gas concentration is crossed. This global budget can then be scaled down to a national level, and finally, a regional level. See Appendix 3 for more details on how the Tyndall Centre break down the global carbon budget.

Emissions now mean impacts later: The most crucial element of this approach is understanding the importance of cumulative carbon emissions. Once emitted, carbon dioxide remains in the atmosphere for many years, contributing to increasing the average global temperature. The carbon budget does not reset; it represents a fixed upper limit to emissions, analogous to a monthly payday cheque. This means that the year that Lewes becomes zero-carbon is considerably less important than the annual reductions rate of emissions.

The dotted red line below gives a visual representation of the 13.3% average annual reduction required to keep Lewes within budget. The total area under the red dotted line represents the total carbon budget. Historic emissions are denoted in the grey region of the graph, with the beige area representing cumulative carbon emissions which add up to the 2,600 $ktCO_2$ total.

Figure 2: Graph showing historic emissions (grey dotted line), cumulative historic emissions (grey area) Tyndall Centre's recommended reduction pathway of 13.3% annual reduction (red dotted line), and the carbon budget for Lewes district (beige area).



The consequence of unchecked growth in aviation and shipping emissions is an even smaller budget for the energy system, and vice versa, to remain on track for 1.5°C. A visual representation of this is available in Appendix 3.

Exclusions from this budget

A key omission from this budget are emissions from aviation and shipping – the budget considers only the *energy system*. This "energy-only" budget also excludes emissions from land use, land change and forestry, as well as cement manufacturing.

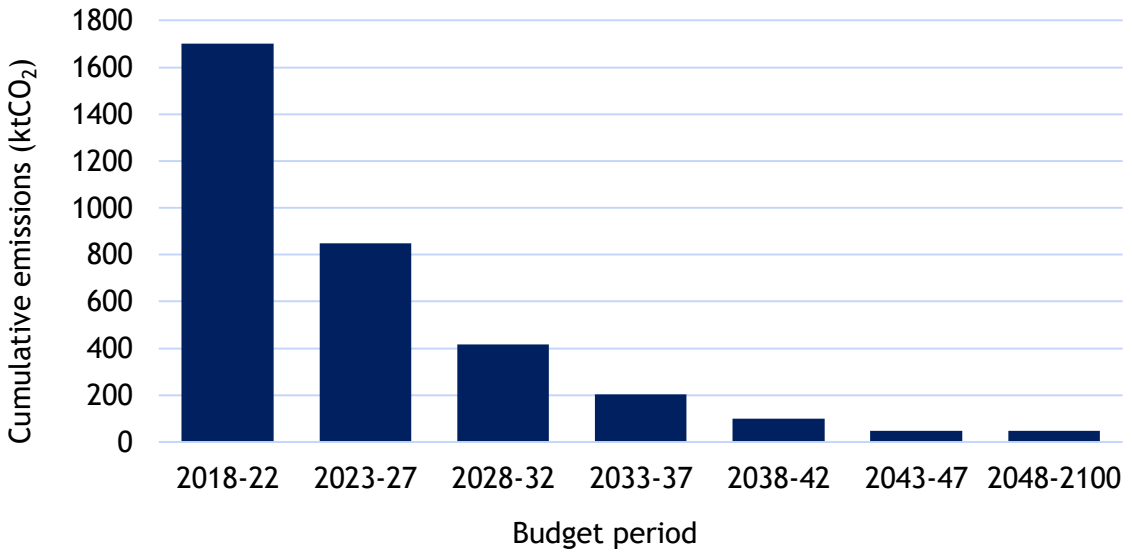
The nature of aviation & shipping emissions means that responsibility is not attributed to individual authorities, but is instead accounted for at the UK level, as a "national overhead". The Tyndall Centre analysis assumes that UK emissions from aviation remain constant up until 2030, followed by a steady reduction towards net zero carbon by 2075.

Pre-COVID Government forecasts anticipated a growth in aviation and shipping emissions, which would erode the remaining UK budget available for local authorities. Whilst emissions from aviation in the first half of 2020 were significantly reduced, the extent of a potential "emissions rebound" post-COVID remains uncertain. Models vary widely on the level of international industry collaboration and level of government intervention to encourage economic recovery.

The Tyndall Centre analysis is also a CO_2-only budget, excluding contributions from other greenhouse gases. This slight difference in scope means that direct comparisons with the cumulative emissions from SCATTER Pathways trajectories should be taken as estimates only.

Budget Milestones

Figure 3: The chart below gives the budget in terms of the periods set out in government reporting frameworks.



04 SCATTER Pathways

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INTRODUCTION

SCATTER is one of many information sources designed to help local authorities inform priorities for emissions reduction. It is intended to focus on the 'what' rather than the 'how'.

The SCATTER pathways are intended to act as 'lines in the sand' for Lewes. They serve as an indication of whether the adoption of certain interventions can drive the transition to a low carbon economy and help to guide target-setting and key performance indicators. SCATTER pathways run up to 2050, though "checkpoint" interventions have been given for 2025 and 2030 to guide progress in the near-term.

It is also important to note that SCATTER does not intend to prescribe certain technologies or policies, and similarly does not intend to discount other methods of arriving at the same outcome, just because they do not feature in the model.

SCATTER Pathways is now available as a free-to-use online tool for local authorities following a systems update in Spring 2020.

Basic principles

Sir David MacKay's 'Sustainable Energy - Without Hot Air (2009)" provides the basis for the pathways modelling. As a scientific advisor to the Department for Energy & Climate Change (DECC),[1] MacKay's work led to the development of the 2050 Pathways Calculator. Two key modifications were made by Anthesis:

1) We scaled it down for sub-national regions: Scaling assumptions and localised data sets were built into the tool so that results were representative of cities and local authority regions, rather than the UK as a whole.

2) We pushed ambition further: Technologies within the tool were reviewed and updated where judged to be out of date and constraining ambition. Given that almost a decade had passed between MacKay's publication and the release of the 2050 Pathways tool, we sought the counsel of a technical panel to make these updates. The technical panel comprised subject matter experts from Arup, BEIS, Electricity North West, GMCA, The Business Growth Hub, The Energy Systems Catapult, The Tyndall Centre and Siemens.

1 – DECC responsibilities were reformed into BEIS in 2016

SCATTER PATHWAYS MODEL

The graph below shows two possible future emissions pathways as modelled by the SCATTER tool, compared against the Tyndall Centre's recommended annual reduction pathway. The full list of measures which influence these pathways is given on page 30.

Adoption of the High Ambition Pathway does not achieve Lewes' target of carbon neutrality by 2030. Gaps exist between the SCATTER High Ambition Pathway and the Tyndall-aligned pathway (red-dotted line) because modelling assumptions are based on present day evidence and technologies. See page 27 for discussion around the residual emissions and what "closing the gap" may look like.

Historic reductions in emissions will slow down along a BAU pathway. The trends since 2005, whilst positive, have been driven largely by the decarbonisation of the electricity grid. Emissions savings are expected to "bottom out", and after factoring in the growth of the district, the pathway flattens out.

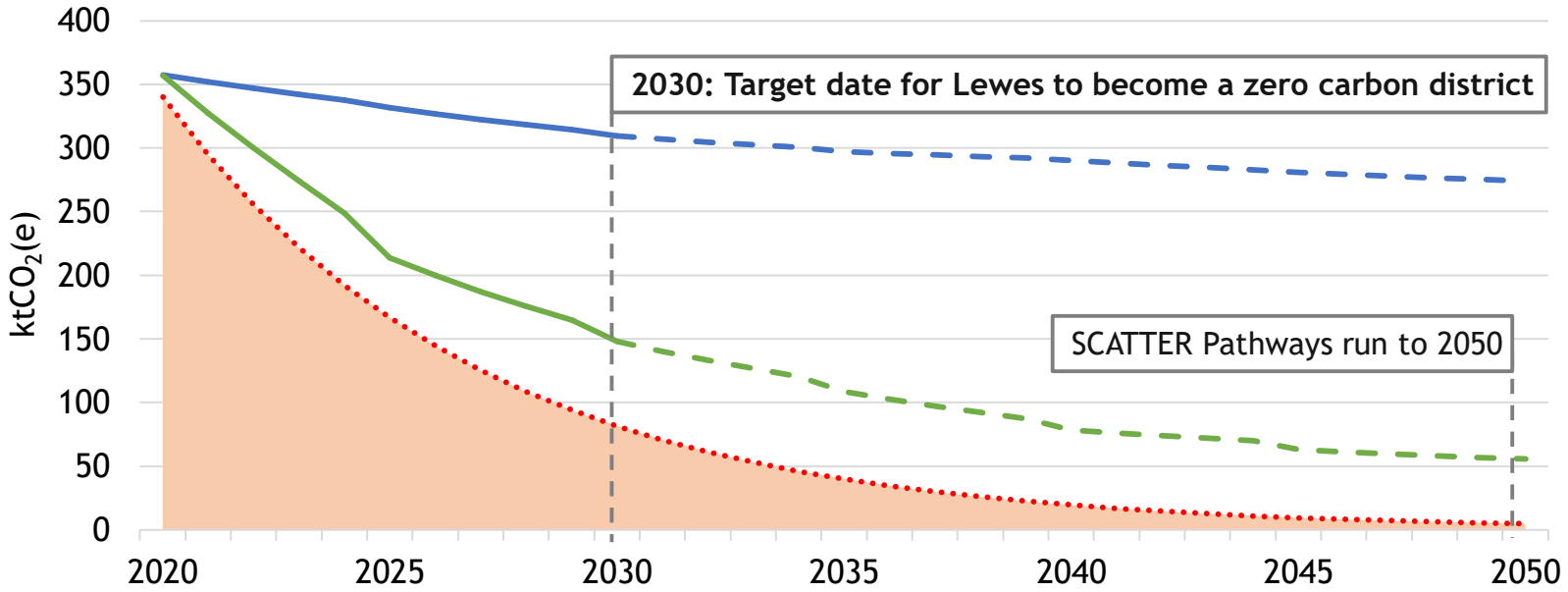


Figure 4: SCATTER Pathways for Lewes district.

SCATTER BAU Pathway - Assumes Lewes continues along current "business-as-usual" (BAU) trajectory in terms of nationally-led policy and behavior change. Reductions largely the result of continued grid decarbonisation.

SCATTER High Ambition Pathway - Assumes Lewes goes significantly beyond national policy and National Grid assumptions, across both energy supply and demand measures.

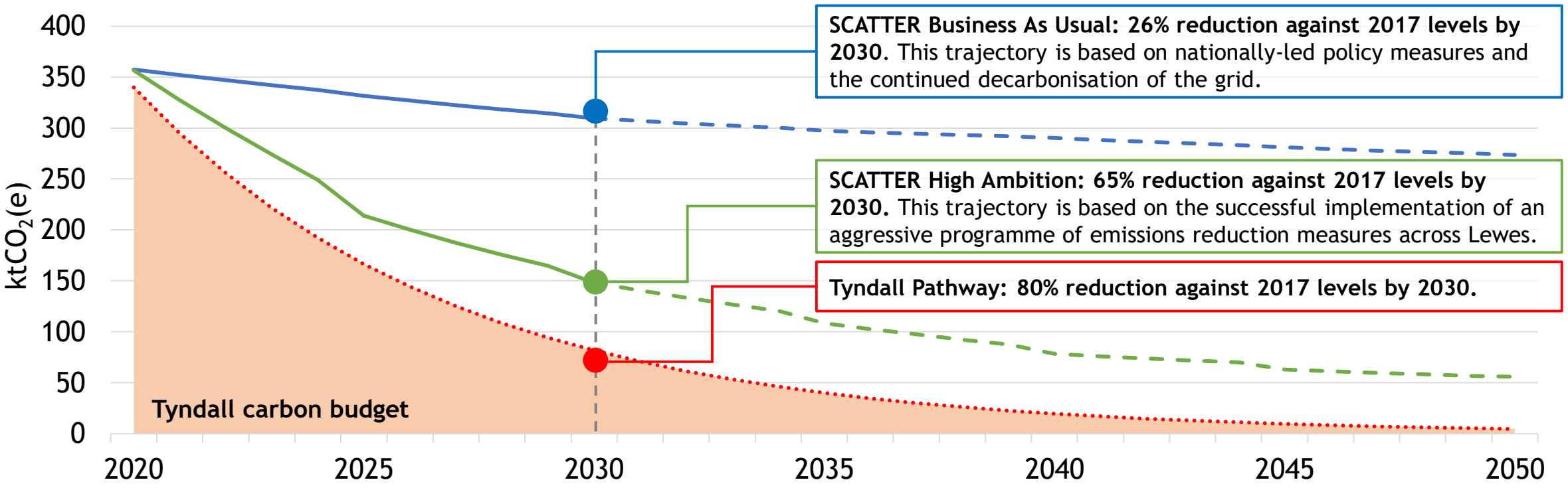
Tyndall Carbon Budget - A representative area equal to the cumulative emissions budget for Lewes, based on research by the Tyndall Centre for Climate Change Research.

Tyndall Pathway - A 13.3% annual reduction as defined by Tyndall research. Unlike the SCATTER Pathways, this does not specify what tangible measures could achieve this pathway, but instead sets out what is recommended scientifically.

SCATTER PATHWAYS MODEL – SUMMARY

Historic emissions reductions

BEIS publishes regional-level emissions annually, with data being provided two years in arrears. Based on those datasets, Lewes' emissions fell 30% between 2005 and 2017, due largely to the decarbonisation of the electricity grid.[1]



1 – BEIS uses a different methodology to SCATTER for many of its emissions, meaning that a direct comparison is not always possible. A description of these differences is given in Appendix 1.

Prioritising actions

Aggressive and urgent emissions reductions interventions are demanded by the High Ambition Pathway. The scale of the actions necessary to reduce emissions even 65% by 2030 requires radical step changes in behaviour, across almost every area of activity within Lewes district.

The next chapter of this report defines these interventions, but they can be thought of as falling into two main categories; interventions focused on reducing energy *demand* and interventions focused on decarbonising energy *supply*.

Being able to confidently prioritise actions is important for Lewes as it begins to coordinate actions and projects. It can be helpful to refer to a defined hierarchy of actions when considering new initiatives.

Reducing demand should always come first.

This avoids placing too much reliance on long-term, higher risk renewable supply infrastructure to deliver the emissions savings so urgently required, safeguarding carbon budgets in the process:

- Economically, consumer energy bills are reduced. At the district level, costs associated with installing new generation assets, new grid connections and grid reinforcement works can be minimised.
- Socially, there are benefits for citizens associated with increased walking and cycling. Increasing the efficiency of public transport services also maximises social benefits.
- Environmentally, emissions savings can often be achieved much quicker by implementing various demand side behaviour changes or 'quick win' efficiency measures.

Future demand is hard to predict accurately - but decarbonising the energy supply is the next highest priority.

The National Grid's Future Energy Scenarios (FES) indicate that even under a scenario that meets the UK's net zero by 2050 (Two Degrees), electricity demand still increases. On the other hand, SCATTER's High Ambition Pathway assumes that electricity demand reduces due to

1 - A more detailed breakdown of the predicted residual emissions at 2030 is given on page 53

A **carbon offset** is defined by the IPCC as a reduction in emissions of carbon dioxide or other GHGs made in order to compensate for an emission made elsewhere.

improvements to efficiency of operation.[1] Factors such as increased electrification of heat and transport are naturally big drivers for the increase, but incentives and opportunities for demand reduction and energy efficiency measures are still significant and could slow or tip trends in the other direction.

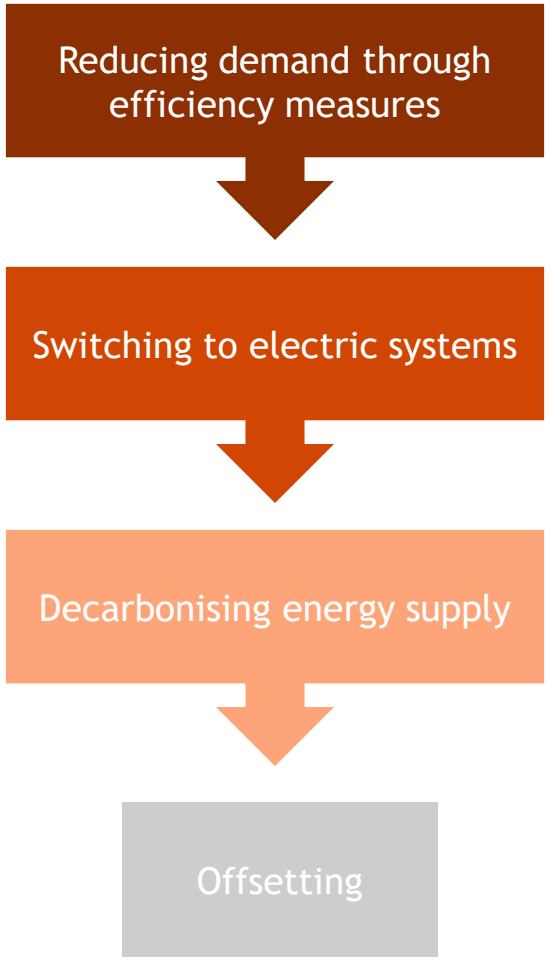
This hierarchy of actions is of course idealised and naturally the Council's influence and key local stakeholders may allow for some initiatives to be implemented before others.

Tackling residual emissions and "the gap"

Despite the extensive actions described by the High Ambition Pathway, significant residual emissions persist at 2030 (and even at 2050).

Having adopted the High Ambition Pathways interventions, residual emissions can be tackled through a transparent, well-defined strategy of *carbon offsetting* in order to reach Lewes' carbon neutrality goal by 2030. Despite its criticisms and limitations, offsetting is an important and valid mechanism that can help meet carbon neutrality goals.

Information on upholding integrity and the key principles of offsetting can be found in this carbon neutrality guidance from C40.



Example interventions:

- Building retrofit
- Driving less/modal shifts
- Producing less waste
- Phasing out gas appliances
- Electrifying processes
- Switching to electric buses and rail networks
- Installing PV
- Improving storage capacity
- Installing off-shore wind
- Natural sequestration projects
- Out-of-boundary investments (i.e. carbon credits)

1 – It should be noted that this optimism for demand reduction is consistent with the legacy 2050 Pathways tool.

05 Emissions Reduction Interventions

INTRODUCTION

The SCATTER Pathways tool models the influence of a range of interventions on emissions within Lewes district. This chapter of the report defines the measures which are locally influenceable, and which interventions are necessary to deliver drastic reductions in emissions.

The defined interventions are based on what is needed to achieve carbon reductions for the High Ambition pathway and do not consider how they can be delivered e.g. policy, feasibility, financing or skills required.

The tool also operates on more forecasts and predictions than are listed in this chapter. National measures, such as those including aviation & shipping, are set to central governmental forecasts. Other forecasts, such as those for increases to household numbers and population, also follow ONS predictions.

Navigating this chapter

The following sections provide various metrics and data designed to describe the nature and extent of measures specific to Lewes district:

- **Measure:** Defines the 'action' or changing activity.
- **Intervention:** Defines the target or indicative level of change required to achieve the High Ambition Pathway.
- **Current Context:** Describes the existing 'state of play' within Lewes. Every effort has been made to define the current contexts in the same parameters as the SCATTER interventions for comparability, though this is not always possible.
- **Pathway Outputs:** These are given at milestones of 2025, 2030 and 2050. The 5- and 10-year milestones give an indication of the urgency for front-loaded actions and underscores the need for urgent action. The 2050 milestone is included to offer an 'endpoint' evaluation for the measures.

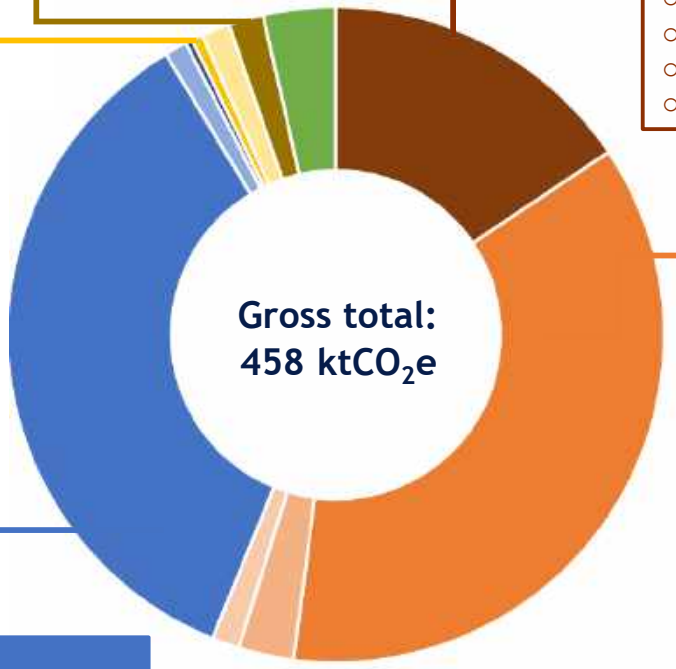
Measures are broken down into various sectors, which match up with the SCATTER Inventory given in Chapter 1.

SUMMARY OF MEASURES

The range of measures considered as part of the SCATTER Pathways tool is summarised opposite. Activity in each of these areas underpins the forecast trajectories (i.e. the blue and green lines on the page prior). Many of these measures are based on the DECC 2050 Calculator. See Appendix 4 for more.

Measures have been grouped into different sectors, which also link directly to the sectors described within the annual emissions profile (the doughnut chart).

Each group of measures has some sort of activity focused on *demand-side* reductions, switching to electrified systems, or greening energy *supply*.



Industrial Processes
- More efficient processes
- Shifting off oil fuels

AFOLU
- Increased tree coverage
- Land management
- Livestock management
- Tree planting

Non-domestic Buildings
- More energy efficient heating
- Shifting off gas heaters
- Appliance and lighting efficiency
- Shifting off gas for cooking

Waste
- Producing less waste
- Increased recycling rates

Domestic Buildings
- Shifting off gas heaters
- Appliance and lighting efficiency
- Shifting off gas for cooking
- More energy efficient homes and new-builds

Transport
- Travelling shorter distances
- Driving less
- Switching to electric vehicles
- Improving freight emissions
- International aviation & shipping

Energy Supply
- Increased solar PV
- Increased biomass
- Increased solar thermal
- Increased wind
- Increased tidal, wave & hydro

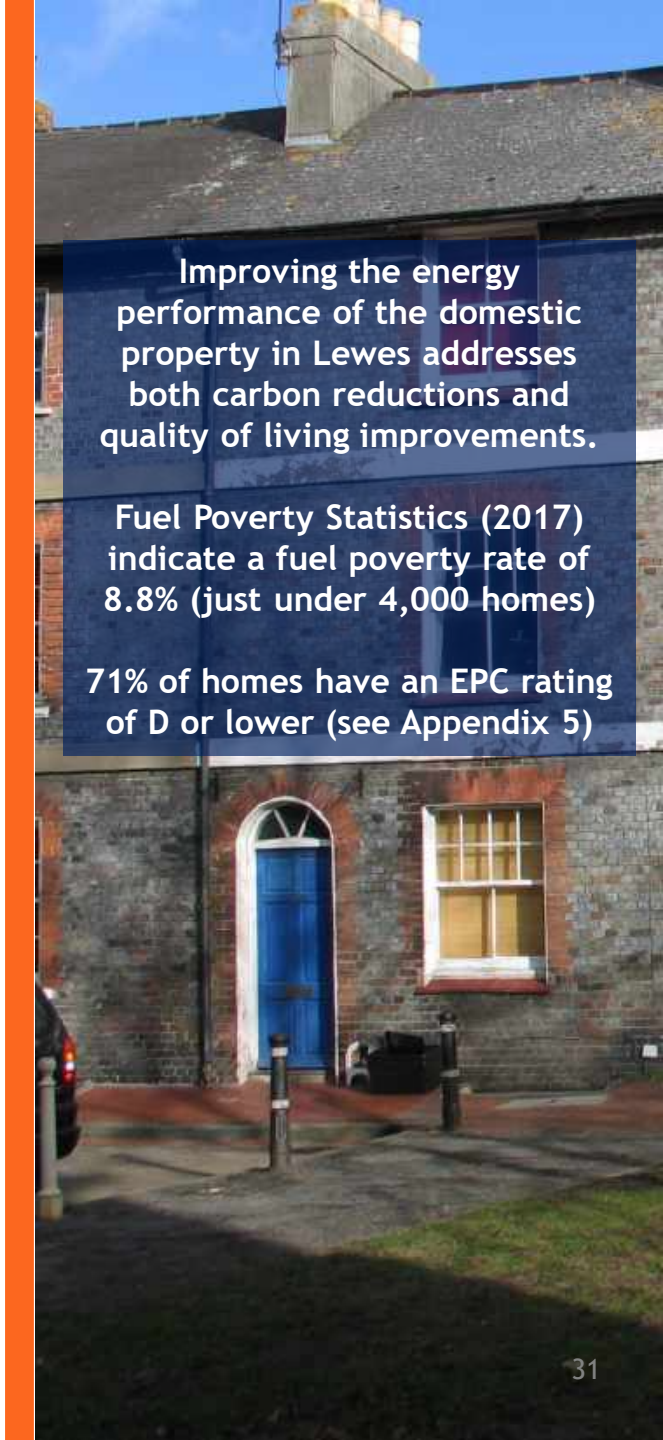
DOMESTIC & NON-DOMESTIC BUILDINGS

Buildings are responsible for **56%** of Lewes' emissions

Decreasing the demand for energy and electrifying our heating systems & appliances

The following measures relate to domestic households, commercial properties and institutional buildings, as well as industrial property. The first two measures consider demand-side reductions, whilst the second two consider the effects of electrification.

- More energy efficient homes and buildings: For domestic property, this measure considers changes in the energy demand for heating and cooling our buildings. Different retrofit options are considered for existing households, as well as the performance of new builds. For non-domestic property, SCATTER considers improvements to practices and buildings, including improvements to building fabric. "Non-domestic" includes commercial, industrial and institutional buildings.
- Appliance and lighting efficiency: Considers the reduction in energy demand from more efficient lighting and appliances, including electrical devices, and all forms of lighting and cooking.
- Shifting off gas heaters: Considers the uptake of non-fossil fuel sources for heating within homes and commercial properties, including heat pumps, district heating and combined heat and power networks (CHP). The impact of the fuel mix will be heavily influenced by the increased availability of renewable energy. No fuel mixes contain any hydrogen technology.
- Shifting off gas for cooking: Models the uptake of electrical cooking systems and discontinuation of gas cookers.



Improving the energy performance of the domestic property in Lewes addresses both carbon reductions and quality of living improvements.

Fuel Poverty Statistics (2017) indicate a fuel poverty rate of 8.8% (just under 4,000 homes)

71% of homes have an EPC rating of D or lower (see Appendix 5)

More energy efficient homes - retrofitting & new builds

The energy we use within buildings is a significant driver of emissions. Tackling the causes behind energy demand can be met in a number of ways. Chief among these is the retrofitting of homes and ensuring that new builds are built to high efficiency standards.

We can think of retrofit measures as improvements to a building's energy performance; they include things like insulation (of windows, floors & ceilings) and improved ventilation. Retrofitting serves to drive down the energy required to heat a building. Currently, household retrofitting is led largely by the government-led ECO scheme. The nature of these retrofit measures vary widely, though the majority (roughly two-thirds) are some form of insulation. SCATTER makes its estimations based on two levels of retrofit:

- Medium – a 66% reduction in annual average energy demand through inner wall insulation.
- Deep – an 83% reduction in annual average energy demand, through inner & external wall insulation.

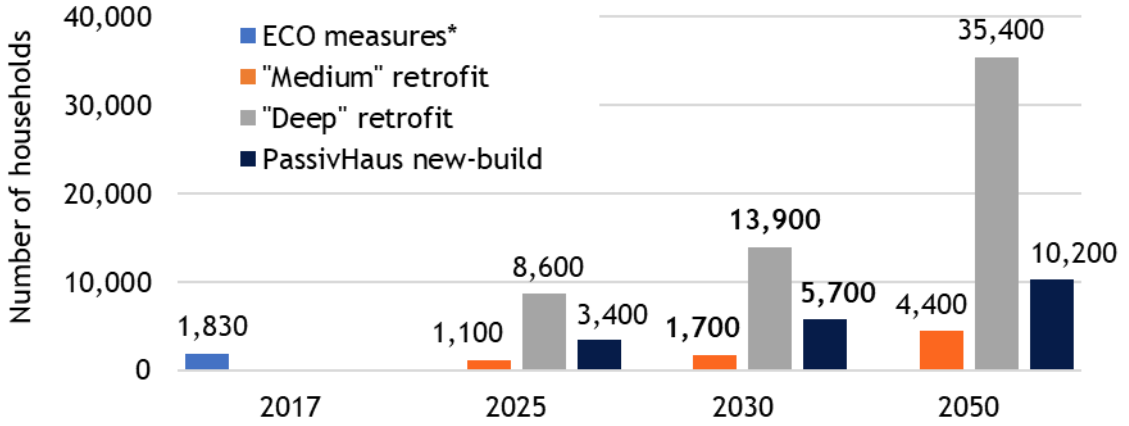


Figure 5: Indicative targets for the improvement of household energy efficiency. *ECO measures are included as a current context proxy. It is worth acknowledging that the subsequent improvements to efficiency from ECO measures are much more modest than the "medium" retrofit level described within SCATTER.

New builds must also be constructed to extremely high energy performance standards.[1] A PassivHaus standard home operates using roughly 10% of the average demand for a typical house.

SCATTER forecasts an extra 5,700 homes will be built between 2020 and 2030 within Lewes, an increase of around 13% on the existing number. The High Ambition Pathway demands these new builds are constructed to PassivHaus standard.

1 – A "high performance" building (as defined by the Association for Environment Conscious Building) operates using roughly 25% of the average energy demand for a typical house.

More energy efficient buildings – demand reduction for heating

The aim of retrofitting is to drive down the energy demand for heating and hot water in buildings. Alongside behavioural change and other efficiency improvements, SCATTER measures this demand reduction in terms of energy usage:

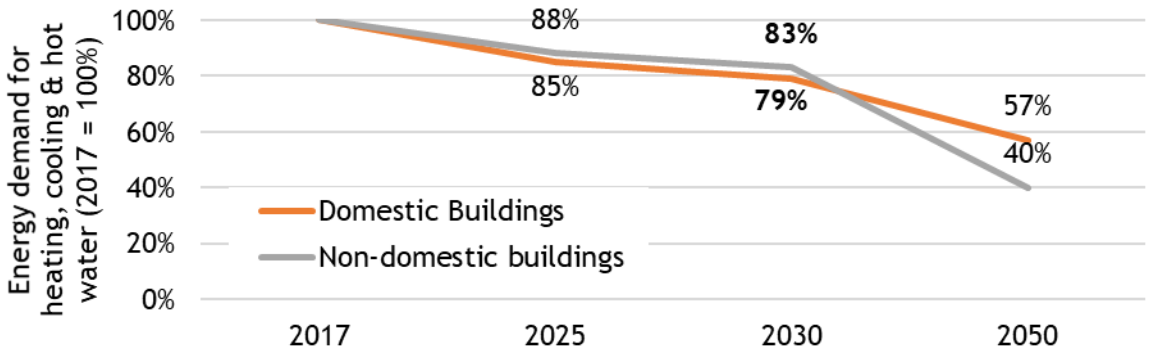


Figure 6: Energy demand reduction changes for heating, cooling and hot water, defined against a 2017 baseline. Since the number of different building types is much larger for non-domestic buildings than for households, more specific retrofit measures are not modelled within SCATTER. Instead, only the energy demand is modelled.

The reductions in demand also take into account improvements to the efficiency of new water heating systems. Domestic demand is measured in terms of energy required per household. Reductions are applied to whatever fuel the household is using i.e. accounting for more efficient gas boilers as well as electrical heating systems.

Appliance & lighting efficiency

The graph below plots a reduction in the net energy demand from lighting and appliances. Reductions are measured against a baseline of 2017 data. Both domestic and non-domestic buildings are considered.

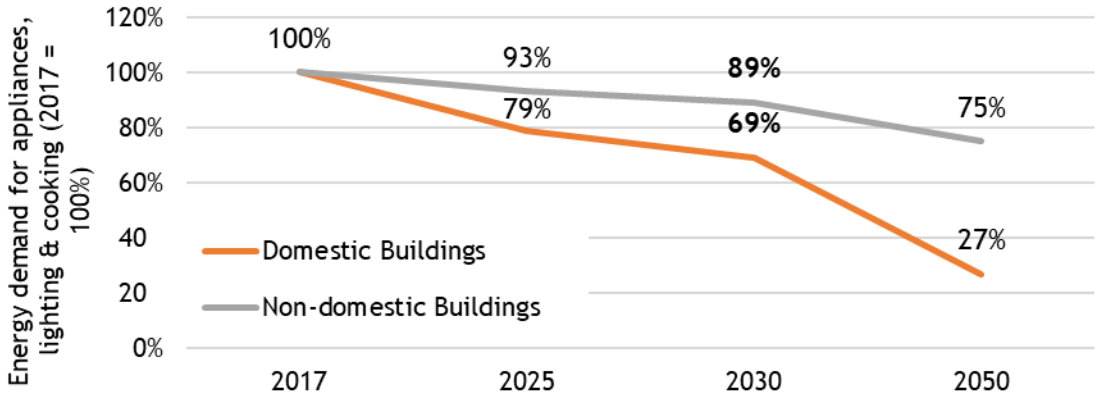
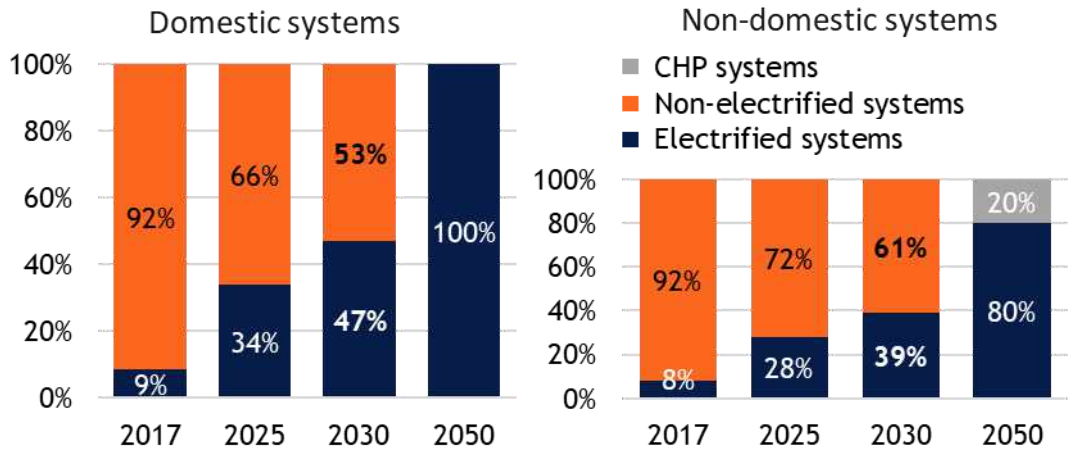


Figure 7: Energy demand reduction changes for appliances, lighting and cooking, defined against a 2017 baseline.

Shifting off gas for heating

Making demand-side reductions underpins significant progress for reducing emissions, with further significant steps being made in using low-carbon technologies for heating and cooking. The rate of decarbonisation of the electricity grid will have a significant impact on the potential emissions reductions for certain technologies (see page 46). In other words, there is little value to be gained in switching to electrified systems if the carbon intensity of the grid remains high.

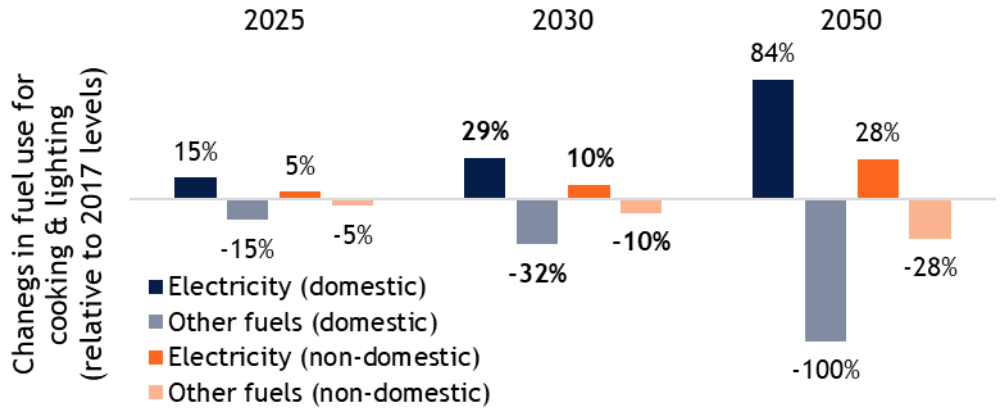
Figure 8: The changing technologies used for heating our buildings.



Shifting off gas for cooking

The graph below plots the uptake of an increased number of electrified cooking systems, again for both domestic and non-domestic buildings. Consideration is also made for systems which are not necessarily electrified, but are more energy efficient than existing systems. For the most part, the uptake of electrified cooking systems directly reduces other fuel usage, though efficiency improvements also serve to reduce the fossil fuels used for cooking.

Figure 9: Changes in fuel demand for cooking, given uptake of electrified systems.



LOCAL

Best Practice

Warmer Sussex, launched in October 2019, offers domestic retrofit services using through local tradespeople across East & West Sussex

East Sussex Fuel Poverty Reduction Programme includes retrofitting measures and behaviour change initiatives to improve energy performance

NATIONAL

Best Practice

Trent and Dove Housing retrofit programme includes the installation of ground-source heat pumps for 130 residents

Exeter City Council have developed 103 PassivHaus certified homes as part of their low energy development plans

Yorkshire's Zero Carbon cross-sector working group promotes zero carbon domestic buildings which underpins strategic planning policy

Camden's Passivhaus project is the largest residential new-build project for Passivhaus standard properties.

POLICY

Drivers & Levers

Gas boilers will be banned in **new** homes from 2025

Clean Growth Strategy set targets to upgrade as many houses to EPC band C by 2035 (2030 for all fuel-poor households)

Third phase of the Energy Company Obligation (ECO3) will conclude in 2022

The Future Homes Standard provides an update to Part L of the building regulations

Minimum energy efficiency standards (MEES) in the private rented sector and non-domestic property prevents landlords from letting properties rated below EPC Band E

LOCAL

Best Practice

East Sussex schools have made use of an LED retrofit scheme which cuts electricity consumption significantly, led by czone, funded in many cases by Salix loans (see opposite)

LOCASE scheme was recently extended into September 2020, offering grant funding which improves the energy efficiency of SMEs in East Sussex

NATIONAL

Best Practice

Cornwall Council have piloted the use of ground source heat pumps at Tolvaddon Energy Park as part of a £4m investment in 19 commercial units

The Carbon Trust's Green Business Fund has supported hundreds of small businesses to identify energy savings and energy efficiency improvements

Keynsham Civic Centre aims to be one of the lowest energy-consuming public buildings in the UK, incorporating EPC A rated measures into the design process

POLICY

Drivers & Levers

The UK Green Building Council was set up in 2013 to investigate and recommend new ways forward to reach zero-carbon buildings

Salix Finance offers 100% interest-free capital across Great Britain to deliver energy-saving measures across public sector organisations

MEES consultation for privately-rented non-domestic buildings closed in January 2020

The Government's preferred target is that non-domestic property owners in the private sector achieve EPC band B ratings by 2030 across all properties

TRANSPORT

On-road transport is responsible for **35%** of Lewes' emissions

Changing the way we travel & phasing out fossil fuel vehicles

Transport measures consider changes in behaviour around transport, as well as the adoption of more electric vehicles for our journeys:

- Travelling shorter distances: A change in the overall mileage travelled per passenger across all forms of transport. Increases in population are also taken into account in this measure.
- Driving less: Changes to the means by which passengers travel, defined by miles travelled. These are broken down into car (which includes petrol, diesel, hybrid and electric vehicles), active (walking and cycling) and public (train and bus).
- Switching to electric vehicles: Considers the speed of the uptake of electric cars, trains and buses and phasing out of petrol and diesel vehicles. The impact of this measure is influenced by both the demand-side reductions and grid supply from renewable energy supply. The tool does **not** consider hydrogen-fuel vehicles.
- Improving freight emissions: Considers changes to both the fuel efficiency and mode of travel for freight and commercial journeys. Within Lewes, there are approximately 7,200 LGVs and HGVs registered.[1]
- International aviation and shipping: Applies government projections for aviation and percentage changes in fuel use at UK ports.

1 – Government vehicle statistics (table veh0105)

Modal shift: Replacing one means of transport with another, normally to reduce congestion e.g. commuting by bus or train rather than by car.

Travelling shorter distances

This measure models the reduction in total travel demand – across all transport modes – per person. Travelling shorter distances can be achieved in a number of ways; the COVID-19 pandemic encouraged large numbers of people to find remote working solutions, such as home offices or remote working. Changes to transport infrastructure, public transport services and traffic management can are also key drivers for reducing the average distance travelled per person.

This intervention also considers increases in population between 2030 & 2050.

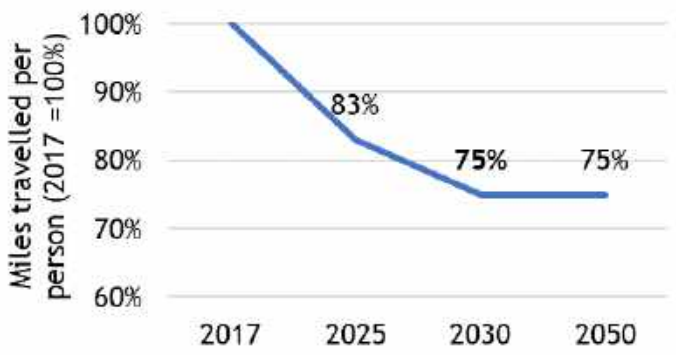


Figure 10: The shortening of the average number of miles travelled per passenger across all modes.

Between 2002 and 2018 the average distanced travelled per passenger per year in the UK dropped over 9%.

Driving less

As well as reducing the average distance travelled per passenger, SCATTER also considers changes to the *mode* of travel i.e. the means by which the journey was completed. SCATTER breaks these modes of transport into private vehicle (i.e. cars), public (which includes buses and trains) and active (i.e. walking & cycling).

Emissions savings can be made by reducing the modal share of private vehicles and increasing the proportion of people who travel by bicycle or train.

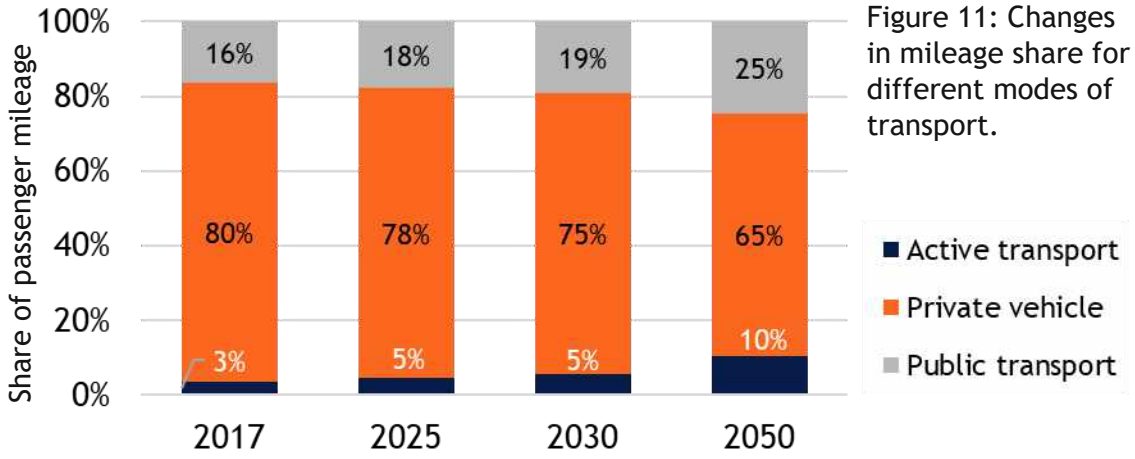


Figure 11: Changes in mileage share for different modes of transport.

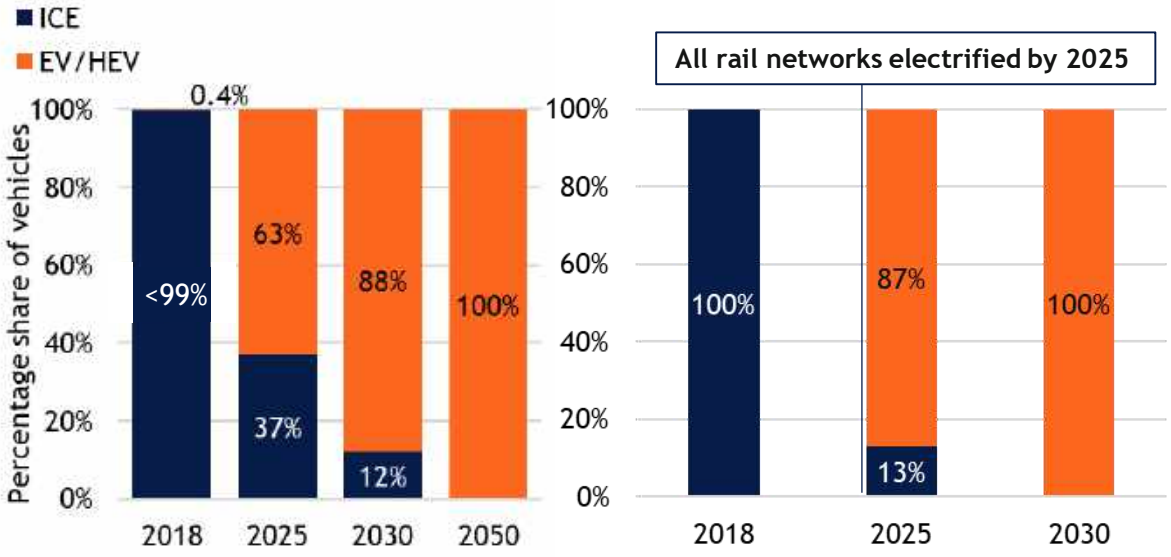
Transport glossary

EV – Electric vehicle
ICE – Internal combustion engine
HEV – Hybrid electric vehicle

Switching to electric vehicles

One of the most important steps to reducing transport emissions in Lewes district is the transition to electric vehicles. As with other measures around electrification, the success of the switch to EV relies heavily on grid decarbonisation and renewable electricity supply.

Fig 12: Changes in the share of electric vehicles for private vehicles (left), and public transport (right).



Improving freight emissions

Freight emissions are notoriously challenging to tackle. Limitations to existing electric battery technology for HGVs mean that within SCATTER, electric vehicles for freight are only modelled after 2040. SCATTER accounts for three things which improve freight emissions:

1. Improved journey efficiency: reducing the mileage travelled by HGVs through more efficient infrastructure and fewer "empty-trailer" journeys.
2. Improved efficiency of freight vehicles themselves i.e. a reduction in energy used per mile travelled as more fuel-efficient (and eventually, electric) vehicles are used.
3. A modal shift from road freight to waterborne transport.

The graph overleaf plots these three measures to 2050, with 2017 serving as the baseline. All percentage changes are with respect to the 2017 figure (i.e. in 2050, the energy demand per mile travelled is 25% the current figure).

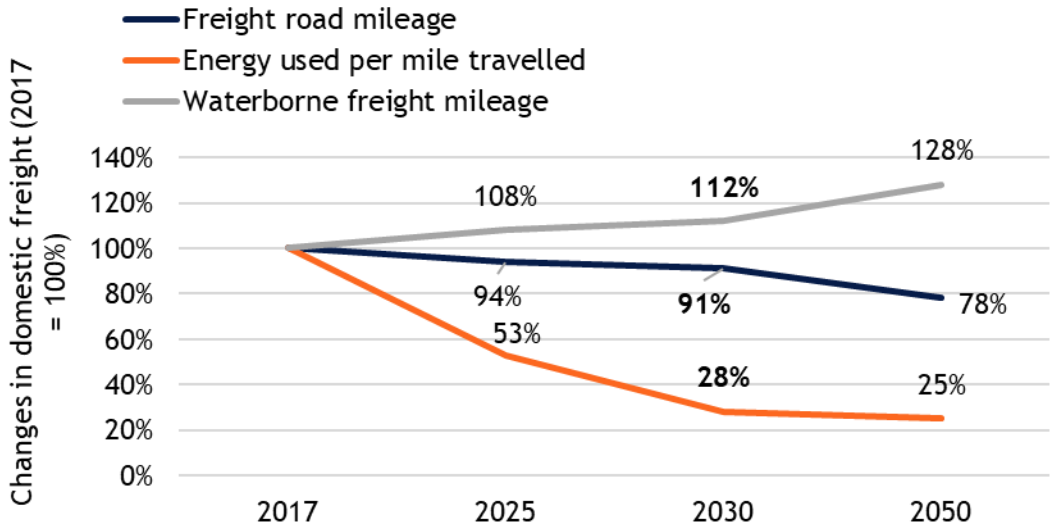
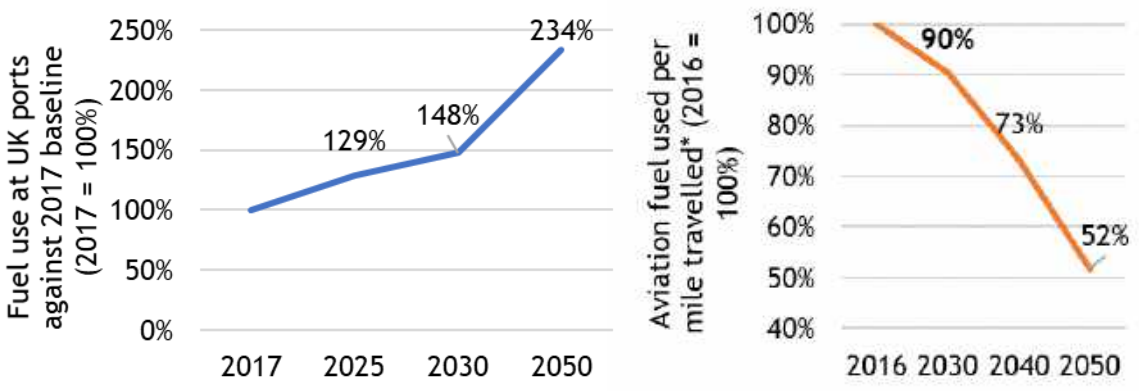


Figure 13: Improving freight emissions across three areas of activity.

Aviation & shipping

The Department for Transport (DfT) "central" forecast for aviation was modelled within SCATTER, which represents the baseline trajectory for aviation emissions in the UK. It is worth noting that these forecasts were made pre-COVID-19 and the future of aviation emissions is uncertain. The DfT scenarios model various factors related to aviation, including passenger mileage, fleet mix, fuel mix and other efficiencies. Trajectories for international shipping have been modelled based on assumptions used in the DECC 2050 Pathways calculator for fuel use from marine bunkers. These are also based on a fixed fuel mix and derive from DfT scenarios, before being applied to fuel usage at UK coastal ports.

Figure 14: Left: Projected changes in fuel usage at UK ports, from DfT scenarios. Right: Projected improvements to fuel efficiency according to DfT scenarios. *listed as improvement to fuel efficiency in the DfT report.



LOCAL

Best Practice

Brighton & Hove initially announced 30 new hybrid buses with the capability to run in a 'zero-emissions mode' through the city's Ultra Low Emissions Zone – this number has since grown

Lewes District Council owns two EV charging points and are developing a strategy to install more within their car parks

Co-wheels Car Club operates five small vehicles in Lewes town, travelling just under 70,000 miles in the 12 months to February 2020. Each car club vehicle is estimated to take between 9 and 15 cars off the road

NATIONAL

Best Practice

Edinburgh City Council's Electric Vehicle Framework outlines that in residential developments where there are 10+ parking spaces, every 6 spaces should include an electric vehicle charging point

London Borough of Waltham Forest has a dedicated scheme to improve walking and cycling has developed 24km of cycle route and trained 15,000 to cycle

Nottingham City Council introduced a Workplace Parking Levy congestion charge to the reduction of the number of free workplace parking places provided to staff and switch to alternative modes of transport

POLICY

Drivers & Levers

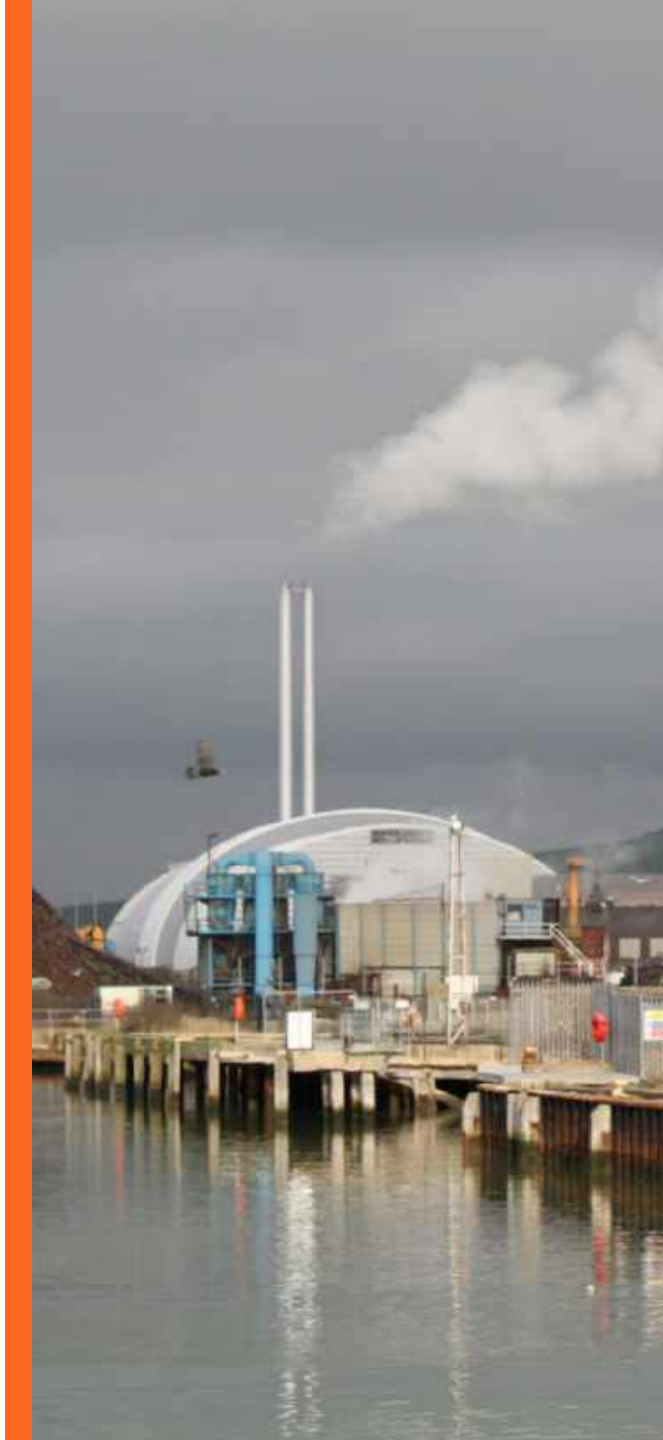
Go Ultra Low is a national scheme aiming to inform consumers and promote the savings associated with switching to EV

Moving Forward Together strategy commits bus operators to only purchase ultra-low or zero carbon buses from 2025. The current definition for an ultra-low emissions bus target is a 30% reduction in GHG emissions against Euro VI average performance

The UK government has the ambition to stop the sale of petrol and diesel cars by 2040 and instead switch entirely to electric vehicles

WASTE & INDUSTRY

Waste & industrial processes are responsible for **4%** of Lewes' emissions



Improving waste streams

The measures which relate to waste emissions are:

- Producing less waste: Considers changes in the overall weight of waste produced across all streams from domestic, commercial and industrial activity.
- Increased recycling rates: Considers the different destinations for waste streams.

Cutting industrial emissions

The following industrial measures are defined within the tool:

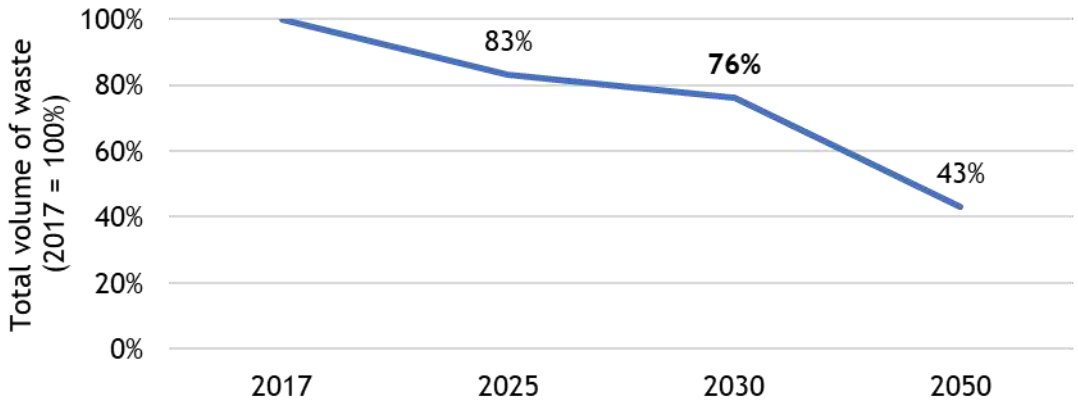
- Shifting off oil fuels: Considers changes to the energy consumption in industrial processes and activity. Trajectories measure the changing fuels used – and what proportion of processes can be powered with electricity and natural gas rather than heavier oil fuels.
- More efficient processes: Considers annual reductions in process emissions via a reduction in the production index of various industries. Separate trajectories are included for chemical, metal and mineral sectors, with all other industrial activity grouped together (labelled as "other" industry).

Producing less waste

The first step in improving emissions from waste is a reduction in the total volume of waste produced. This reduction covers waste from households, commercial & industrial usage, construction & demolition.

In Lewes, each household was responsible for an estimated 670kg of waste in 2018/19, of which approximately 40% was recycled. For non-household waste, the recycling figure drops to 7%.

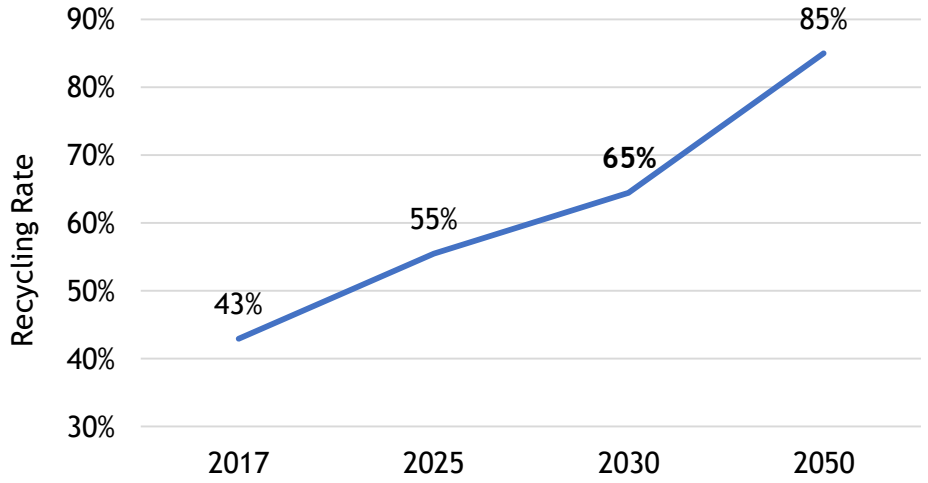
Figure 15: Reductions in the overall volume of waste produced within Lewes district.



Increased recycling rates

After reducing the amount of waste produced outright, the second SCATTER intervention considers changes to the amount of waste that is recycled. SCATTER trajectories incorporate EU targets for a recycling rate for municipal waste of 60% by 2035, rising to 65% by 2035.[1]

Figure 16: Growth in the recycling rate within Lewes district.

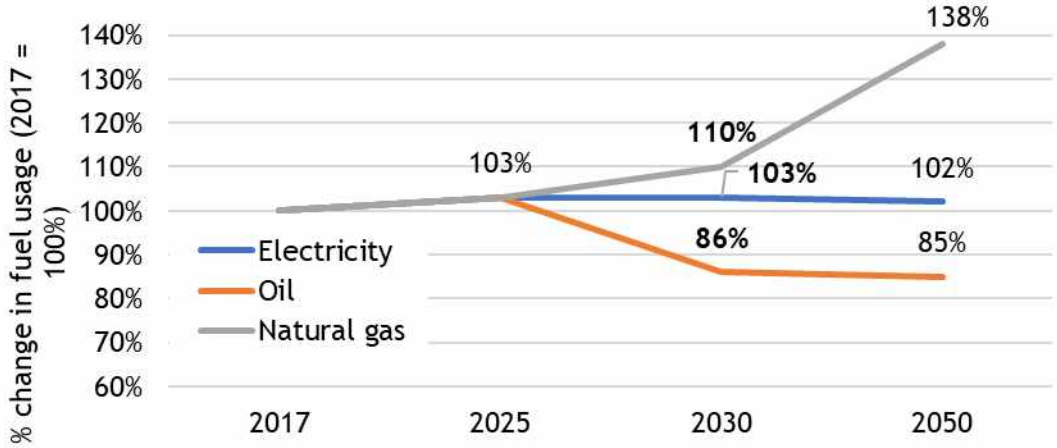


1 – These targets have since been revised to a higher level of ambition (65% by 2030), though this occurred after the development of SCATTER.

Shifting off oil fuels

Tackling industrial emissions can be extremely challenging, particularly the decarbonisation of very energy-intensive processes and reducing the emissions from the processes themselves. For the chemicals, metals and minerals industries, SCATTER models the changing use of fuels for these processes, shifting off the most carbon-intensive fuels (i.e. fuel oil) in favour of transition fuels such as natural gas.

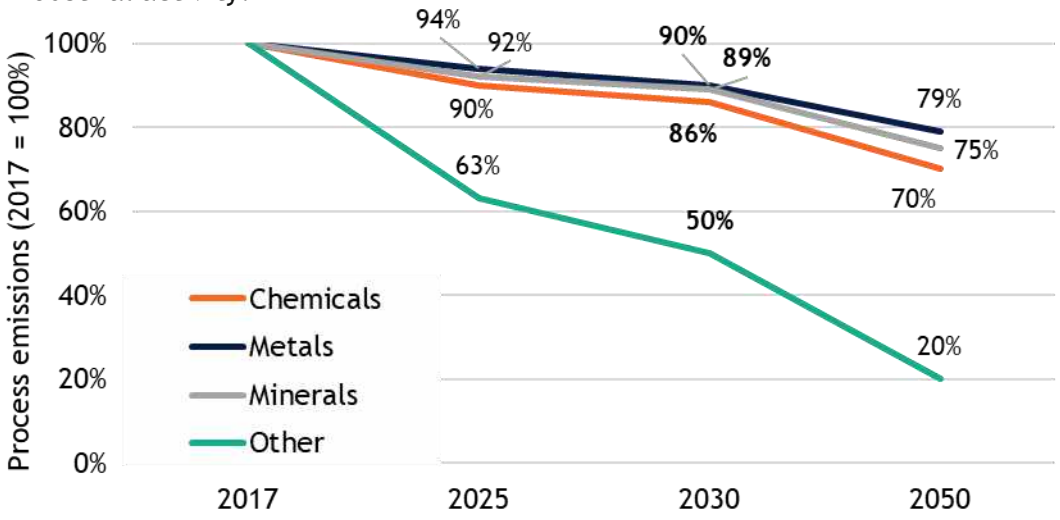
Figure 17: Changes in the fuel consumption within the industrial sector.



More efficient processes

This intervention considers the growth of different industries' greenhouse gas emissions that result from the industrial processes themselves. Process emissions arise from the manufacture and/or production of materials, chemicals and other products e.g. through combustion.

Figure 18: Reductions in process emissions. Separate trajectories are measured for chemicals, metals and minerals industries. "Other" industries covers all other industrial activity.



LOCAL

Best Practice

Brighton & Hove Food Partnership coordinate community composting schemes to help residents reduce food waste going to incineration under the East Sussex waste contract

East Sussex has developed a Good Practice Guide to assist property developers with their waste storage facilities

NATIONAL

Best Practice

Powys Council achieved the greatest reduction in carbon associated with recycling in the UK, partly due to shifting of the collection schedule

Loughborough University are leading innovation in food waste processing with industry partners

POLICY

Drivers & Levers

The UK has a recycling target for packaging of 70% by 2030

The Waste and Resource Strategy defines a 25-year plan for England to increase the value received from waste and promote a circular economy

An extended producer responsibility for packaging material is planned for introduction in 2023

ENERGY SUPPLY

Meeting demand with green energy

The measures described so far across the buildings, transport and industry sectors are heavily influenced by the provision of renewable electricity from zero-carbon sources. SCATTER considers a wide range of renewable technologies:

- Wind: Both onshore and “small-scale” wind are considered for Lewes. Small-scale is defined as power generated from sources that are not Major Power Producers.
- Solar PV: As with wind, installed capacity from both Major Power Producers and “small-scale” sites is considered.
- Biomass/coal power stations: Switching from fossil fuels to biomass generation in power stations.
- Hydroelectric power: Scaled to the local authority level by area of inland water.

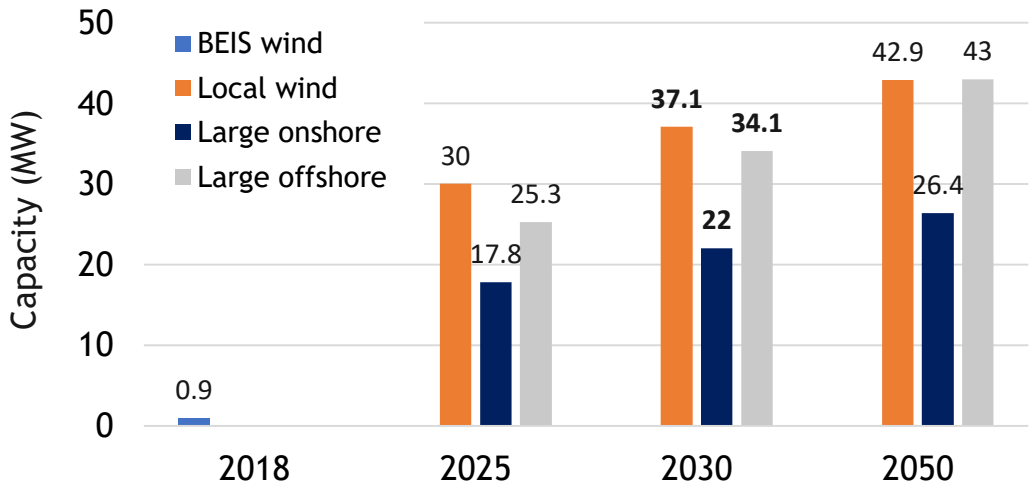
Offshore wind, as well as tidal and wave power, are applied only to local authorities with pre-existing installations. The suggested capacities are scaled to Lewes by energy consumption, except where stated otherwise. For all of the supply technologies referenced in this section, if the technology is not deemed feasible within Lewes to the suggested extent, the residual capacity is assumed to occur outside the boundary.

Major Power Producers - organisations whose prime purpose is to generate energy.

Wind

Wind power technologies vary between local, on- or off-shore installations. A typical on-shore wind turbine has a capacity of 2.5 MW, with off-shore turbines typically of higher capacity (e.g. those at Rampion Wind Farm off the West Sussex coast have a 3.5 MW capacity).

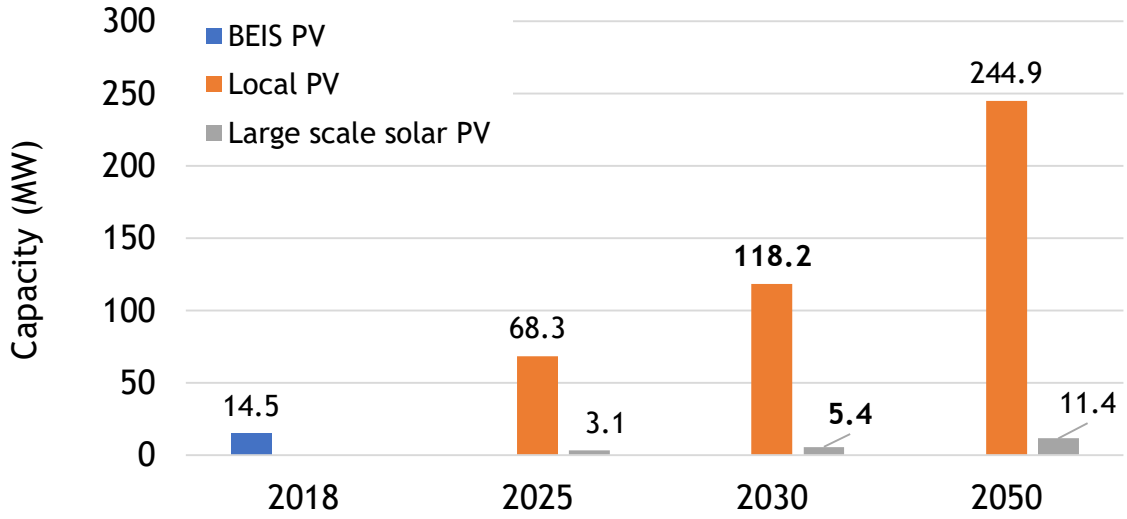
Figure 19: comparing the SCATTER outputs against the recorded installed capacity from BEIS renewable energy statistics.



Solar PV

Similarly, solar PV technologies can be split out into local installations, and larger sites for ground- or roof-mounted arrays. According to the Energy Saving Trust, the typical household array capacity is between 2-4 kW.

Figure 20: Comparing the SCATTER outputs against the recorded installed capacity from BEIS renewable energy statistics.



Biomass

Biomass within SCATTER is assumed to displace fossil fuels as an energy source for generation in power stations. The combustion of solid biomass fuels (such as woodchips or chicken litter) still releases greenhouse gases into the atmosphere, albeit with a much smaller impact than that of coal or natural gas.

The current installed capacity within Lewes for all biofuels is 25.3 MW, largely down to the solid waste facility at the Newhaven energy recovery facility.

For the High Ambition pathway, generation in power stations from solid biomass fuels is modelled to increase fourfold by 2025, before dropping off to very low levels by 2050. Without the coupling of biomass generation to carbon capture and storage technology, there will always be residual emissions associated with the consumption of solid biomass fuels.

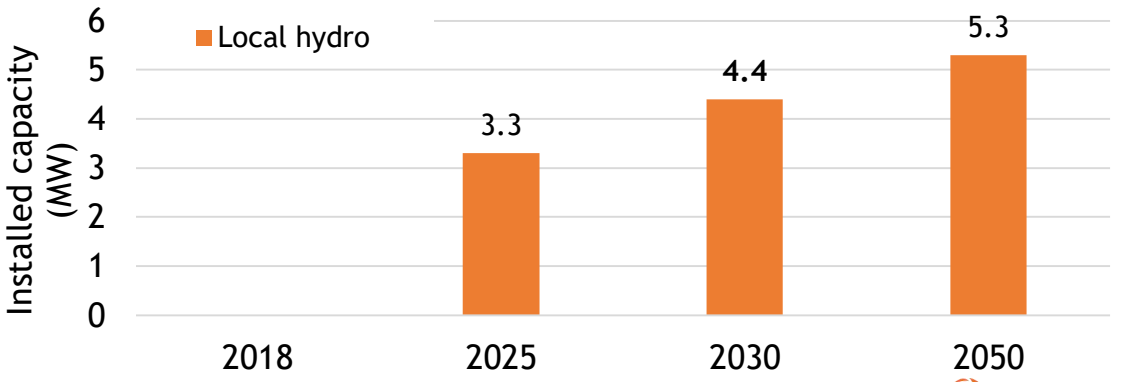
The phasing out of coal and natural gas follow trajectories in the National Grid Two Degrees scenario.

Other renewable technologies

The other technologies considered within SCATTER are wave, tidal and hydro power stations. Local wave, tidal & large scale hydro projects have not been forecast on the basis that no existing capacity exists within Lewes district. The tool only models a percentage increase on existing installed capacity for these technologies rather than new installations.

However, small scale hydroelectric projects have been identified as suitable for the Lewes district, despite no current installed capacity for hydroelectric power.

Figure 21: SCATTER-modelled growth in installed capacity for local hydroelectric power in Lewes.



LOCAL

Best Practice

The local cooperative OVESCO installed solar PV panels on the Harvey's Brewery depot roof in Lewes, saving about 26 tonnes of CO_2e per year and providing an annual return of 11.7%

Community Energy South, based in Lewes, is an umbrella organisation for local community energy groups & organisations to develop new local energy project initiatives.

Lewes District Council has allocated £500,000 as part of a project aimed at decarbonising local social housing and is facilitating a Community Energy Forum to enable the council to work in partnership with community energy groups to increase renewable energy generation

NATIONAL

Best Practice

Warrington Borough Council own two solar farms outside of the borough. Enough energy is generated to power a town and it is expected to generate income for the local authority

Forest Heath Council own the solar farm at Toggam Farm, Lakenheath and have used the proceeds to plug funding gaps in frontline services

Stockport Hydro was Greater Manchester's first community owned hydroelectric project. It has been operational since 2012 and generates enough clean energy to power 60 homes

POLICY

Drivers & Levers

The UK government has set a target to achieve 15% of its energy consumption from renewable sources by 2020.

Contracts for Difference scheme is the governments principal mechanism for encouraging investment in renewables

UK National Energy and Climate Plan sets out integrated climate and energy objectives, targets, policies and measures for the period 2021-2030

RENEWABLE ENERGY SUPPLY – COMPARATIVE STUDY

The feasibility of given renewable technologies varies greatly from district to district, given the constraints of local contexts and factors (e.g. wind farms in a geographically small area, or domestic PV uptake in a region with few households etc.). The below table is intended to serve as a reference for the variety of technologies available across a number of regions that are roughly comparable in terms of their economic output and number of households:

Local Authority	Households	GVA per head (£/capita)[1]	Installed capacity, selected renewable technologies (MW)				Total installed capacity (MW)	Renewable energy capacity per unit area (kW/km^2)	Emissions per head (tCO_2/capita)
			PV	Onshore Wind	Hydro	Organic fuels[2]			
Lewes	42,463	20,211	14.5	0.9	-	25.3	40.8	138	3.8
Eastbourne	+5.9%	-7.1%	5.1	-	-	-	5.1	113	2.9
Mid Suffolk	-3.5%	+2.4%	31.4	12.4	-	47.4	91.2	105	6.3
North Devon	-2.1%	+3.4%	75.3	86.4	0.3	1.0	163.1	148	4.9
Folkestone & Hythe (Shepway)	+8.7%	-6.8%	27.8	59.8	-	0.3	88.0	241	4.2
South Hams	-0.2%	+15.2%	122.4	0.8	1.4	0.6	125.2	138	6.5
South Staffordshire	+5.4%	-19.3%	20.0	4.1	-	33.1	57.2	140	8.4

Table 1: Listed percentages are relative to the figures for Lewes (i.e. there are 5.9% more households in Eastbourne than Lewes)
1 – GVA per head data is from 2016 (most recently available year). All other data is from 2017 (BEIS emissions data & renewable technology data).
2 – includes anaerobic digestors, sewage & landfill gas, municipal solid waste, animal & plant biomass

Lewes performs well against peer authorities in terms of its gross emissions per head of population. Lewes also performs well against neighbouring Eastbourne in terms of installed renewable capacity, as well as an average capacity per unit area. However, the total installed capacity for renewable technologies is comparatively low against similar districts, with regions of lower GVA output demonstrating higher levels of installed renewables.

AGRICULTURE & LAND USE

Lewes' livestock is responsible for about **4%** of total emissions

Lewes' natural environment acts as a carbon sink for approximately **8%** of total emissions

Managing natural infrastructure

The use of green spaces and the natural environment has a significant role in acting as a carbon "sink" – meaning that it removes carbon emissions from the atmosphere in the form of trees, peat and other natural features.

- Increased tree coverage: Considers the increase in the proportion of land which is forest cover.
- Tree planting: Considers changes to the coverage of trees outside of woodland, through new trees being planted and maintenance of existing trees.
- Land management: Considers changes to green belt, grassland and cropland coverage.
- Livestock management: Considers changes in the number of livestock in the area (cattle, pigs, sheep and horses).

A more detailed analysis of agriculture and land use emissions will follow this report as a separate document, with a much more specific focus and different methodology to SCATTER.

Increased tree coverage & tree planting

Tree coverage and the associated sequestration potential has been separated out into “forest coverage” and “lone trees”. Forest coverage relates to areas of trees which can be defined as such by a land use map.

Lone trees instead relates to smaller wooded areas, hedgerows, trees contained within gardens and so on.

Year	Forest coverage	Tree planting outside woodlands (i.e. lone trees)
Current	2019 Woodland Trust survey[1] of Lewes indicate a woodland coverage of 24.9%	Tree planting outside woodlands is equivalent to roughly 35 lone trees per hectare in Lewes
2030	24% increase in forest coverage	Increase in lone tree coverage to around 47 lone trees per hectare

Land & livestock management

The sequestration potential for rural areas can also be maximised by transitioning towards natural features which absorb more carbon than grass- and cropland.

The Knepp Estate in Horsham is a pioneering local case study focused on *rewilding*, restoring land which was once intensively farmed to a wildlife conservation project.

Year	Land management	Livestock numbers decrease 0.5% annually
Current	3% reduction in farmed area, 5% reduction in grassland between 2013 and 2016	7% reduction in the total number of livestock between 2013 and 2016
2030	N/A	5% decrease on 2017 levels
2050	7% decrease in grassland; 1% decrease in cropland	14% decrease on 2017 levels

1 – Woodland Trust Surveys give data on tree coverage of parliamentary constituency, rather than local authority.

HIGH AMBITION PATHWAY: 2030 SUMMARY

By 2030, the emissions profile for Lewes is predicted to look very different from today. Concerted local actions can have a significant effect on district emissions, making reductions of around 65%.

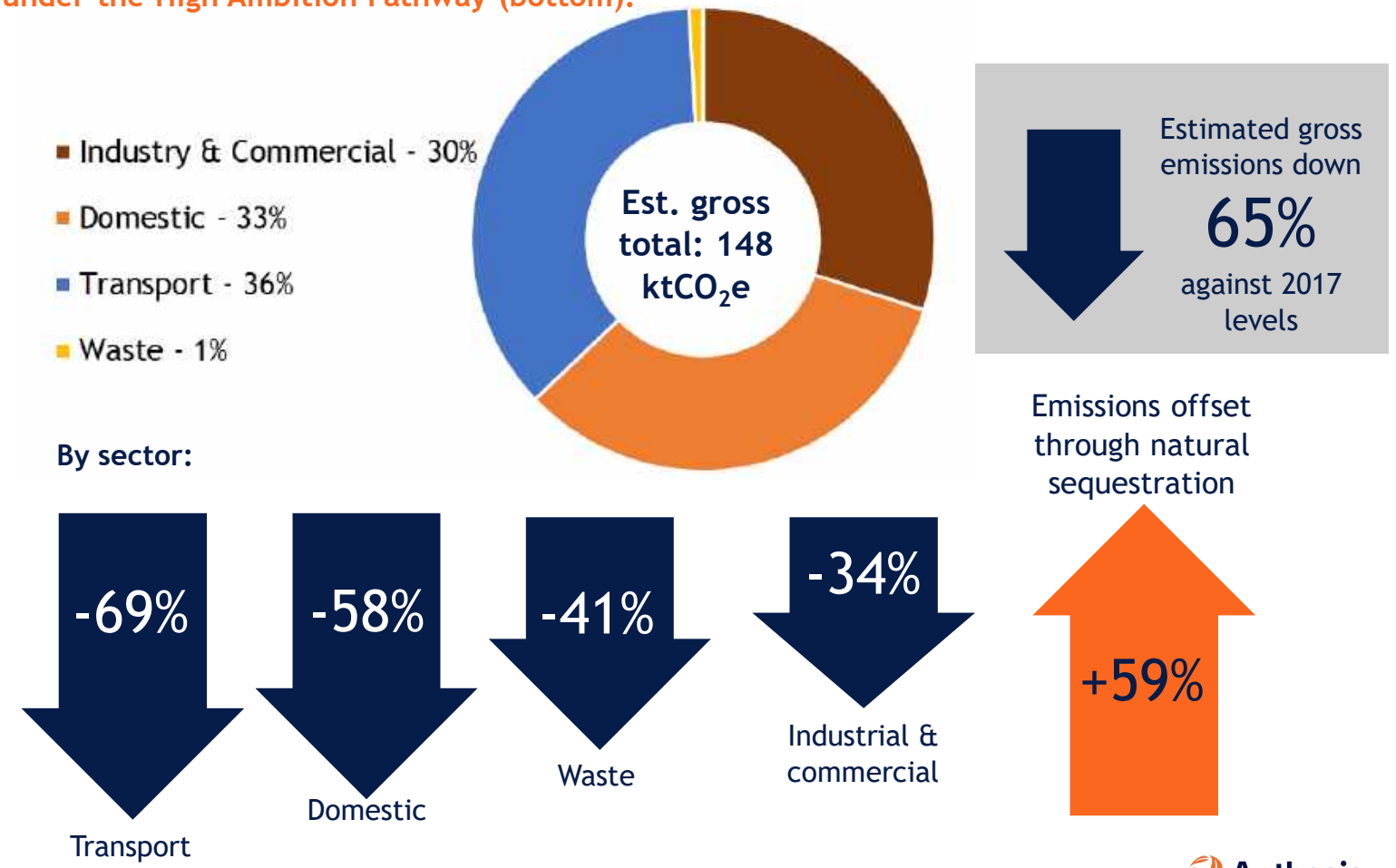
Tackling residual emissions – closing the gap to carbon neutrality

Despite the aggressive actions described, hard-to-remove emissions in industry and freight transport persist. Whilst emissions from the domestic and waste sectors are massively reduced, the scale of improvement is not enough to reach zero by 2030.

Offsetting strategies are recommended as a means of addressing these residual emissions.

Even at the most ambitious pathway, Lewes is not predicted to reach carbon neutrality by 2030. Despite emissions reductions of around two-thirds by 2030, emissions persist.

Figure 22: Estimated 2030 emissions profile (top). Emissions reductions in key sectors under the High Ambition Pathway (bottom).



Summary of Interventions to 2030

The following tables describe the 2030 interventions required to adopt the High Ambition Pathway (green line) for Lewes. All reductions are against a 2017 baseline except where stated otherwise:

Sector	Measure	2030 Intervention
Domestic buildings	More energy efficient homes & new builds	• 1,700 “medium” retrofit • 13,900 “deep” retrofit • 5,700 new builds to PassivHaus standard
Buildings	Reduced energy demand for heating, cooling & hot water	• Domestic: 21% reduction • Non-domestic: 17% reduction
Buildings	Reduced energy demand for appliances, lighting and cooking	• Domestic: 31% reduction • Non-domestic: 11% reduction
Buildings	Shifting off gas heating systems	• Domestic: 47% of heating systems are electrified • Non-domestic: 39% of heating systems are electrified
Buildings	Shifting from gas to electric for cooking	• Domestic: 29% increase in electric fuel usage for cooking • Non-domestic: 10% increase in electric fuel usage for cooking
Transport	Travelling shorter distances	• 25% reduction in the average number of passenger miles travelled per person
Transport	Driving less	Mileage share of different transport modes: • Active transport: 5% • Public transport: 20% • Private on-road transport: 80%
Transport	Switching to electric vehicles	• 88% of cars are EV or HEV • 100% of buses and trains are electric
Freight transport	Improving freight emissions	• 12% increase in waterborne freight mileage • 9% reduction in road freight mileage • 72% reduction in energy used per mile travelled • 148% increase in fuel use at UK ports

Sector	Measure	2030 Intervention
Waste	Producing less waste	• 24% reduction in the volume of waste
Waste	Increased recycling rates	• 65% recycling rate
Industry	Shifting off fossil fuels	• 14% reduction in oil fuel usage • 3% increase in electricity consumption • 10% increase in the use of natural gas
Industry	More efficient processes	Process emissions reduced: • 14% for chemicals • 10% for metals • 11% for minerals • 50% for other industries
Renewable energy supply	Wind	• Local wind: 37.1 MW installed capacity • Large onshore: 22 MW installed capacity • Large offshore: 34.1 MW installed capacity

Sector	Measure	2030 Intervention
Renewable energy supply	Solar PV	• Local PV: 118.1 MW installed capacity • Large scale PV: 5.4 MW installed capacity
Renewable energy supply	Biomass	• Declining usage having displaced fossil fuel sources in power stations
Renewable energy supply	Other renewables	• Local hydro: 4.4 MW installed capacity
Agriculture & land use	Forest coverage & tree planting	• 24% increase in forest coverage • Increase in lone tree coverage to around 47 lone trees per ha
Agriculture & land use	Land & livestock management	• 5% decrease in livestock numbers • 7% decrease in grassland • 1% increase in cropland

06 Appendices

APPENDIX 1: DATA TABLES FOR SCATTER AND BEIS PROFILES

Sector	Scope 1 & 2 Emissions, $ktCO_2$
Industry and Commercial Electricity	37.3
Industry and Commercial Gas	19.1
Large Industrial Installations	1.6
Industrial and Commercial Other Fuels	15.7
Agriculture	8.8
Domestic Electricity	46.1
Domestic Gas	88.3
Domestic 'Other Fuels'	16.3
Road Transport (A roads)	112.1
Road Transport (Motorways)	-
Road Transport (Minor roads)	64.8
Diesel Railways	5.7
Transport Other	0.8
LULUCF Net Emissions	-24.4
Grand Total	**392.3**

Sub Sector	Direct, $ktCO_2e$	Indirect, $ktCO_2e$
Residential buildings	103.1	63.9
Commercial buildings & facilities	6.9	5.6
Institutional buildings & facilities	13.9	28.1
Industrial buildings & facilities	13.1	16.3
Agriculture	6.1	0
Fugitive emissions	0	0
On-road	161.1	IE
Rail	5.0	IE
Waterborne navigation	0	IE
Aviation	0	NO
Off-road	1.6	IE
Solid waste disposal	2.4	0
Biological treatment	0	0
Incineration and open burning	0	0
Wastewater	6.4	0
Industrial process	7.9	0
Product use	0	0
Livestock	100.2	0
Land use	-37.8	0
Other AFOLU	0	0
Electricity-only generation	0	0
CHP generation	0	0
Heat/cold generation	0	0
Local renewable generation	0	0
Sub-total	**390.1**	**113.8**
Grand total	**503.9**	

Notes:

- BEIS data (far left) and SCATTER data (near left) are compiled using different methodologies.
- Within the SCATTER model, national figures for emissions within certain sectors are scaled down to a local authority level based upon a series of assumptions and factors.
- Figures for land use were omitted from the profile given in Section 1. The gross totals described in the emissions inventory have been adjusted to reflect this.

IE = Included Elsewhere
NE = Not Estimated
NO = Not Occurring

APPENDIX 2: SCATTER FAQ

What do the different emissions categories mean within the SCATTER Inventory?

Direct = GHG emissions from sources located within the local authority boundary (also referred to as Scope 1). For example petrol, diesel or natural gas.

Indirect = GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the local authority boundary (also referred to as Scope 2).

Other = All other GHG emissions that occur outside the local authority boundary as a result of activities taking place within the boundary (also referred to as Scope 3). This category is not complete and only shows sub-categories required for CDP / Global Covenant of Mayors reporting.

The BEIS Local Emissions Summary does not differentiate between direct/indirect/other (or the various 'scopes').

Note that the categories may not sum to 100% due to rounding.

What do the different sectors and subsectors represent within the SCATTER Inventory?

- **The Direct Emissions Summary and Subsector categories** are aligned to the the World Resource Institute's Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC"), as accepted by CDP and the Global Covenant of Mayors.
- **The BEIS Local Emissions Summary** represents Local Authority level data published annually by the Department for Business Energy & Industrial Strategy (BEIS).
- **Stationary energy** includes emissions associated with industrial buildings and facilities (e.g. gas & electricity).
- **IPPU** specifically relates to emissions that arise from production of products within the following industries: iron and steel, non-ferrous metals, mineral products, chemicals. These are derived from DUKES data (1.1-1.3 & 5.1).
- **Waterborne Navigation and Aviation** relate to trips that occur within the region. The figures are derived based on national data (Civil Aviation Authority & Department for Transport) and scaled to Lewes.
- The full methodology is available at http://SCATTERcities.com/pages/methodology

Why does the BEIS summary differ from the SCATTER summary?

- The BEIS summary **represents CO_2 only**; SCATTER also includes emissions factors for other greenhouse gases such as Nitrous Oxide (N_20) and Methane (CH_4). These are reported as a CO_2 'equivalents (e)'.
- The BEIS summary **does not provide scope split**; SCATTER reports emissions by scope 1, 2, and 3 (i.e. direct, indirect or other categories).
- **The BEIS summary categories are not directly consistent or mapped to the BEIS LA fuel data** which is available as a separate data set. SCATTER uses published fuel data and applies current-year emissions factors, whereas the BEIS data calculations scale down national emissions in each transport area. Specifically for road transport, BEIS data splits total emissions across road type; SCATTER uses fuel consumption for on-road transport per LA.
- **Different treatment of 'rural' emissions** i.e. Agriculture, Forestry and Other Land Use (AFOLU) and Land Use, Land Use Change & Forestry (LULUCF) categories are derived from different underlying data sets.

APPENDIX 3: DERIVING THE CARBON BUDGET

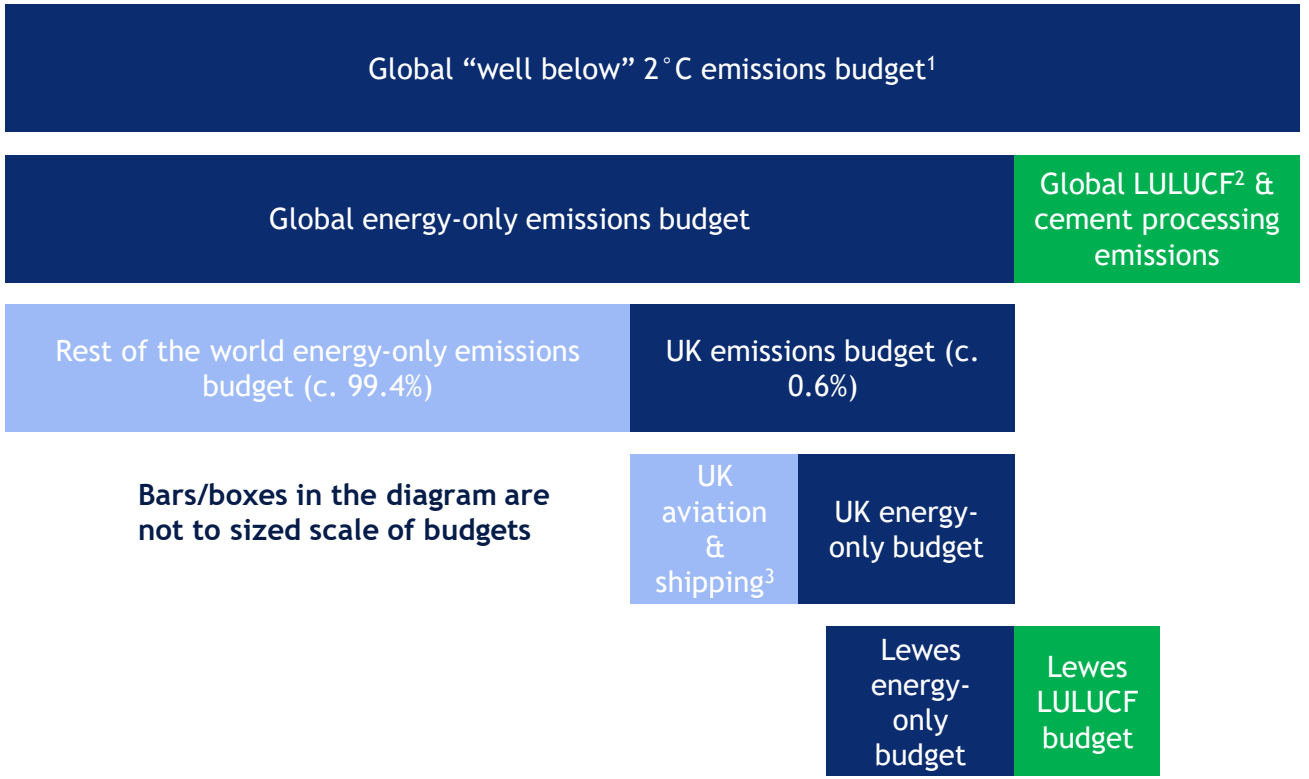
Lewes' Budget

The carbon budget (2,600 $ktCO_2$ for the period 2020-2100) sets out a finite emissions limit that the should not be exceeded in order that Lewes remains in line with the Paris Agreement. The budget itself is derived from a 'scaling-down' approach – a full methodology is available to view in the full print version of the Tyndall Centre's research.
The Tyndall Centre for Climate Change Research have based this budget on a 2°C global average temperature rise, on the basis that:

1. The Paris Agreement commits us to limiting warming to this level.
2. Global modelling for both 1.5°C and 2°C assume planetary scale negative emissions.

Negative Emissions Technologies (NETs)

NETs remain a highly speculative and uncertain development and are leaned upon heavily in IPCC models. Large-scale NETs are not likely to be viable within the boundary of Lewes due to the profile of emissions.
If research, development and demonstration of NETs shows that they may work at scale, and then they are rolled out globally at unprecedented rates, 1.5°C may theoretically be achievable. However this is only made possible if rapid, deep 2°C mitigation begins now and additional feedbacks do not occur.



1 - Budget derived from IPCC AR5 synthesis report and represents a 66-100% probability of global warming not exceeding 2°C ("well below"). Due to the inertia in our energy systems and the amount of carbon we have already emitted, the Paris 1.5°C commitment is now only likely to be viable if negative emissions technologies (NETs) prove to be successful at a global scale. If the 13.3% emissions reduction rates for Lewes are achieved and NETs are deployed at the scales assumed in the global models, then the targets adopted may be considered as a 1.5°C compatible. This also expressly assumes that other carbon cycle feedbacks, such as methane released due to melting permafrost etc., do not occur, and that an overshoot of 1.5°C does not result in increased feedbacks that further accelerate warming at lower budgets than the IPCC budgets currently estimate.
2 - Land Use, Land Use Change & Forestry
3 - UK Aviation & Shipping is accounted for at the national level. If emissions due to aviation and shipping increases, then a smaller proportion of the UK-wide budget is available for the energy-only budget and vice versa.

APPENDIX 4: MODIFICATIONS SUMMARY

Measure	Updated from original Pathways Calculator?
Energy generation & storage	
Onshore wind	No (N)
Biomass power stations	Yes (Y)
Solar panels for electricity	N
Solar panels for hot water	N
Storage, demand shifting & interconnection	N
Geothermal	N
Hydro	N
CCS	N
Bioenergy sourcing	
Increase in land used to grow crops for bioenergy	Y
Reduction in quantity of waste	N
Increase the proportion of waste recycled	Y
Bioenergy imports	N
Transport	
Reducing distance travelled by individuals	N
Shift to zero emission transport	Y
Choice of fuel cell or battery powered zero emission vehicles	N
Freight: Shift to rail and water and low emission HGVs	N

Measure	Updated from original Pathways Calculator?
Domestic buildings	
Average temperature of homes	N
Home insulation	Y
Home heating electrification	Y
Home heating that isn't electric	N
Home lighting & appliances	N
Electrification of home cooking	N
Commercial buildings	
Commercial demand for heating and cooling	Y
Commercial heating electrification	Y
Commercial heating that isn't electric	N
Commercial lighting & appliances	N
Electrification of commercial cooking	N
Industrial processes	
Energy intensity of industry	Y
Domestic buildings	
Average temperature of homes	N
Home insulation	Y
Home heating electrification	Y

APPENDIX 5: EPC RATINGS

Lewes EPCs

- Energy Performance Certificates provide an energy efficiency rating from A (most) to G (least) and are valid for 10 years. It provides information on a properties energy use and typical energy costings.
- They can provide a good indication of the level of insulation and thermal leakiness of a property.
- Defining in terms of 'lodgements' allows direct comparison between domestic and non-domestic property.
- In Lewes, 72% of domestic properties carry a publicly available EPC rating
- Live reporting on the EPC ratings of all properties (both domestic and non-domestic) can be found at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-energy-performance-of-buildings-certificates#epcs-for-all-properties-non-domestic-and-domestic

Domestic EPC ratings for Lewes, 2008-19	
EPC Rating	Number of lodgements
A	10
B	960
C	7,960
D	13,575
E	5,938
F	1,770
G	469
Not Recorded	1
Total number of lodgements	30,683

Non-domestic EPC ratings for Lewes, 2008-19	
EPC rating	Number of lodgements
A	25
A+	2
B	105
C	406
D	471
E	249
F	91
G	97
Not Recorded	5
Total number of lodgements	1,451

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