

Pathways to a zero carbon Oxfordshire

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Environmental Change Institute

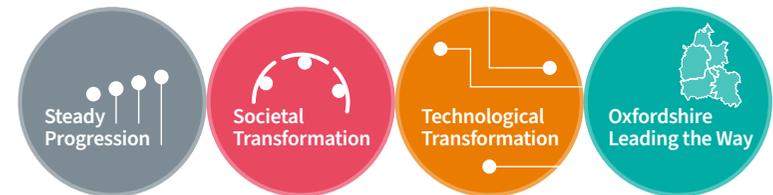


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Summary

Tackling climate change has become an urgent priority for governments, businesses and citizens around the world. In 2019, the UK Parliament passed legislation committing to a target of net-zero carbon emissions by 2050. In response, local authorities around the country have been scaling up their ambitions to tackle climate change. In Oxfordshire, all local authorities have acknowledged and responded to the climate emergency, and are developing plans to achieve net-zero carbon emissions by 2050 or sooner.



Oxfordshire has made rapid progress in reducing carbon emissions over the last decade, and is on track to achieve the target agreed by its local authorities of a 50% reduction by 2030 (from 2008 levels). While its GDP grew by 34% between 2011 and 2018, its usage of energy remained roughly constant, and CO₂ emissions fell by 17%.

This report addresses the question of how Oxfordshire can sustain the momentum of the last decade to achieve net-zero emissions. While substantial progress has been made to decouple economic growth from carbon emissions, driven by cleaner electricity supply and increased energy efficiency, there remains a significant way to go to decarbonise transport, reduce reliance on fossil fuels for heating, and protect and enhance carbon stored in the natural environment. Maintaining the same rate of emissions reduction in Oxfordshire will require relatively greater investment locally, in building retrofit, cleaner heating systems and electric vehicles; and cultural and behavioural changes such as active travel, dietary changes and reduced energy demand.

Our analysis shows that there are different routes to net-zero, and in presenting scenarios for the next three decades, we outline three distinct pathways to eradicating emissions from the economy.

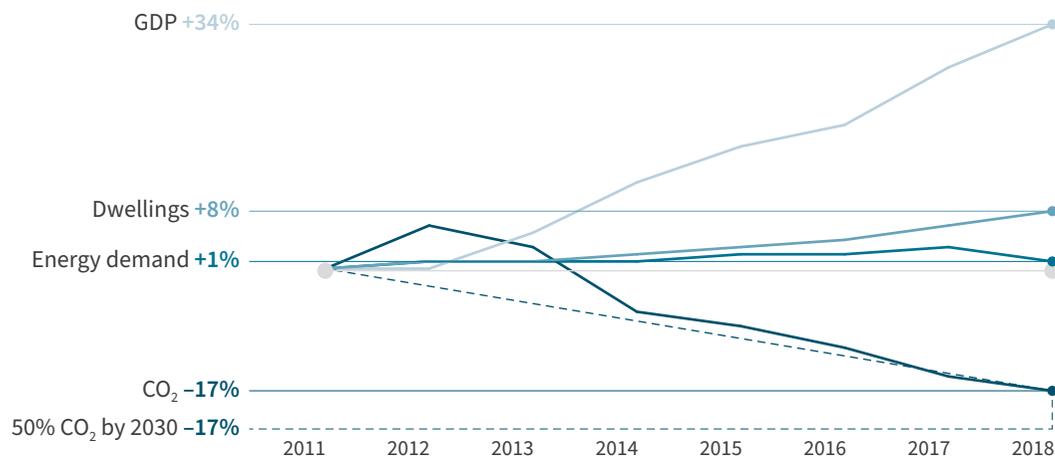


Figure 1: Relative change in GDP, number of dwellings, CO₂ emissions and energy demand (2011=1)

Our **Steady Progression** scenario falls well short of stated climate aims, and illustrates the scale of change needed to achieve net-zero. **Societal Transformation** is led from the bottom up, with householders adopting new technologies and practices, and community groups corralling action. **Technological Transformation**, by contrast, relies on systemic changes driven at the national level, including the deployment of hydrogen for heating and other technical solutions which require the least change to individual behaviour. Finally, **Oxfordshire Leading the Way** mirrors the widespread cultural and behavioural changes seen in Societal Transformation, and combines this with high deployment of new local electricity generation using solar photovoltaics.

Which pathway Oxfordshire will take depends on a variety of factors, including technological innovation, macro-economic trends following COVID-19, public support, changing social norms and behaviours, and policy decisions taken at the local, national and international levels. While some factors are outside of local control, businesses, policy makers and residents in Oxfordshire have a crucial role to play in innovating, investing, strategising and implementing the changes needed for net-zero.

The second half of the report analyses the implications of net-zero for different sectors of the economy, as follows:

Low carbon innovation: Oxfordshire’s low-carbon sector is thriving. Two of four national energy systems demonstrator projects are based in Oxfordshire, and its automotive sector continues to lead the way on innovation for autonomous vehicles, electric powertrain development and battery technologies. The University of Oxford has successfully generated 30 new cleantech spinout companies alone, with many more establishing a presence within the county and pioneering new technologies to address the challenges created by the climate emergency. The low-carbon sector is also thriving alongside high-tech industries, as community groups and SMEs develop solutions to reduce carbon emissions through alternative business models and the sharing economy.

Transport: Like the UK as a whole, Oxfordshire has struggled to reduce emissions from transport, despite successes such as accelerated uptake of electric vehicles in the county and increased cycling in Oxford City. There remains significant potential for more widespread walking and cycling, as the transition to net-zero cannot rely on electric vehicles alone. The key components of pathways to decarbonise transport are ‘Avoid, Shift, Improve’. Switching to electric is an example of ‘Improve’, while telecommuting can be a way to ‘Avoid’ travel. A ‘shift’ to local, active travel can help increase footfall on local high streets and ease congestion as well as improving health. There is an urgent need for improved infrastructure for public transport and active travel; controlling and charging for parking; supporting digital connectivity that reduces the need to travel; requiring new developments to be compact and walkable; and encouraging the uptake of zero emissions vehicles.



Energy efficiency and heating in buildings: All pathways to net-zero require profound and widespread changes to the built environment. This includes upgrading the energy efficiency performance of the majority of buildings across Oxfordshire, and replacing heating systems which rely on fossil fuels (gas and oil), with low and zero carbon technologies (heat pumps, biomass, hydrogen). The markets for goods and services to create and maintain low-carbon buildings are small and immature. A much stronger focus on market creation and development is needed if existing technologies are to be deployed at the scale and quality required. Not only does this imply a need for a skilled workforce of installers, advisors and other intermediaries, but also regulated minimum standards to create demand, supported by a much more rigorous system of compliance-checking. There is a need to simultaneously stimulate demand and supply for high quality products and services to reduce emissions from the built environment.

Low Carbon Energy: Solar energy is Oxfordshire's greatest low carbon energy generation resource with the county already contributing more than 3% of the total UK solar photovoltaic capacity, more than double its share of population and land area. There is significant potential to expand local solar PV electricity generation. Each of our net-zero pathways includes substantial deployment: the most ambitious sees installed capacity expanded by up to 10 times. Increasing local renewable electricity generation is needed in response to an expected doubling of electricity demand due to the electrification of heating, transportation and high population growth, ensuring Oxfordshire takes a leading role in the decarbonisation of the electricity sector nationally. To maximise local benefits, Oxfordshire should develop local energy partnerships and the proven appetite for community energy.



As with all intermittent decentralised generation, high penetration can have significant impact on local networks with flexibility and data key to maximising system utilisation at the lowest cost to users. Oxfordshire is in the enviable position of hosting two national demonstrator projects (Project LEO and ESO) and a wealth of knowledge in this area which it must exploit.

Land use and carbon sequestration: Oxfordshire is dominated by intensive agriculture, with farmland occupying 70% of the county. With 14% being built-up, there is only 9% woodland and 7% other semi-natural habitats. We estimate that currently around 316,000 tonnes of CO₂ are sequestered each year (after accounting for at least 100,000 t lost annually when land is cleared for development); a small fraction of the 4 Mt produced through use of fossil fuels. However, around 85 Mt CO₂ are stored in the county's soils and vegetation and it is vital to protect and enhance this carbon store well as restoring soils, woodland and other ecosystems to enhance sequestration further.

Land is a finite and precious resource, and our scenarios reveal trade-offs between demand for land for food, bioenergy, solar, housing, carbon sequestration and biodiversity. For example, it would take 37–56% of Oxfordshire's land to produce the quantity of bioenergy envisaged in the National Grid scenarios in order to provide the 'negative emissions' (via BECCS, i.e. bioenergy with carbon capture and storage) needed to reach net-zero. Stringent energy demand reduction can reduce the need for such negative emission options. Shifting to a lower meat diet also has a vital role to play in freeing up farmland for sequestration.

Smart land-use planning with the participation of all stakeholders is essential in order to minimise trade-offs and maximise the substantial co-benefits that could be achieved through well-designed nature-based solutions, including a mix of ecosystem restoration and regenerative agriculture that enhances soil carbon storage, as well as integrating high quality green infrastructure into new developments. The proposed new Local Nature Partnership will have a critical role in developing a Natural Capital Plan for Oxfordshire that meets targets for both net-zero and Nature Recovery, as well as securing livelihoods for farmers and health and wellbeing co-benefits for local communities.

Conclusions and recommendations

All net-zero pathways will involve:

- the expansion of solar generating capacity in Oxfordshire
- a major programme of retrofit for existing homes and non-domestic buildings
- prioritising climate goals when planning for new homes and developments
- substantial increases in electricity demand, driven by heat and transport, requiring grid reinforcement *and* flexibility provided by various means
- the phase out of gas boilers and fossil-fuelled modes of transport
- a need for innovation in food production to maintain or increase output while agricultural land makes way for development, and Oxfordshire grows its fair share of biofuels.
- protection and restoration of ecosystems and natural capital, for enhanced sequestration and increased biodiversity.

Net-zero targets: While each local authority in Oxfordshire has set an aspirational date for area-wide net-zero emissions, some have chosen 2050 (County Council, West Oxfordshire DC), Vale of White Horse DC is aiming for 2045, Oxford City council for 2040 and others 2030 (Cherwell DC, South Oxfordshire DC). These differences partly reflect local circumstances, such as differences between urban and rural districts, but they have substantial implications for policy, investment and local action.

Although ambitious targets can be vital for driving policy change and investment, our models suggest that achieving the earlier targets will be extremely challenging, especially without significant devolution of additional powers to local authorities. However, there are additional ways to demonstrate leadership on climate change as well as target setting, such as in using planning powers to develop policies that align with net-zero carbon developments by applying 15-minute neighbourhood principles, implementing active travel infrastructure, and including ecosystem restoration.

Shattering myths



“We should plant trees to offset our emissions”

... we need to protect existing trees, but planting new trees can remove only a small fraction of current emissions, and we need to restore a mix of native ecosystems to reverse biodiversity loss.



“We need a more skilled & qualified workforce”

... the skills challenge is not just a supply problem, we also need demand for skills, driven by markets for zero-carbon solutions.



“Electric vehicles are coming to save us”

... switching to cleaner fuels is insufficient for net-zero. We also need to reduce our transport demand and complete more of our journeys by walking, cycling, public and shared transport.



“Net-zero can be achieved by 2030”

... without relying on offsets, the scale of investment, technological and lifestyle change, without national policy support, is unrealistic.



“Fossil fuels are needed for economic growth”

... renewable energy and other zero-carbon solutions represent opportunities for more efficient use of resources. Unlike spending on fossil fuels, investment can be kept local.



“It all comes down to individual behaviours”

... while lifestyle change and sustainable choices will be crucial, these are influenced by infrastructures, systems of provision and social norms. Reshaping these requires action from myriad actors



Co-benefits: If the phase-out of carbon emissions is managed effectively, a variety of economic, social and environmental benefits can be achieved. These include the creation of high-skilled, well paid jobs in the zero carbon sector; creating cohesive and desirable places to live by empowering local communities and diverse individuals to drive action; and cutting air pollution. Restoring habitats, providing urban green infrastructure and shifting to regenerative agriculture can support wildlife while delivering ecosystem services such as natural flood management and urban cooling, and providing health and wellbeing benefits for local people.

COVID-19 recovery: More than 1000 people in Oxfordshire have lost their lives to COVID-19, and the pandemic has had a severely detrimental impact on nearly all residents and businesses in Oxfordshire. In the short term, energy demand and carbon emissions have fallen sharply. As the economy gets back on its feet, it is imperative that the sustainable practices adopted by businesses and individuals, such as telecommuting and active travel, are supported and sustained.

Embodied carbon: This report focuses on direct emissions (Scope 1) and those associated with purchased energy (Scope 2). However, there are emissions ‘embodied’ in the goods and services imported into the county, including the materials used for constructing new housing, the batteries used in electric vehicles, and food and biofuels that must be produced elsewhere when land in the county is used for carbon-reducing activities such as planting trees. In the next decade, the priority must be on reducing Scope 1 and 2 emissions. However, as the emissions associated with energy and transport usage reduce over time, the relative proportion of embodied emissions will grow.

Climate change will need to be increasingly factored into procurement decisions and supply chain governance, whether those are major investments in construction materials for new homes, or everyday purchases such as food. A shift towards a circular economy based on reducing waste and unnecessary consumption will play a large part in reducing the embodied emissions imported in material goods.

Infrastructure: The forthcoming update to the Oxfordshire Infrastructure Strategy is due to include climate related indicators when evaluating the need for strategic infrastructure. While it goes without saying that all investments in local infrastructure should be compatible with net-zero, there is also a need to systematically review the role of existing infrastructure in 'locking in' high carbon practices, and plan for change. More granular data on demand patterns will help enable the more efficient use of existing infrastructure. There is a need to expand the definition of infrastructure to include Oxfordshire's building stock, and to rank retrofit as a strategic priority alongside electricity grid reinforcement and the installation of new solar generation. Green infrastructure should also be integrated into the strategy, as it has potential to deliver multiple benefits for climate, health and biodiversity.

Financing the transition: Local authorities have experienced significant funding cuts in the last decade, and COVID-19 has led to further financial woes. While there is uncertainty over the future of core funding for programmes to drive down emissions, there are other options for raising investment in zero-carbon solutions. These include expanding the Low Carbon Hub's model for raising community investment; following West Berkshire Council's example of launching a Green Bond, and developing projects for investment by the Oxfordshire Local Government Pension Fund.

Partnership working: Stakeholders in the low carbon sector have a strong record of collaborating to attract investment and drive forward innovation. There is potential to expand networks such as Oxfordshire Greentech, Community Action Group network and Low Carbon Hub CIC. The Oxfordshire Growth Board recently proposed the creation of a new environment advisory group which was supported by all local authority leaders. If properly resourced, this could drive forward the agenda set out in the Oxfordshire Energy Strategy, and begin to develop an action plan to meet climate goals. It is hoped that the evidence and modelling in this report will directly inform this advisory group, as well as the work of the proposed Local Nature Partnership.

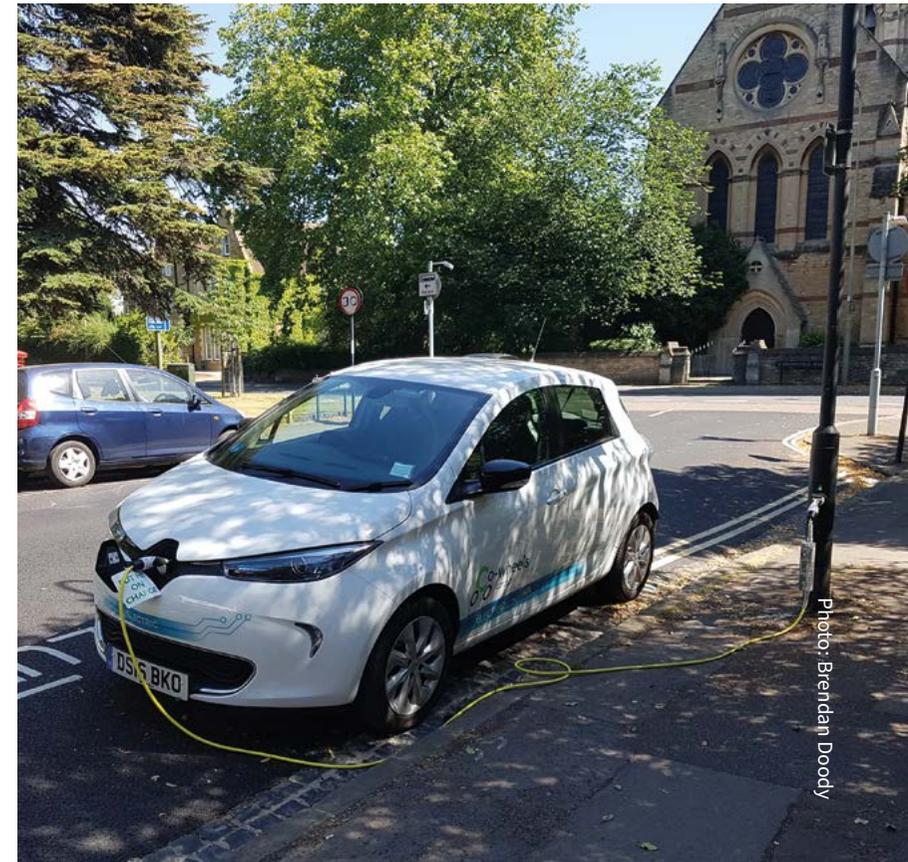


Photo: Brendan Doody

Authors

Sam Hampton, Lewis Knight, Hannah Scott, Hannah Budnitz, Gavin Killip, Scot Wheeler, Alison Smith and Nick Eyre

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Environmental Change Institute, OUCE,
South Parks Road, Oxford OX1 3QY

www.eci.ox.ac.uk

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