

## Appendix - Summary of findings from the Net Zero Leicestershire Roadmap research report

### Baseline

1. There is no national guidance on how different types of emissions might be included in local authority action plans. However, the Global Protocol for Community-Scale Greenhouse Gas Inventories states that “an inventory boundary identifies the gases, emission sources, geographic area, and time span covered by a GHG inventory. The inventory boundary is designed to provide a [county] with a comprehensive understanding of where emissions are coming from as well as an indication of where it can take action or influence change.”
2. The Protocol requires that “the assessment boundary shall include all seven Kyoto Protocol GHG<sup>1</sup>s occurring within the geographic boundary of the [county], as well as specified emissions occurring out-of-boundary as a result of [county] activities. The inventory shall cover a continuous 12-month period. [Counties], by virtue of their size and connectivity, inevitably give rise to GHG emissions beyond their boundaries. Measuring these emissions allows [counties] to take a more holistic approach to tackling climate change by assessing the GHG impact of their supply chains and identifying areas of shared responsibility for upstream and downstream GHG emissions.”
3. In line with the Protocol, the baseline inventory of emissions for Leicestershire included in the Roadmap report is based on the latest annual (2019) national datasets produced by the Department for Business, Energy and Industrial Strategy for local authority territorial carbon only emissions, which cover direct emissions mainly from energy and fuel use within the county boundary.
4. To provide a more comprehensive assessment of the emissions related to activities in Leicestershire in line with the Protocol, these annual territorial carbon emissions have been supplemented with additional greenhouse gases (e.g. methane and nitrous oxide) related to these activities (4.5 Million tonnes CO<sub>2</sub>e<sup>2</sup> per year) and Leicestershire consumption emissions (an additional 4 million tonnes of carbon dioxide equivalent (MtCO<sub>2</sub>e) per year), these are emissions occurring out-of-boundary as a result of County activities. This gives a total annual greenhouse gas emission baseline for Leicestershire (territorial plus consumption) of 8.5 MtCO<sub>2</sub>e.

---

<sup>1</sup> The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto protocol covers seven categories of greenhouse gas (GHG) emissions: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF<sub>6</sub>) and nitrogen trifluoride (NF<sub>3</sub>).

<sup>2</sup> “Carbon dioxide equivalent” or “CO<sub>2</sub>e” is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO<sub>2</sub>e signifies the amount of CO<sub>2</sub> (carbon dioxide) which would have the equivalent global warming impact.

5. However, the scenario modelling to assess the pathways to net zero include a smaller scope of consumption emissions that more closely reflect the areas that could be influenced by the County Council and other local partners, and align to other objectives of related strategies and plans, specifically waste, water, food and drink and embodied emissions in new builds.
6. The predominant emission sources for Leicestershire are road transport (1.9 MtCO<sub>2</sub>e), domestic energy use (1 MtCO<sub>2</sub>e) and industrial and commercial energy use (1.1 MtCO<sub>2</sub>e).

### Scenarios modelled in the Leicestershire Net Zero pathways

7. The Net Zero Roadmap study has modelled four scenarios (the existing policy pathway and three additional) to understand the impact of different interventions on decarbonisation and the pathways to net zero for Leicestershire by 2045.
8. The pathways modelled include a Current Policy pathway, a Council Influenced Pathway, a Balanced Pathway, and a Tailwinds Pathway. The current policy pathway provides an understanding of Leicestershire's future emissions pathway under current policy and existing commitments at both a national and local level, for example, the petrol and diesel car ban and local tree planting ambitions. This is the 'Business as Usual' Scenario. More information on the assumptions included in the pathways are provided below.

	<b>Current policy pathway</b>	<b>Council Influenced</b>	<b>Balanced</b>	<b>Tailwinds</b>
<b>What this pathway illustrates</b>	Existing policy commitments	What the Council can achieve, and the collective action required to reach net zero	What Leicestershire could achieve following UK Government decarbonisation timeframes and interventions	What could be achieved through widespread, fast-paced change
<b>Ambition</b>	Low	High (only in Council Influenced areas)	High	Very High
<b>Key interventions</b>	<ul style="list-style-type: none"> <li>• Very low level of building retrofit for higher energy efficiency</li> <li>• Electrification of vehicles</li> <li>• Increase in vehicle mileage</li> <li>• Increase in waste and water demand</li> <li>• 65% of LCC collected waste recycled</li> </ul>	<ul style="list-style-type: none"> <li>• Retrofit of Council Influenced buildings (2% of total)</li> <li>• 2/3 buses switched to electric/hydrogen</li> <li>• Installation of photovoltaic solar panels (PV) on 25% of social housing and 40% of</li> </ul>	<ul style="list-style-type: none"> <li>• Widespread retrofit of buildings</li> <li>• Full EV roll out and decrease in vehicle mileage</li> <li>• Industry heat source switched to electric/hydrogen</li> <li>• High PV installation</li> </ul>	<ul style="list-style-type: none"> <li>• Near-total retrofit of buildings</li> <li>• Full EV roll out and decrease in vehicle mileage</li> <li>• Industry heat source switched to electric/hydrogen</li> <li>• Very high PV installation</li> <li>• Total reduction in embodied carbon of new builds</li> </ul>

		public buildings		
--	--	------------------	--	--

9. The Council Influence Pathway seeks to understand how the emissions trajectory can be affected solely through Council actions and areas of high influence. The pathway is based on current policy, plus more ambitious action by the County Council through its direct control and influence on the decarbonisation of public buildings (including those outside its ownership).
10. The Balanced and Tailwinds Pathways follow the principles of the national carbon budget assessments undertaken by the UK Climate Change Committee. Following these pathways has the advantage of applying the principles of the national assessment at the local level and there is a wealth of background evidence and information to inform these targets.
11. These pathways are based on much more ambitious action across all areas of the economy and society. The Balanced Pathway is the basis of the Climate Change Committee's advice on the UK Sixth Carbon Budget and includes a combination of high levels of public engagement and behaviour change to reduce demand, alongside the uptake of technological solutions.
12. The Tailwinds Pathway demonstrates a radical stretch scenario which is 'highly optimistic' in terms of behaviour change. The Leicestershire Tailwinds Pathway is a bespoke pathway and explores some locally specific opportunities such as the potential for advanced logistics to decarbonise HGV road transport earlier than national targets.
13. The Current Policy pathway shows a steady decrease in scoped emissions modelled in the study resulting in a 33% reduction between 2020–2045. The Council Influenced Pathway shows a small improvement (37%) in emissions reductions compared with the current policy pathway. The Balanced and Tailwinds Pathways both achieve notable reduction in emissions by 2045 (91% and 95% respectively). The Tailwinds Pathway is also notable in that it is the only pathway that delivers 50% reduction in carbon emissions by 2030, the definitive decade for climate action.

### **Emission savings impact assessment**

14. The Leicestershire net zero pathways modelling includes several emissions categories and interventions. The Impact Assessment considers the amount by which different emissions categories are reduced in each pathway, including the relative impact of some different interventions.
15. For the Tailwinds Pathway, emissions reductions are achieved in all emissions categories modelled. The greatest absolute emissions savings are modelled in the Tailwinds Pathway, in which fuel switching in the road transport and domestic/non-domestic buildings categories achieve savings of around 2,000 ktCO<sub>2</sub>e. Demand reductions through retrofit and reduced mileage save a further 1,000 ktCO<sub>2</sub>e in the same categories. Though Solar PV installation is associated with a relatively small amount of emissions savings in this pathway

(78 ktCO<sub>2</sub>e), renewables are a critical precursor to decarbonising the grid, have fuel saving benefits and create resilience across the County; they should therefore not be overlooked. High-levels of savings are achieved through industrial demand reductions and heat switching (665 ktCO<sub>2</sub>e), while the majority of the rest of emissions savings are the industry-wide reductions in consumption emissions in manufacturing and construction (new build embodied carbon and food & drink; over 1,000 ktCO<sub>2</sub>e).

16. Table representing the emissions impact assessment (Tailwinds Pathway)

Action	Emissions saving (ktCO <sub>2</sub> e)
Transport fuel switching	1,327
Water, waste and new build reductions	993
Heat switching (including grid decarbonisation)	829
Food and drink measures	682
Industrial measures	665
Demand reduction	539
Transport mileage	409
New PV installations	78
<b>TOTAL</b>	<b>5,522</b>

### Paris Agreement Compliant Pathway

17. Leicestershire County Council declared a climate emergency in May 2019. The declaration noted that “the UK has, at an international level, signed into the Paris Accord 2015 and to the commitments agreed in 2018 at the Conference of Parties to the UN Framework Convention on Climate Change (COP24) which amongst other things recognise the need to limit by 2030 temperature rises to between 1.5°C and 2°C above the internationally recognised pre-industrial baseline”.
18. The Tyndall Carbon Budget Tool presents climate change targets for UK local authority areas that are based on the commitments in the United Nations Paris Agreement, informed by the latest science on climate change and defined by science-based carbon budget setting. The Tyndall Centre Carbon Budget Tool (which focusses on direct energy related emissions) concludes that for Leicestershire to make its fair contribution to delivering the Paris Agreement's commitment to staying “well below 2°C and pursuing 1.5°C” global temperature rise, then an immediate and rapid programme of decarbonisation is needed. The County will need to stay within a maximum cumulative carbon dioxide emissions budget of 26.7 million tonnes (MtCO<sub>2</sub>) for the period of 2020 to 2100 to deliver a Paris Agreement compliant pathway.
19. None of the pathways modelled in the Net Zero Roadmap study for Leicestershire are Paris Agreement Compliant pathways, although the Balanced and Tailwinds Pathways approach the 2045 targets set out in the Tyndall Carbon Budget Tool. However, all the pathways modelled in the study emit substantially more than the total carbon budget defined by the Tool over the period between 2020 to 2045.

20. The inability of even the most ambitious policy pathways to align with a Paris Agreement compliant pathway highlights the major policy gap between current targets and the required pace of action, this has also been acknowledged in the UK Climate Change Committee modelling, and the dependence of national carbon budgets and targets on removals and negative emissions technologies to meet Paris Agreement goals (these are not modelled in the Leicestershire Net Zero Pathways).

### **Residual emissions**

21. Under all emissions pathways, Leicestershire is left with some annual residual emissions. As such, if net zero is to be achieved in any pathway carbon removals either through carbon capture and storage or offsetting would be required in 2045. These are in line with the proportion of residual emissions in the Climate Change Committee's Sixth Carbon Budget which assumes a certain amount of carbon removal technology and net emissions reductions activity will be required to meet net zero by 2050 in the UK.
22. The largest residual emissions categories in both the Balanced and Tailwinds Pathways are:
- a) Road transport – a small amount of residual emissions resulting from HGV vehicles that have not switched to electric or hydrogen fuel by 2045;
  - b) Industry and building emissions – because of latent carbon in the electric grid and hydrogen sources. Industry emissions categories also include agricultural emissions, which may prove hard to reduce; and
  - c) Other GHGs – non-CO<sub>2</sub> emissions linked to the territorial emissions categories are modelled to reduce in line with CO<sub>2</sub> territorial emissions reductions (source). As a result, a fraction of residual Other GHGs emissions remain, as per the proportion of remaining CO<sub>2</sub> territorial emissions.

### **Sequestration**

23. Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide in plants, soils, geological formations and the oceans. This can be through both natural and human activities. Recent studies for Leicestershire<sup>3</sup> indicate that only 6% of the County is 'built'. The majority (65%) is farmland, while 8% is 'potentially valuable grassland', 5% is garden and 5% is woodland. This study indicates that ecosystems in Leicestershire and Leicester City sequester 40 ktCO<sub>2</sub> every year. Given the urban density of the Leicester City area, it can be assumed that a large proportion of this sequestration occurs outside of the City. This carbon sink of 40 ktCO<sub>2</sub> is equivalent to 1% of Leicestershire territorial emissions in 2019, or 14% of 2045 territorial emissions projected in Leicestershire under the Tailwinds Pathway. The study further

---

<sup>3</sup> *High-level strategic assessment of the natural capital assets of Leicester and Leicestershire (Holt et al, 2021).*

explores opportunities for increasing carbon sequestration and the scale of action that would be required to address the residual emissions in 2045.

### **Costs and benefits of the net zero transition**

24. Financing net zero will require investment from both the private and public sector for infrastructure, and by both organisations and individuals in their own assets such as buildings and vehicles. Although this capital investment is significant, it has the potential to deliver operational cost savings over time from reduced maintenance costs and avoided fuel costs and can provide an economic boost to jobs in the low-carbon sector and greening other sectors. The cost of further delays and the impacts from global heating threaten to be much higher, as illustrated in the recent report of the Intergovernmental Panel on Climate Change – The Physical Science and previous economic assessments such as those from the Office of Budget Responsibility, Swiss Re Institute and Stern Review.
25. The UK Net Zero Strategy states “Both public and private investment will be crucial for any path to net zero. While we expect most investment to come from the private sector, market failures mean the private sector alone will not deliver emissions reductions and innovation at the pace required”. It goes on to highlight “The scale of the net zero challenge and persistent market failures mean that public sector intervention is needed to shape and accelerate the flow of private capital.”
26. Benefits that occur because of greenhouse gas emission reduction are known as ‘co-benefits’. Co-benefits are important to consider when assessing the overall costs and benefits of abatement. Co-benefits will arise for the economy, health, and society, where interventions are implemented with equitable policies that maximise the opportunities for improved air quality, active travel, biodiversity recovery, good jobs and affordable, quality homes and buildings.
27. The Climate Change Committee provides the most detailed set of cost projection models for UK-wide decarbonisation currently available. They find that the capital cost of implementing a Balanced Net Zero nationally would cost £1,415bn (2020 - 2050), and that of a Tailwinds Pathway would cost £1,440bn (2020 - 2050) (excluding removals). Capital cost dominates in the first 10 to 15 years but by 2050 aggregate operating savings are similar to the annual UK capital investment requirement
28. Leicestershire territorial emissions in 2019 amounted to 4.5MtCO<sub>2</sub>e, 1.3% of national emissions (345MtCO<sub>2</sub>e). Pro rata, this indicates that decarbonisation efforts in Leicestershire could cost in the region of £18bn under either a Balanced or Tailwinds Pathways. This investment would include contributions from both the public and private sector.
29. However, there are several reasons why this figure is indicative only as the scope of emissions and geographic variations mean the cost model is not directly applicable at a local level. Further detailed consideration of the costs for

building decarbonisation are considered in the report and demonstrate a strong case for investment as a no-regret measure with a good return on investment.

### **High-level action plan**

30. The Roadmap research concluded with recommendations for a high-level action plan. The actions to reach net zero will require urgent change across all sectors and at all levels. All scenarios modelled confirm that there are significant policy and resource gaps between the existing policy pathway and a net zero by 2045 pathway for Leicestershire.
31. The Council Influenced Pathway confirms that the Council acting alone will not be able to deliver the change required. However, the study concludes that there is a role for the Council in convening partners and key stakeholders to make the best use of resources locally and to secure the investment and the national policy required to deliver the infrastructure and interventions that will support the net zero transition.
32. The Roadmap study has concluded that it will not be a choice between interventions but will rather require the deployment of all possible decarbonisation approaches at pace and scale to meet the net zero by 2045 ambition. For some areas, this assumes new technologies will become technically and financially feasible in the intervening decades.
33. In summary, in order to meet Leicestershire's 2045 net zero target there must be:-
  - a) **a massive reduction in demand for energy** through building retrofits, solar PV, reduced vehicle mileage and industrial and manufacturing process efficiencies;
  - b) **County-wide switch to low carbon fuel** including building heat sources, vehicle electrification and switching industrial and manufacturing fuels to low carbon equivalents – such as green hydrogen;
  - c) **significant reduction in material demand** including waste arisings, water demand, water supply leakage, reduced material consumption and material substitution in construction and manufacturing to lower embodied carbon of goods and services;
  - d) **a just transition** to ensure that all interventions are implemented with equitable policies and co-benefits fully harnessed;
  - e) **a coherent programme to enhance biodiversity** across Leicestershire, restoring existing spaces, maximising carbon sinks and protecting endangered species;
  - f) **carbon capture and storage** will be required to bridge the gap where full decarbonisation is not possible;
  - g) **offsetting** carbon should only be considered as a last resort.

This page is intentionally left blank