

West Yorkshire Carbon Emission Reduction Pathways

Key findings report

July 2020



Introduction

The West Yorkshire Combined Authority and the Leeds City Region Enterprise Partnership (the LEP) are working towards the challenging ambition of being a net zero carbon economy by 2038, and to have made significant progress by 2030. Net zero carbon means emissions produced and emissions taken in are balanced.

In June 2019, the Combined Authority and the LEP formally declared a climate emergency supported by a range of partners including local authorities, businesses and young people.

The 2038 target was determined following work by the Tyndall Centre for Climate Change Research, which was commissioned to create a science-based carbon budget for the Leeds City Region that is consistent with the objectives of the UN Paris Agreement on Climate Change (Paris Agreement) and the Intergovernmental Panel on Climate Change (IPCC).

The target builds on the Leeds City Region Energy Strategy and Delivery Plan (adopted December 2018) and sector-specific low carbon workshops held in summer 2019. It also builds on our existing work to address the climate emergency, including the Resource Efficiency Programme, Energy Accelerator, Better Homes Yorkshire, the Clean Bus Technology Fund, Stourton low energy park and ride, and the Ultra-Low Emission Capital Grant Scheme.

Meeting our target, achieving emission reductions of over 11 MtCO₂e by 2038, will require urgent and collaborative action across all sectors of our regional economy in partnership with businesses and communities.

The Carbon Emissions Reduction Pathways (CERP) study, produced for the Leeds City Region and York and North Yorkshire local enterprise partnerships, is the first in a three-step process to determine what steps are needed to create a net zero carbon economy.

The results will set out how we can address the climate emergency, meet our target and reduce emissions across five sectors of our economy: buildings, industry, land use and agriculture, power, and transport.

The findings will also help local authorities within our region develop their own responses to the climate emergency, including in some cases becoming net zero before 2038, as well as helping businesses and other organisations that have signed up to the Leeds City Region Climate Coalition.

Following this in-depth study, the Combined Authority and LEP will work with partners and stakeholders to identify what policies are needed to meet the net zero carbon ambition before a public consultation is carried out in late 2020.

Key findings

West Yorkshire could reduce emissions by 100 percent and achieve its 2038 net-zero target by delivering between 73 percent and 82 percent of emissions savings through the measures that have been modelled in the CERP.

The remaining 27 percent to 18 percent could be reduced through a combination of specific, ambitious measures and innovative new technologies as they become available. Examples of more ambitious measures we could take include:

- Increasing the amount of land allocated to the planting of trees
- Generating a more electricity from large-scale solar farms
- Maintaining levels of remote working seen throughout the COVID-19 pandemic
- Providing funding and support for innovative emission reduction technologies

To achieve our net zero carbon ambition, our region requires:

- Ambitious leadership at local, regional and national levels
- Funding support and policy change from national Government
- A robust plan to overcome challenges including public behaviour change and technology supply chains
- A strengthened partnership approach from the public sector, businesses and communities

The key findings of the study allow us to start on a pathway towards net-zero carbon by 2038 and to focus, in the short-term, on those common actions which are identified in all the pathways. These include:

Transport

- Reducing private car travel by 21 percent through shifting demand to public, shared and active travel e.g. walking and cycling
- Increasing travel by walking by 78 percent
- Increasing travel by bike by 2,000 percent
- Increasing travel by bus by 39 percent
- Increasing travel by rail by 53 percent

Buildings and industry

- Retrofitting nearly 700,000 homes with energy efficiency measures such as loft and cavity wall insulation
- Installing heat pump heating systems in over 300,000 homes

Power

- Generating enough electricity from onshore wind and solar to power more than 162,000 homes

- Investigating the implementation of carbon capture and storage technology to energy from waste facilities.

Land use and agriculture

- Increasing the area of tree coverage by the equivalent of 420 football pitches
- Restoring 100% peatland
- Reducing food waste by 38%

We cannot fully commit to a specific pathway that has been modelled in the study at this stage due to the uncertainty that exists around the deployment of specific measure identified. To fully commit to a pathway, we need government to make decisions on certain issues, including the preferred route for heat decarbonisation in our homes and buildings, support for carbon capture and storage, and national policy on reducing emissions from aviation. A full set of asks of Government will be developed as part of Tasks 2 and 3 of the CERP.

Current situation

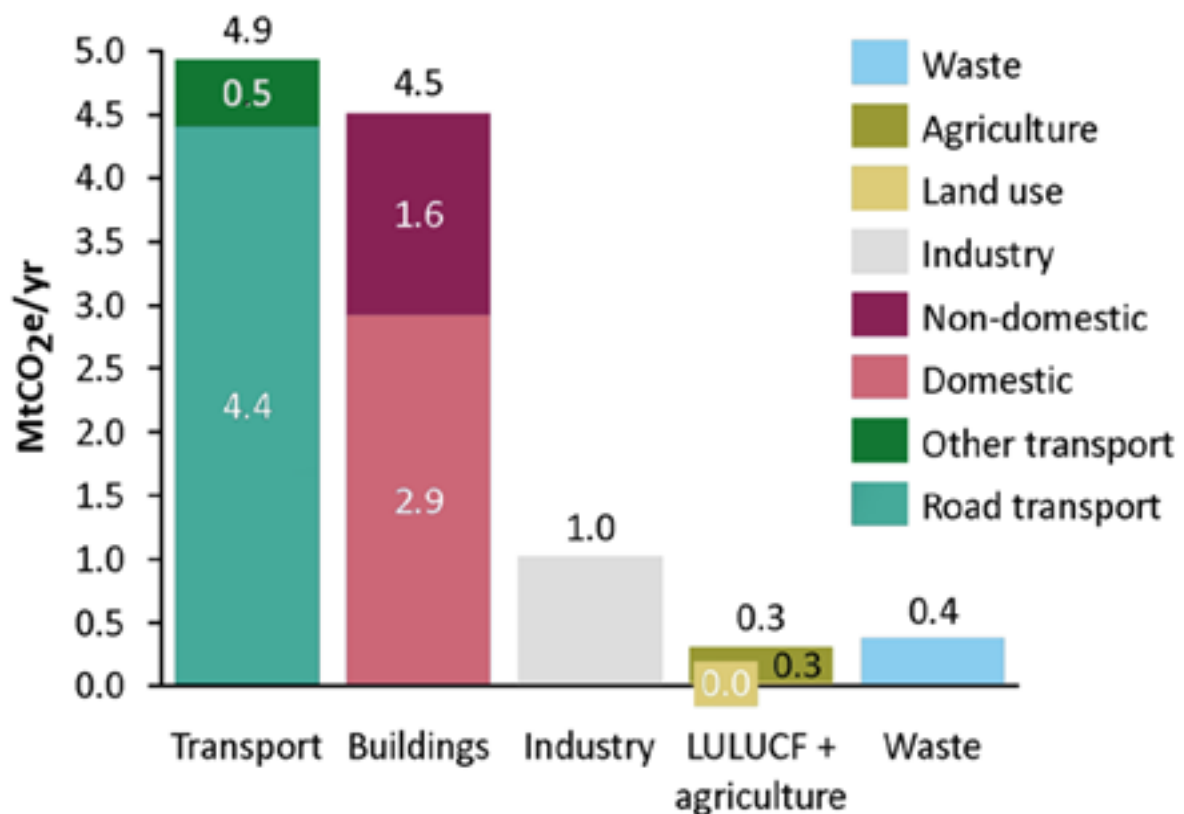
In 2018, the Government estimated the UK produced 449 million tonnes of carbon dioxide equivalent. As a region, West Yorkshire currently emits 11.1 million tonnes of carbon dioxide equivalent per year.

Transport is the largest emitting sector, dominated by road transport and private vehicle use.

The majority of emissions from buildings and industry are due to heat generation, primarily as a result of the combustion of natural gas.

In comparison to other parts of the UK, West Yorkshire does not have a large number of energy intensive industries such as refining or cement, and industry emissions reflect this. Glass, chemicals and food and drink are the key sectors contributing to industry emissions.

Due to the urban nature of our region, land use and agricultural emissions are low. Emissions from waste are small and mostly from landfill sites.



Methodology

The study looked at the current baseline situation and three possible pathways to decarbonise different sectors of the economy by 2038.

For each economic sector, the three different scenarios were applied to show the difference in carbon reductions from 2020 to 2038. These three scenarios are set out below.

Baseline situation

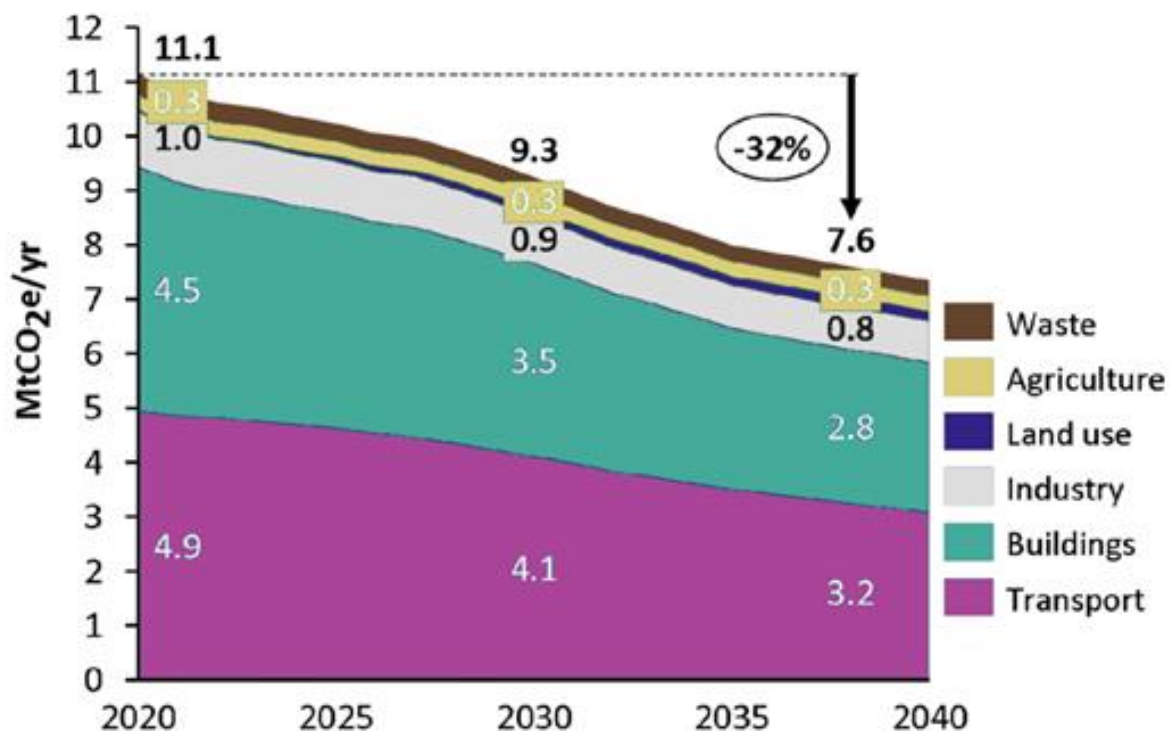
The study explored the likely levels of carbon emissions by 2038 if no new action to reduce them was taken. This assumed no new national and local policies, regulations or incentives were introduced.

It found that overall, emissions would fall by 32 percent leaving 7.6 million tonnes of carbon remaining, primarily in the transport and building sectors.

In the transport sector, reductions would occur through wider adoption of cleaner, more cost-effective technology such as electric powered vehicles.

National efforts to decarbonise electricity and increase energy efficiency would result in reductions in emissions from buildings and industry.

However, we would see a growth in emissions from agriculture and land use as our population rises to meet the demand for increasing food production and urban spread.

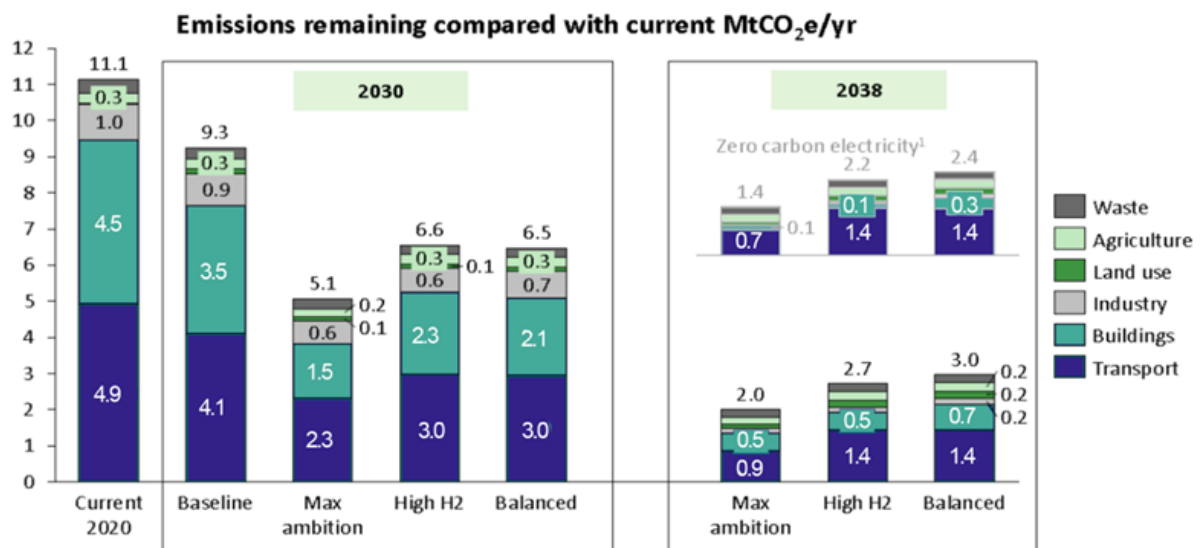


The pathways

The study looked at three potential pathways to decarbonise different sectors of the economy.

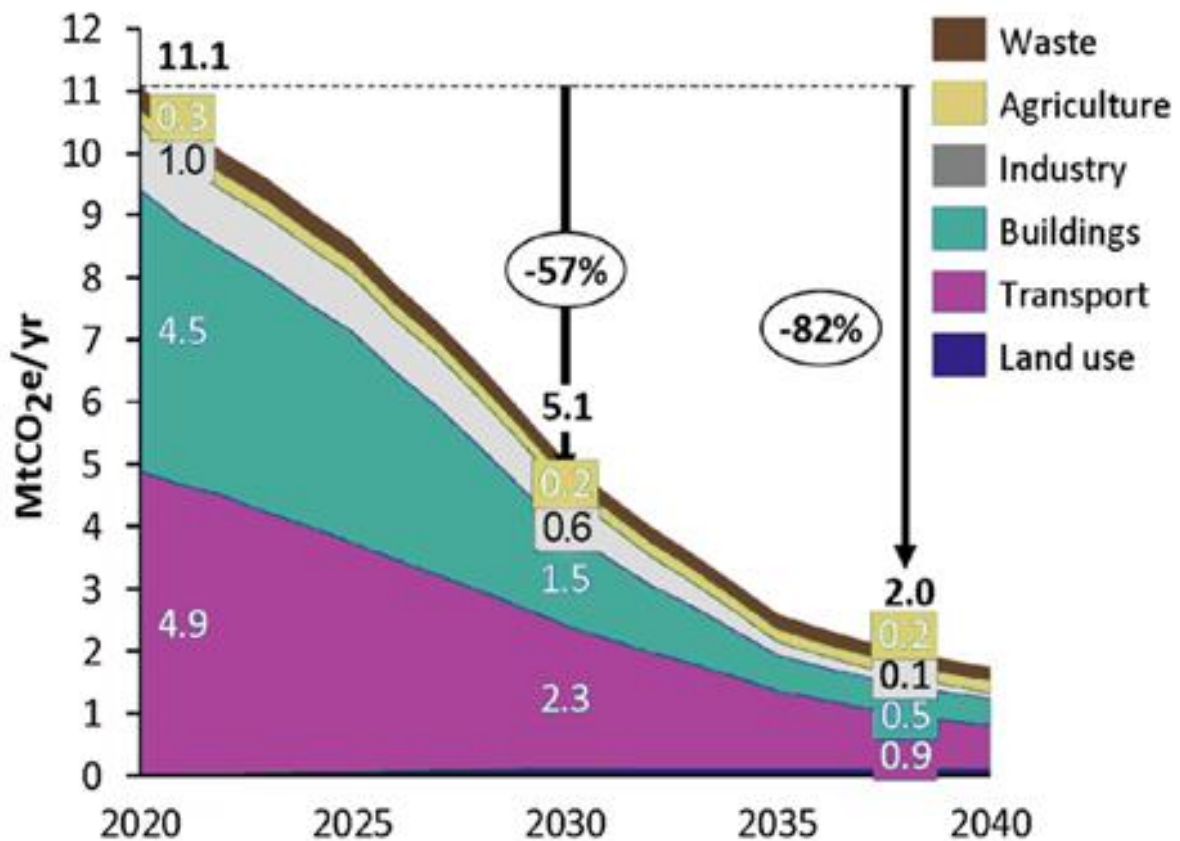
For each economic sector, the three different pathways were applied to show the difference in carbon reductions from 2020 to 2038.

- **Max Ambition** – this assumes significant electrification of heat, transport and industry supported by enabling technologies such as demand-side response and energy storage. This also includes significant increases in low carbon power generation with accelerated negative emission technologies and ambitious forest planting rates.
- **High Hydrogen** - Promotes large-scale hydrogen use and carbon capture and storage roll-out. The existing gas network is repurposed for hydrogen, enabling significant hydrogen use in buildings, heating, industry, power and transport. This is supported accelerated forest planting and bioenergy production.
- **Balanced** – Encompasses a balanced mix of technology across all sectors with contributions from hydrogen, electrification, bioenergy, carbon capture and storage, and decentralised energy production.



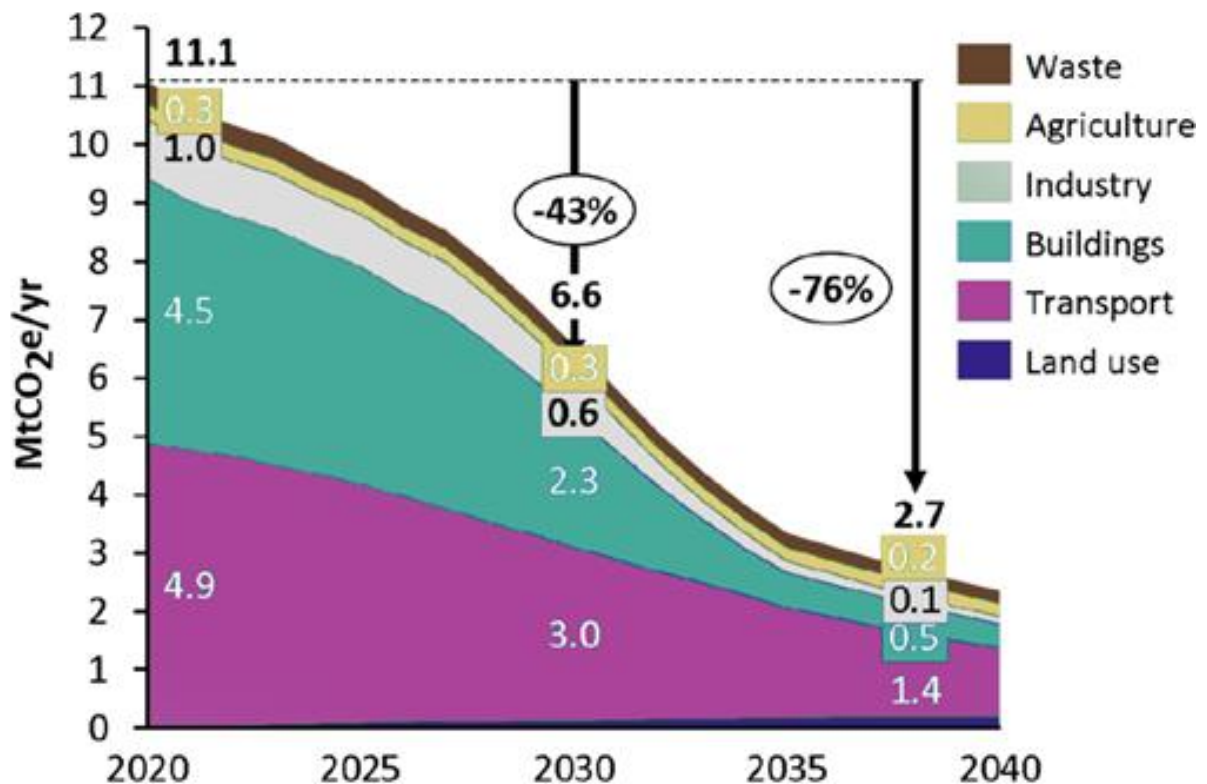
Pathway results

Max Ambition



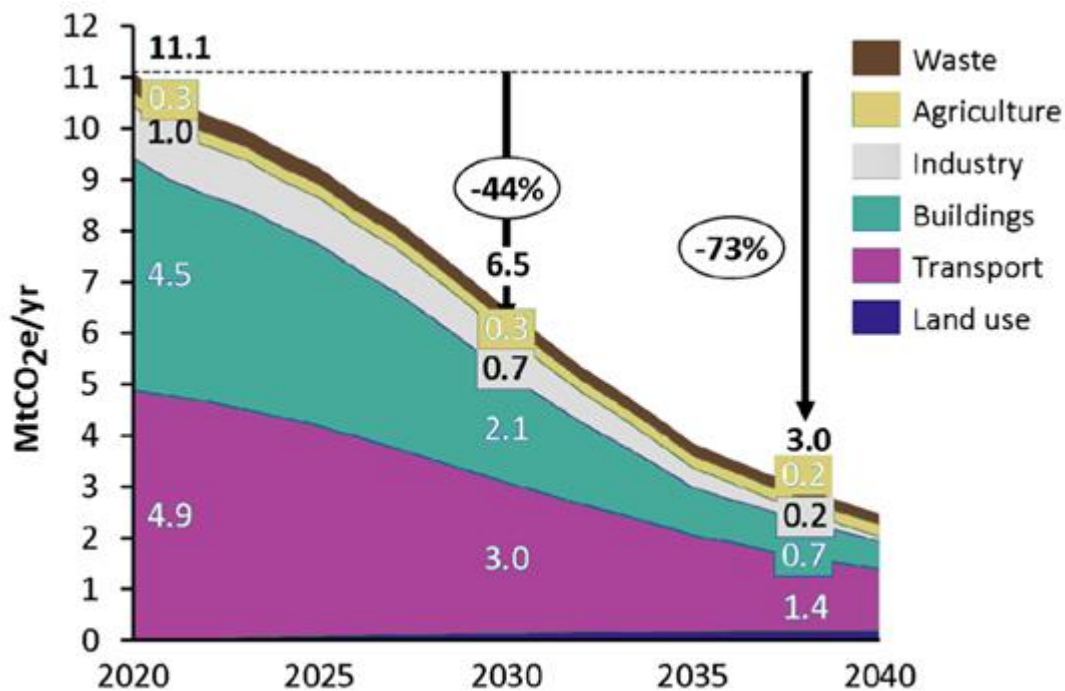
- According to this pathway, by 2038 there would be an 82 percent reduction in carbon emissions across the region leaving approximately two million tonnes of carbon remaining primarily in the transport and building sectors from the use of electricity.
- This requires a rapid update to electric powered vehicles, alongside significant consumer and industry behaviour change.
- There would be a rapid shift from private car use to cycling and walking and electrified public transport.
- From the 2020s onwards, there would be a large-scale retrofit of buildings with an ambitious roll-out of heat pumps and heat networks particularly between 2025-2035.
- By 2030, there will have been a rapid roll-out of solar and onshore wind as well as carbon capture and storage.
- Industry focuses on developing new technology and switching to low carbon fuels (electricity, hydrogen, bioenergy). Hydrogen is available to select industry sites through dedicated pipelines.
- Land use emissions stay steady as forest planting offsets emissions from new urban development. There would be limited impact on agriculture despite ambitious reductions in meat and dairy consumption.

High Hydrogen



- According to this pathway, by 2038 there is a 76 percent reduction in carbon emissions across the region leaving approximately 2.7 million tonnes of carbon remaining primarily in the transport sector.
- This requires significant uptake of hydrogen fuel-cell vehicles, particularly heavy goods vehicles and buses during the 2030s.
- The natural gas grid will be converted to hydrogen from 2028, powering buildings and industry
- In the 2020s hybrid heat pumps and energy efficiency are implemented and by 2038 nearly half the housing stock is heated by hydrogen.
- Land use and agriculture emissions struggle to decarbonise, with space constraints on new forest planting.

Balanced

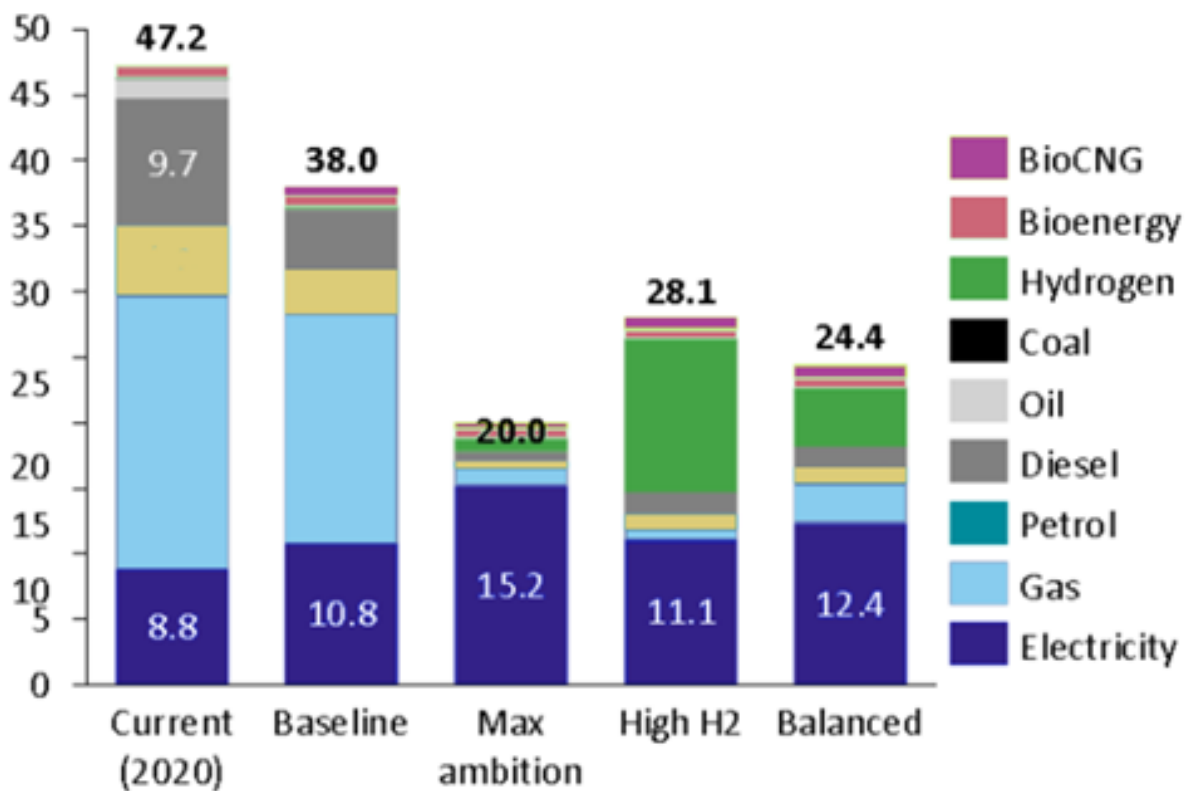


- According to this scenario, by 2038 there is a 73 percent reduction in carbon emissions across the region leaving approximately three million tonnes of carbon remaining primarily in the transport and buildings sectors.
- There will be a significant shift from petrol and diesel to hydrogen and electric vehicles.
- Buildings and industry will rely on a mixture of hydrogen and electric heating technologies.
- Significant gas usage remains in building boilers and industrial sites, resulting in higher emissions compared to the other scenarios.
- As with the high hydrogen pathway land use and agriculture emissions struggle to decarbonise, with space constraints on new forest planting

The remaining emissions in all of the pathways (between 18 and 27 percent) will be reduced through a combination of greater ambition for the deployment of specific measures and/or implementation of innovative technologies.

Fuel demand

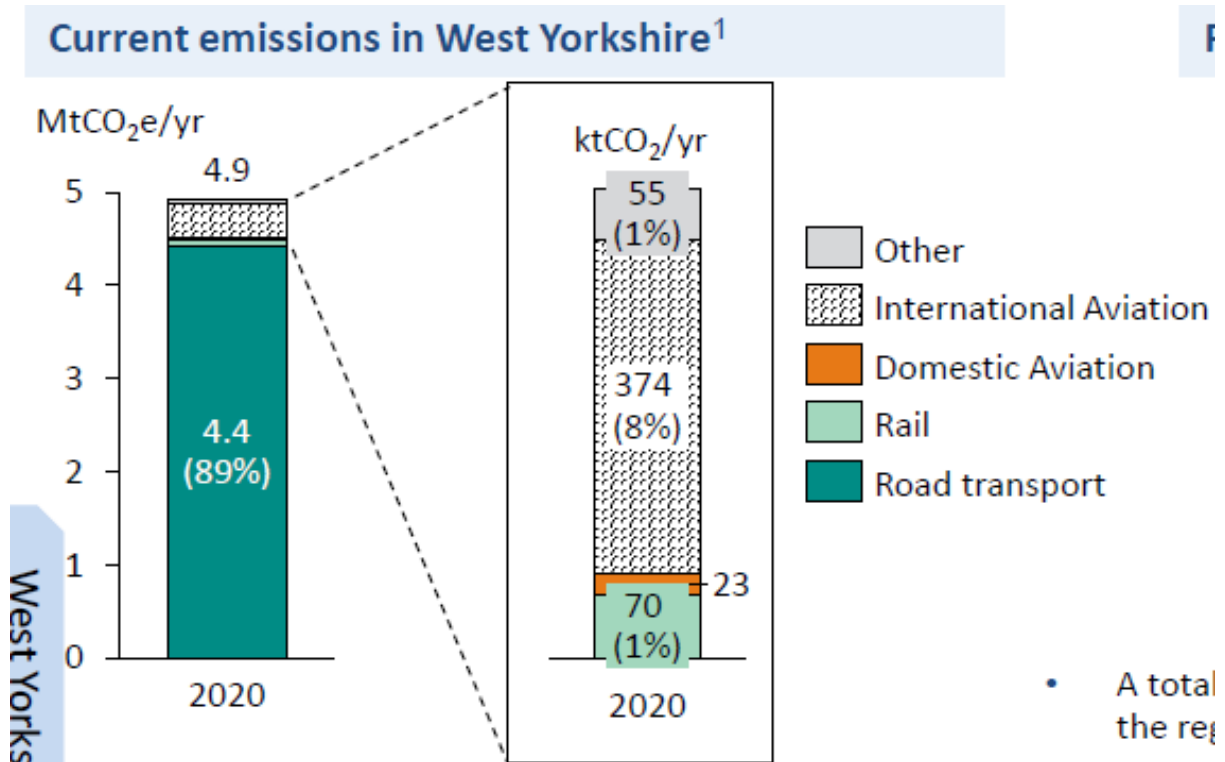
Fuel use in 2038 across scenarios TWh/yr



- By 2038, all pathways rely predominantly on electricity and hydrogen power. This is a significant shift from 2020 where the fuel mix is primarily fossil fuel, with a small amount of electricity.
- Of the three pathways, Max Ambition has the least demand for fuel while High Hydrogen has the greatest.
- Under the Max Ambition pathway, a 72 percent increase in electricity demand would be required as heat and transport are electrified. Hydrogen and bioenergy use is limited.
- Under the Hydrogen pathway, 42 percent of fuel demand is hydrogen with 40 percent attributed to electricity demand.
- Under the Balanced pathway, electricity demand is highest with demands also for hydrogen, bioenergy and natural gas.

Transport

Transport is a critical area for carbon emissions reduction across West Yorkshire and all three pathways will require ambitious action, which goes beyond current national policy and targets. This will require a significant shift in behaviour change and the fast adoption of low carbon technology.



By 2038, under the pathways, emissions from transport would reduce by:

- Max Ambition – 83 percent
- High Hydrogen – 71 percent
- Balanced – 71 percent

Depending on the pathway, actions identified to reduce the levels of emissions by 2038 include:

Road transport

- **Private cars**
 - Private car use must decline by between 38 percent and 21 percent
 - Sales of petrol and diesel cars in the region must end by either 2030 or 2035. Both targets are ahead of the current Government ambition of 2040 but, if commitments are brought forward to 2035 (currently under consultation), the alignment with national targets would require less action at a local level.
 - Sales of plug-in hybrid vehicles must end by 2035 under Max Ambition but continue beyond 2040 in other scenarios.
- **HGVs**

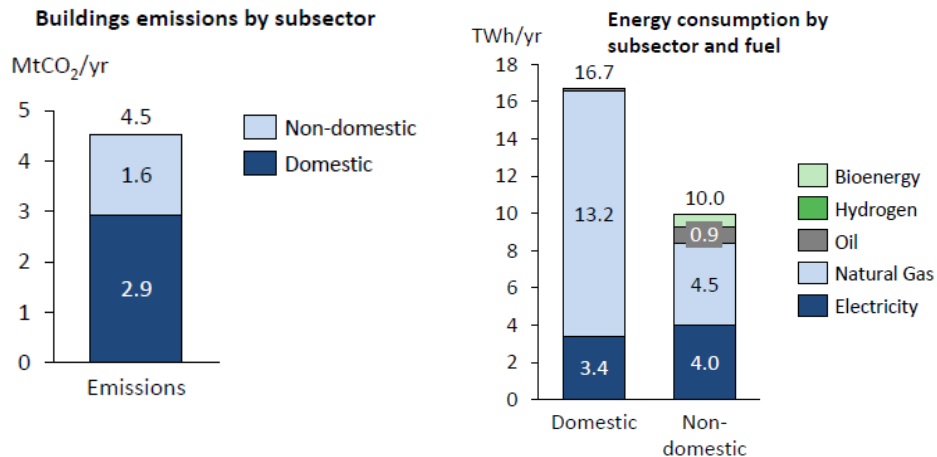
- Sales of zero emission HGVs must increase by between 1,000 and 2,000 per year.
- HGVs will switch from petrol and diesel engines to be 79 percent electric battery powered or two-third powered by hydrogen fuel cell.
- **Public transport**
 - Sales of conventional petrol and diesel buses will end by 2031 across all scenarios.
 - Up to 66 percent of buses will be powered by electric battery and up to 34 percent by hydrogen fuel cell.
- **Active travel**
 - Journeys made by walking need to increase by up to 70 percent.
 - Journeys made by bike need to increase by more than 2,085 percent.
- **Rail**
 - Rail passenger kilometres will increase by 53 percent.
 - Rail freight kilometres will increase by 157 percent.
 - Up to 90 percent of passenger rail services and 75 percent of rail freight services will be electric.
- **Aviation**
 - Demand for domestic aviation needs to reduce by 20 percent.
 - Demand for international aviation must remain at 2020 levels or be limited to a 25 percent increase.

For more technical information on the impact on transport across all pathways please see the CERP Technical Report.

Buildings

West Yorkshire's high population density and relatively older housing stock present challenges for reducing emissions. However, as 95 percent of buildings are already connected to the gas network, a higher proportion than the national average, there are significant opportunities. Consumer confidence and pricing will be vital for success.

Current emissions



By 2038, under the pathways, emissions from buildings would reduce by:

- Max Ambition – 89 percent
- High Hydrogen – 89 percent
- Balanced – 84 percent

Depending on the pathway, actions identified to reduce the levels of emissions by 2038 include:

- Up to 660,000 heat pumps or 515,000 hydrogen boilers will be installed in homes.
- District and communal heating increases to supply up to 250,000 homes and up to 28 percent of non-domestic buildings.
- Nearly 680,000 homes are retrofitted with energy efficiency measures such as loft and cavity wall insulation.
- Domestic solar PV installations will increase by up to 171,000.
- The gas network is converted to hydrogen from 2028.

For more technical information on the impact on buildings across all pathways please see the CERP Technical Report.

Power

West Yorkshire produces only a quarter of the power it consumes and is dependent on importing power from the National Grid. It lacks large-scale power plants such as those seen in neighbouring North Yorkshire. The information below relates to the emissions generated by electricity generating plants in West Yorkshire and does not relate to emissions from electricity supplied by the National Grid.

All pathways see an increase in the demand for electricity over current levels. The trend we see in West Yorkshire for a greater amount of renewable sources generating electricity over time is mirrored by the National Grid, resulting in the amount of emissions generated from the electricity we consume reducing over time.

By 2038, under the pathways, emissions from power would reduce by:

- Max Ambition – 76 percent
- High Hydrogen – 77 percent
- Balanced – 76 percent

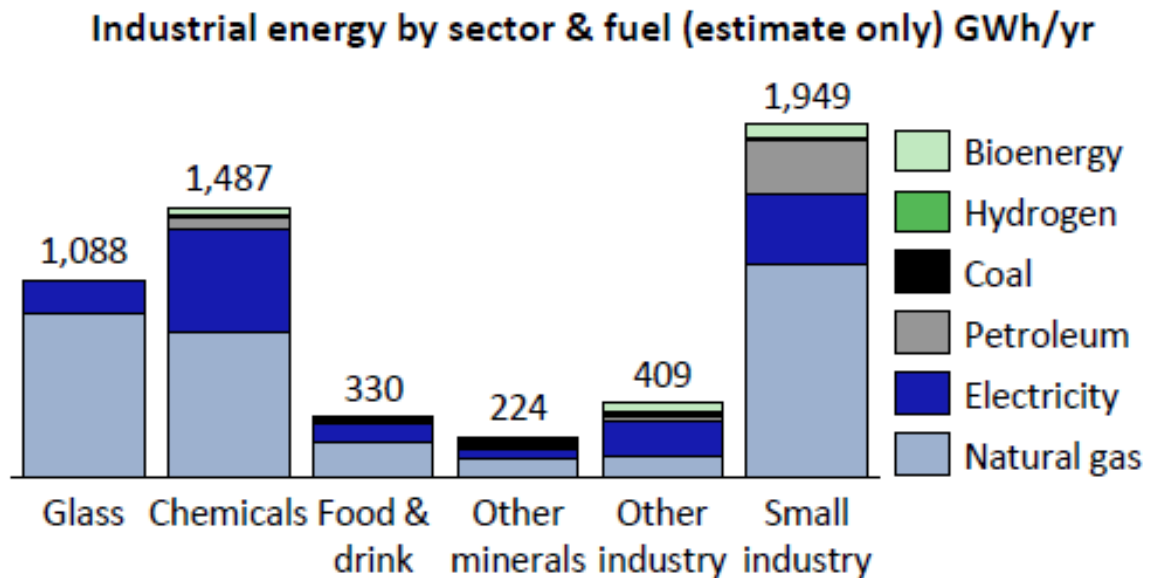
Depending on the pathway, actions identified to reduce the levels of emissions by 2038 include:

- Power generation within West Yorkshire increases by up to 28 percent.
- Power generated by solar PV must increase by 217 percent and by onshore wind by 23 percent.
- Total land required for solar PV and onshore wind in 2038 under the Max Ambition pathway will be 5.5 percent.
- Dependency on National Grid increases to between 79 percent and 81 percent to meet demand from population growth and more people living in urban areas.

For more technical information on the impact on power across all pathways please see the CERP Technical Report.

Industry

Industrial emissions in West Yorkshire are relatively low due to limited heavy industry, which is currently clustered around the Knottingley and Bradford areas, and is confined to large glass and chemical plants. The majority of emissions are from fuel combustion and can be addressed by using low carbon fuels.



By 2038, under the pathways, emissions from industry would reduce by:

- Max Ambition – 87 percent
- High Hydrogen – 85 percent
- Balanced – 82 percent

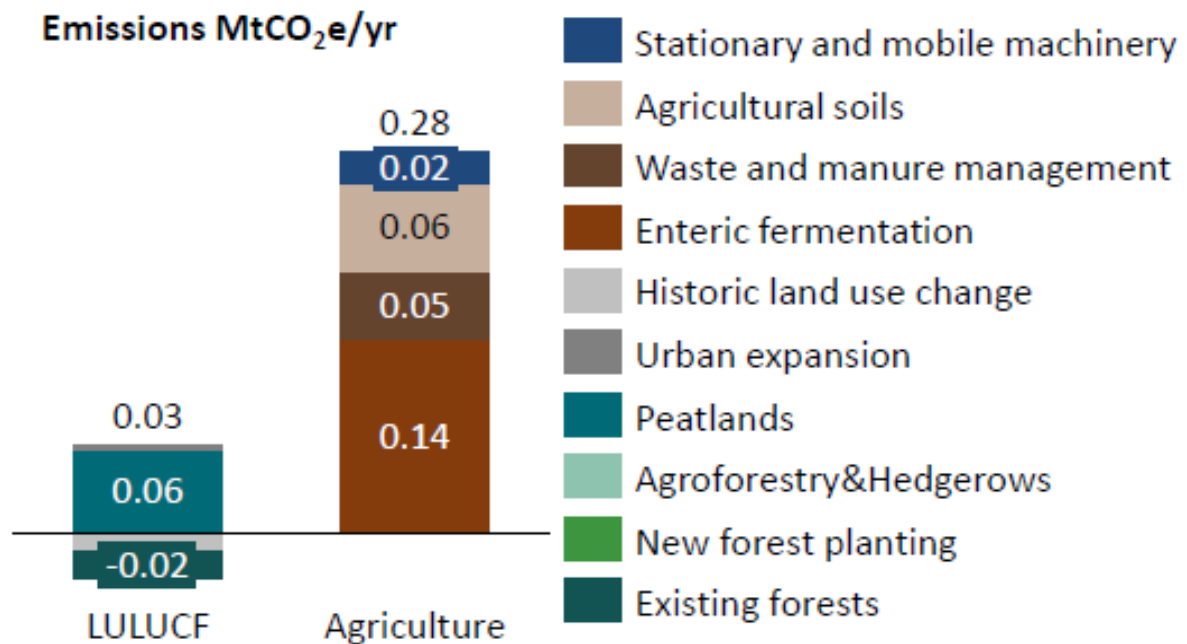
Depending on the pathway, actions identified to reduce the levels of emissions by 2038 include:

- Coal and oil are phased out from as early as the 2020s.
- Natural gas is replaced from as early as the mid 2020s onwards with electricity, hydrogen or bioenergy.
- Carbon capture and storage is implemented during the 2030s to large plants in the glass and chemicals sectors enabling negative emissions.
- Industrial research and development projects must be supported immediately to ensure solutions are available by 2030 for a wide range of industrial applications.

For more technical information on the impact on industry across all pathways please see the CERP Technical Report.

Land-use and agriculture

Whilst West Yorkshire contains a diverse mix of cities, towns and rural areas, overall it is a largely, but not wholly, urban area with an increasing population, resulting in very limited potential for reducing carbon emissions through use of land. However, emissions from land use and agriculture in the region are only a small contribution to the overall emissions. A trade-off will have to be made between using land to create employment or grow food, such as agriculture, or for mitigation, such as planting new forests.



By 2038, under the pathways, emissions from land-use and agriculture would reduce by:

- Max Ambition – 3 percent
- High Hydrogen – 35 percent
- Balanced – 39 percent

Depending on the pathway, actions identified to reduce the levels of emissions by 2038 include:

- Restoration of all lowland peat and 60 percent of upland peat
- Planting 170 new hectares of forest
- Up to 38 percent reduction in food waste
- Up to 32 percent reduction in meat and dairy consumption

For more technical information on the impact on land-use and agriculture across all pathways please see the CERP Technical Report.

Next steps

The Carbon Emissions Reduction Pathways study is a three-step process that will enable West Yorkshire to achieve its ambition of becoming a net zero carbon economy by 2038. The results outlined in this document are from the first step of the study.

The next step is to produce an implementation roadmap plotting when and how each sector can reduce carbon emissions based upon the results of the study.

This will be followed by an action plan with policy recommendations for each sector which will clearly show how we can reach net zero carbon by 2038. This will be codesigned with a number of stakeholders from across different sectors of the economy.

A public consultation will also be carried out to enable communities and businesses to have their say on the action plan and the priority of measures needed.

For more information please contact netzero@westyorks-ca.gov.uk