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GWASANAETHAU ARLOESOL Y DYFODOL
INNOVATIVE FUTURE SERVICES

A DECARBONISATION HANDBOOK FOR WALES

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INNOVATIVE FUTURE SERVICES

Infuse is an innovation and research programme designed to build skills and capacity for innovative future public services across the Cardiff Capital Region.

Infuse is supported by the European Social Fund through Welsh Government and is a collaboration between Cardiff University, Y Lab, Nesta, Cardiff Capital Region City Deal Office (CCR) and the ten local authorities that make up the region. The programme will be built around opportunities to tackle real-life questions, driven by the biggest challenges faced by the region.

Y Lab is the public services innovation lab for Wales, based in Cardiff University.

Executive summary

The challenge of climate change requires everyone to act. There is an information overload about decarbonisation and net zero targets in UK which can cause confusion for people who are not embedded in the topic.

With this in mind, Y Lab has compiled this handbook which brings together information from key official reports, legislative frameworks and scientific literature. We wanted to make this an accessible introduction for everyone, whatever their current knowledge of the topic.

Therefore, this report is designed as a starting point outlining the key points, and readers are directed to other reports for further information or can contact us directly if they have any additional questions.

Contents

The net zero challenge

The goal of Paris Agreement (An international treaty signed by 196 countries in 2015) is to limit global warming to below a 2 °C rise, compared to the pre-industrial levels (1850-1900) and making all out efforts to limit this increase to 1.5 °C.

In 1990, the UK's greenhouse gas emissions stood at 794m tonnes of carbon dioxide equivalent (MtCO2e) which is conventionally taken as the baseline for the UK's climate goals. In 2019, the UK became the first major economy in the world to pass laws to end its contribution to global warming by 2050. This effectively means 100% reduction in greenhouse gas emissions from 1990 levels by 2050. This covers greenhouse gas emissions from all the sectors including transport and residential.

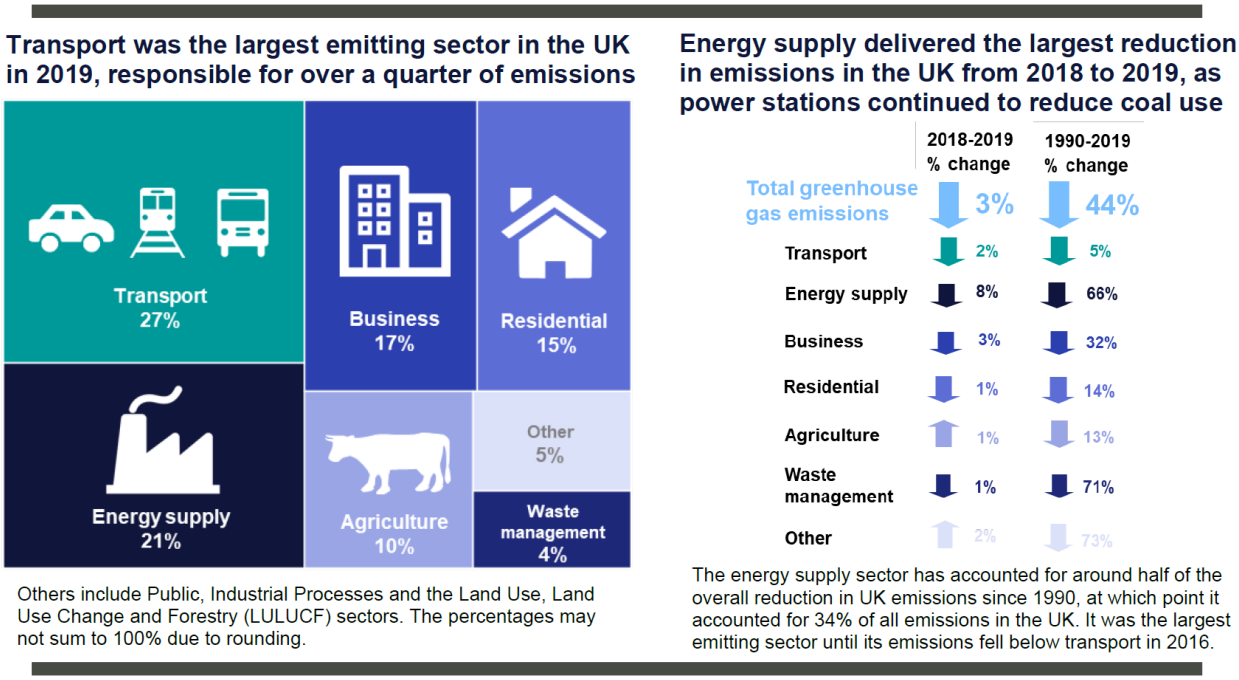


Figure 1- 2019 UK Greenhouse Gas Emissions.
Source: https://www.gov.uk/government/collections/final-uk-greenhouse-gas-emissions-national-statistics

Figure 1 shows the greenhouse gas contribution from major sectors in 2019 and its corresponding change from previous year and an overall change from 1990 levels. It is encouraging to see a significant reduction in greenhouse gas emission in the energy sector from 1990 levels. However, transport and residential sectors have shown only marginal progress. Since 2050 targets include greenhouse gas emissions from all sectors, significant decarbonisation efforts are needed in transport and residential sectors.

On the journey to net zero by 2050, the UK has set ambitious decarbonisation targets, e.g., 68% reduction in greenhouse gas emissions by 2030 from 1990 level. Any remaining emissions by 2050 would be balanced by interventions such as afforestation and Carbon Capture and Storage (CCS) techniques to offset an equivalent amount of greenhouse gases from the atmosphere.

The Welsh perspective

In 2019 Welsh Government became the first Government in the world to declare emergency to trigger more action to meet the climate change challenge. In 1990, the total greenhouse gas emissions in Wales stood at 55m tonnes of carbon dioxide equivalent (MtCO2e). Baseline measures for each gas were set in the Environment (Wales) Act 2016. Baselines for major greenhouse gases, i.e., carbon dioxide, methane and nitrous oxide were set at the 1990 level; whereas levels for hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride were taken from 1995.

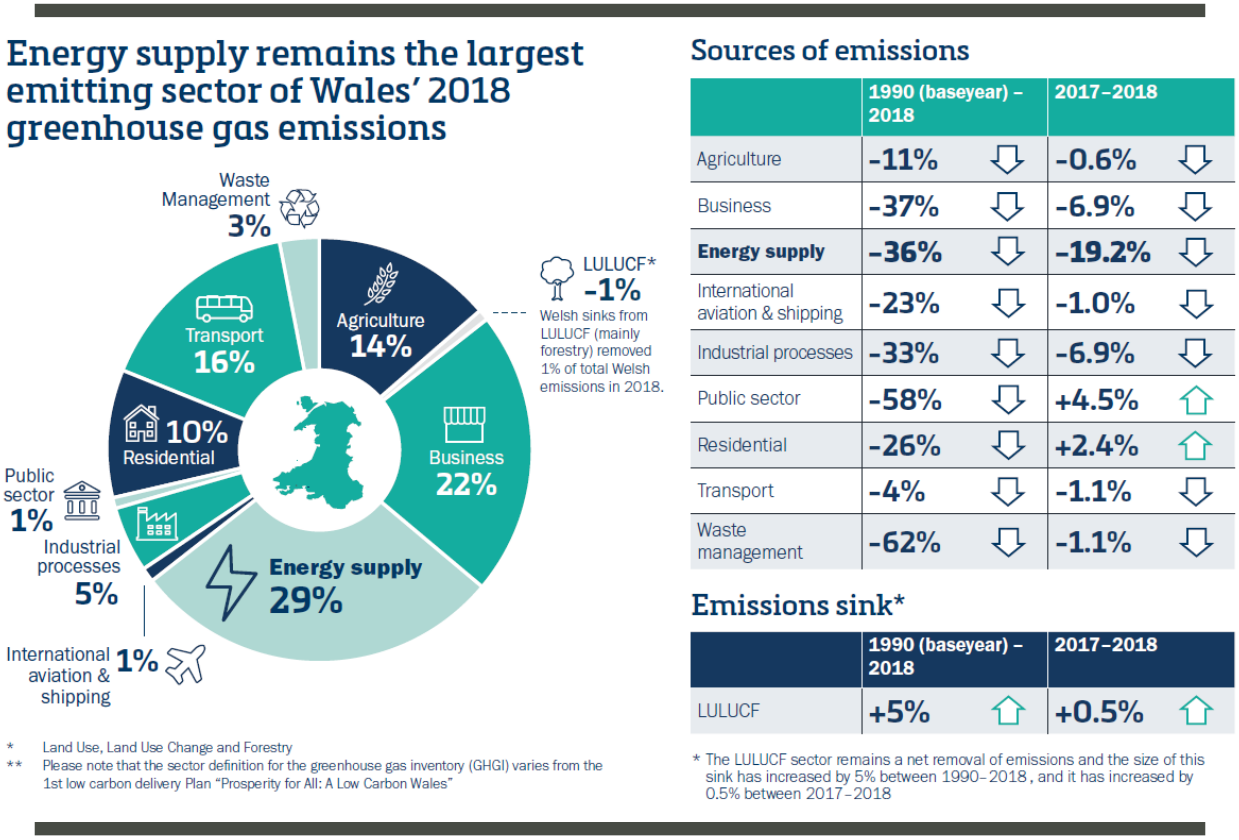


Figure 2- 2018 Welsh Greenhouse Gas Emissions.
Source: https://gov.wales/greenhouse-gas-emissions-infographic

According to the 2018 greenhouse gas emission infographic (Figure 2), Energy supply remains the largest contributor in Wales to the greenhouse gas emissions, followed by businesses, transport, agriculture and residential sectors. In Wales, reducing emissions in partially or fully devolved policy areas (agriculture, land use, planning, transport, energy efficiency for new-builds, and waste management) is a matter for the Welsh Government (Figure 3). Importantly however, decarbonisation in other sectors (energy generation/ supply, industrial production, aviation and shipping) is in the remit of the UK government. This is reflected in Wales's commitments on carbon reduction are on the demand side rather than generation itself. Wales also has higher overall per-capita emissions than the UK as a whole. Therefore, in the Welsh context, a significant reduction in demand through increased efficiency and behaviour change in our society will be key to decarbonisation.

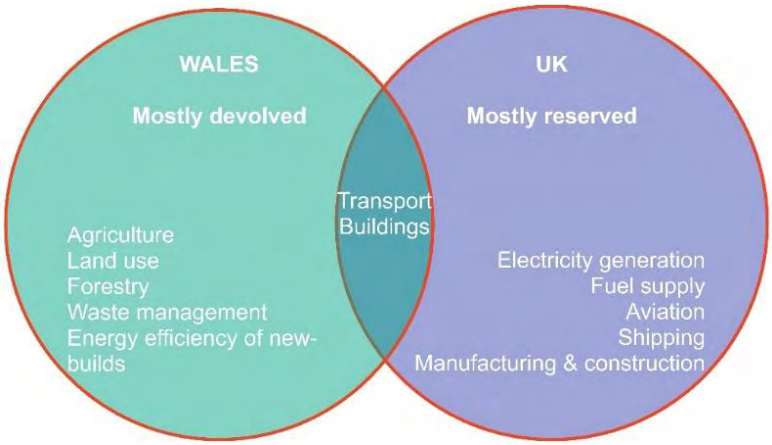


Figure 3- Fully devolved, partially devolved and mostly reserved policy areas

Figure 4 (below), shows a comparison of total final energy consumption in KToe (Killo tonnes of oil equivalent) in Wales by all sectors in 2018. Sector wise division shows, that most of the energy is consumed by the industrial and commercial sector. Pembrokeshire has the highest consumption of energy, followed by Neath Port Talbot and Cardiff. Both Pembrokeshire and NPT are heavily industrialised areas in South Wales. LNG terminals, oil refineries and gas fired power plants are located in Pembrokeshire. Whereas, manufacturing and steel production, dominates the industrial landscape of Neath Port Talbot.

Cardiff consumes more energy in the domestic and transport sector compared to other local authorities. Cardiff is the most populous city in the country and a hub for business and commercial activities. Merthyr Tydfil and Blaenau Gwent have the lowest energy consumptions in all 22 local authorities in Wales.

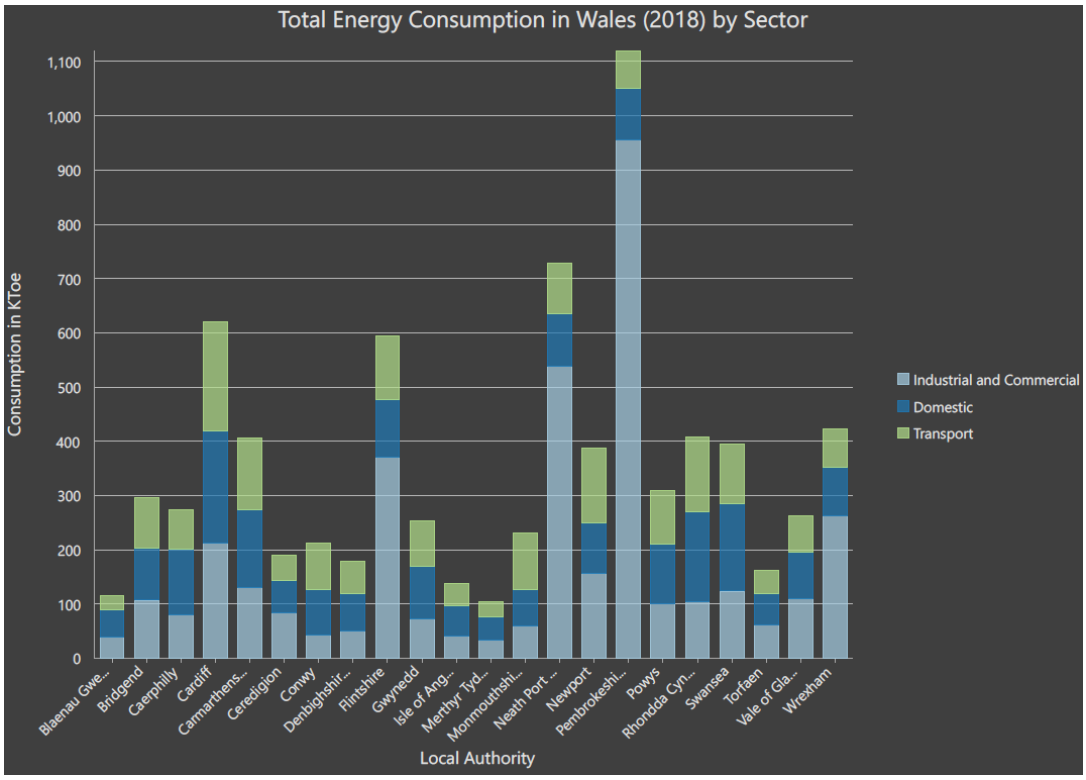
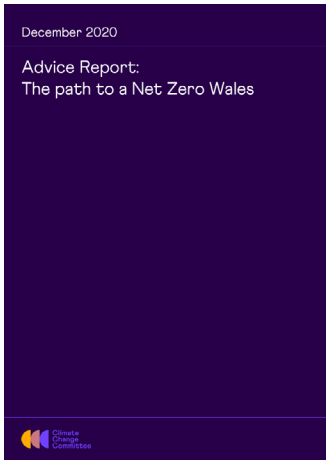


Figure 4- Total energy consumption in Wales (2018) by all sectors.
Data Source: Sub-national total final energy consumption statistics - Department for Business, Energy & Industrial Strategy - GOV.UK

The path to a Net Zero Wales

In December 2020, The Climate Change Committee (CCC) presented the "*The Path To A Net Zero Wales*" advice report to the Welsh Government which sets out recommendations for the actions that are needed in Wales, including the legislation of a Net Zero target and package of policies to deliver it, also a review analysis on whether Wales is on track to meet its currently legislated targets.



Under the 2008 Climate Change Act, Wales is required to contribute to the UK 2050 Net Zero target and the UK's carbon budgets. Wales has announced a fair contribution to the UK net zero goal by bringing forward their target of net zero emissions by 2050. The Climate Change Committee also recommended interim targets for Wales on this decarbonisation path.

Following these recommendations from The CCC, In March 2021 Senedd Cymru approved targets of 63% reduction by 2030; 89% reduction by 2040; and at least 100% reduction by 2050. On this route, there are quinquennial Carbon Budgets for Wales. The first carbon budget ran from 2015-2020. An average of 37% reduction is set for carbon budget 2 (2021-2025) with an offset limit (margin) of 0%. A 0% limit means that Wales must achieve this target by taking appropriate actions. Welsh Government has recently published ***the second emissions reduction plan*** for Carbon Budget 2 (2021 to 2025). The plan also looks ahead to build the foundations for Carbon Budget 3, 2030 targets, and reaching net zero by 2050.

The CCC has proposed different pathways to reach net-zero by 2050 for Wales and for the UK.

These are:

i) Headwinds
ii) Widespread Engagement
iii) Widespread Innovation
iv) Tailwinds
v) Balanced Net Zero Pathway

The Headwinds scenario is mostly dependent on the use of CCS technologies. Widespread engagement relies on carbon reduction through a shift in consumer behaviour (e.g. reduction in air travel, and consumption of meat and dairy products). The Widespread Innovation model sees a significant increase in the adoption of innovative low-carbon technologies as a result of their increased efficiency and decreased costs. Tailwinds suggests that a rapid transition to net zero is possible through a high level of behaviour

change and ambitious cost reduction in low-carbon technologies in coming years. The balanced net zero pathway adopts a fairly steep path for emissions reduction over the next two decades, to reach a level by 2050 where the remaining emissions can feasibly be balanced by greenhouse gas removals.

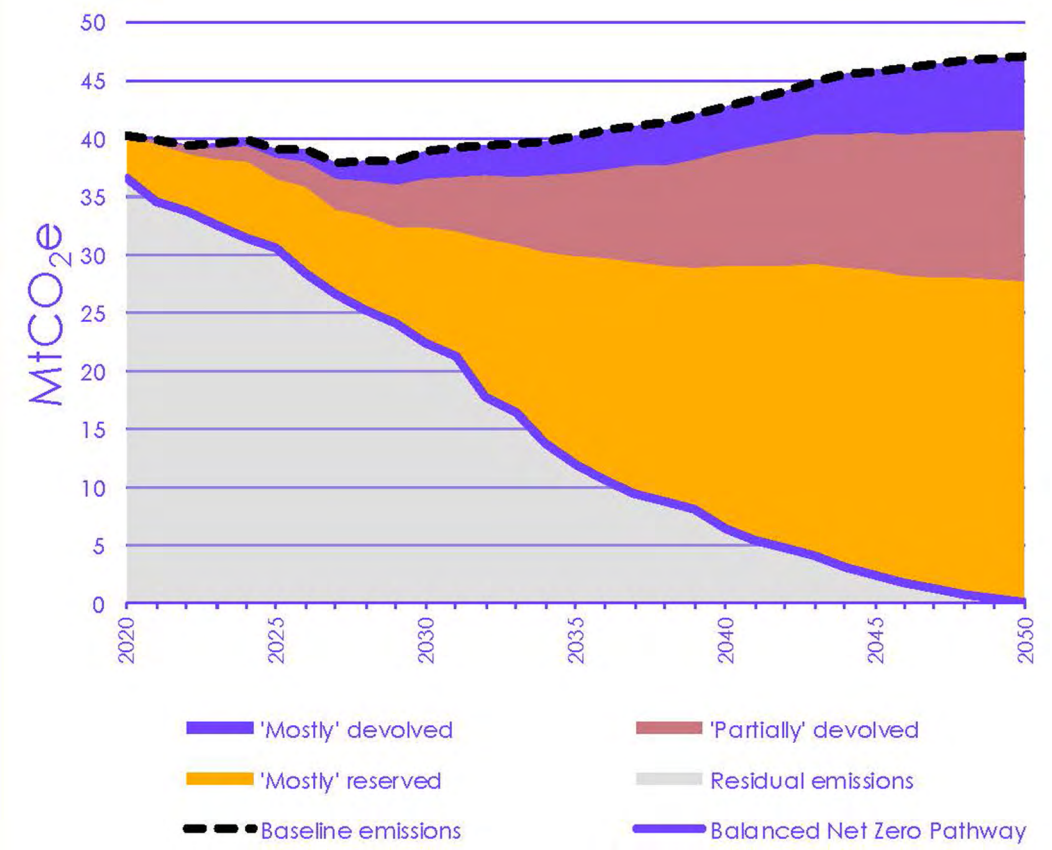


Figure 5- Abatement in the Balanced Pathway for Wales. Share of Wales and UK Government. Source The CCC report "The Path To A Net Zero Wales"

The balanced Net Zero path presented in the CCC report, shows that Nearly 40% of all abatement required in Wales in the next thirty years will take place in 'partially' or 'mostly' devolved sectors (Figure 5). The report highlights these priority sectors: buildings efficiency and heat, agriculture, land use, waste management and demand-side transport measures. Because most of these reductions are on the demand side, the report identified that the key enabling policies that will be crucial in the Welsh context will be across public engagement, education and skills, planning and consenting, public sector operations and measures to enable a just transition.

On the paths to Net Zero Carbon, the CCC also advised a phase-out timeline for high-carbon assets, e.g. diesel petrol car and vans; oil and gas boilers etc. These timelines are in line with the lifetime of these assets in order to avoid the need for investment on early scrappage schemes. Further details of individual sectors are given below:

Buildings

Existing Welsh buildings stock is one of the oldest in UK. Currently, a very small percentage of the energy used for heating our buildings is sourced from renewable means. To achieve net zero in 2050, all the gas and oil boilers in residential and commercial properties will be replaced with low carbon technologies. This will be achieved by uptake of district heating schemes or electrification of heating in buildings. Sale of oil boilers should be phased out from 2028 for the residential buildings and 2025-2026 for the commercial buildings. All oil boilers should stop operations by 2050. Sale of gas boilers for residential buildings should be phased out by 2033 and for commercial buildings should be phased out by 2030-2033. Areas where gas grid is set to convert to low-carbon hydrogen, the hydrogen ready-gas boilers should be exempted from this phase-out plan. Properties not connected to gas grid are likely to go straight onto low-carbon heating systems. During the phase-out period, hybrid heating systems (e.g., combination of heat pump and gas boiler, or solar thermal and gas boiler etc.) in buildings both on and off grid, will help reduce emissions.

Transport

Transport is a partially devolved policy area. Welsh government can devise strategies for an integrated road, rail and public transport service. Aviation, maritime traffic and rail are generally reserved policy areas. The ECC report recommended to phase out fossil fuel cars and vans by 2032 under the balanced net zero pathway. Similarly, a 17% reduction in car miles by 2050 is accounted for in the balanced pathway. This will be achieved through behaviour change and demand reduction. Other measure include electrification of rail network and efficiency improvement of HGVs.

There is a need to develop a better Electric Vehicle charging network in Wales (particularly in mid-Wales) in order to increase the uptake of electric vehicles, which has been slower in Wales than the rest of the UK. The charging network will be extended to the residents who don’t have off street parking. Both public and private investments are required for charging infrastructure improvements, especially the investments from Distribution Network Operators (DNOS) themselves who can play a crucial role. Welsh Government should also consider facilitating the uptake of electric vehicles by providing parking facilities, considering the use of priority lanes, utilising green clauses in public procurement and awareness raising amongst the general population.

Agriculture and land use

Agriculture and change in land use is another source of carbon emissions. Decarbonisation in every sector is necessary to reach the net zero target. Emissions from Land Use, Land-Use Change and Forestry (LULUCF) are inherently location-specific. When compared to the UK, Wales has:

- a similar level of forest coverage;
- slower tree plantation rates;
- a very low amount of emissions associated with degraded peatland;
- a much lower proportion of land area used for crops compared to grasslands; and,
- a significantly higher proportion of total emissions from agriculture compared to the UK.

Wales' Net Zero and climate resilience goals will not be met without changes in farming and land use. In the balanced net zero pathway, Wales must undertake afforestation at a rate of 4,500 hectares per year by 2025, further increasing this rate to 7,500 hectares per year by 2035. Other measures will include:

- Significant reduction in meat and dairy consumption and food waste;
- Increasing average crop and livestock yield;
- Conversion of agricultural machinery on a mix of electricity, hydrogen and biofuel;
- Shifting horticulture indoors;
- Restoration of peatlands;
- Rewetting and sustainable management of lowland cropland;
- An increased cultivation of energy crops.

Waste management

Waste sent to landfills today may continue to release greenhouse gases for decades. Waste management is a fully devolved subject. Wales has outperformed the rest of the UK in recycling rates. Wales currently recycles 62.8% of municipal waste, which is one of the highest recycling rates in the world. Energy is also produced from non-recyclable waste known as Energy from Waste (EfW). Food waste is now collected in all parts of Wales. Under the balanced net zero pathway, key measures recommended for waste manage in Wales are:

- 50% reduction in food waste by 2030 and 60% reduction by 2050;
- Increasing the solid waste recycling rate to 70% by 2025;
- All EfW plants in Wales must be fitted with carbon capture and storage mechanism by 2050;
- Wales must also ban landfilling all municipal & non-municipal biodegradable waste from 2025.

Carbon capture and storage

Wales has large point source emissions (from power generation and industrial units) particularly in South Wales. These units provide jobs and create economic activities in the region. Use of advanced low carbon technologies (e.g., steel making) will help reduce carbon emissions from these units. However, the CCC in their advice report to Welsh Government have synthesised that large parts of Wales have more limited access to CO2 storage sites (e.g., suitable geological formations, saline aquifers, depleted oil and gas reservoirs), therefore CO2 transportation cost will be incurred.

Energy generation

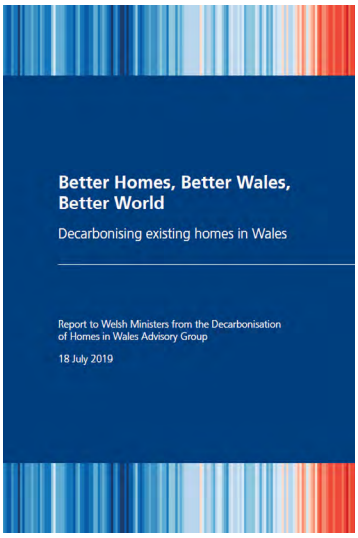
Energy generation/supply is not devolved to Wales and is under full control of the UK Government. Welsh government has set a target to achieve 1GW of locally owned renewable energy capacity by 2030. Welsh electricity demand is expected to double in 2050 as a result of new demand from transport, buildings and industry. Considering the lack of suitable carbon storage sites, Biomass Energy with CCS (BECCS) may not be a suitable option for most of Wales. Alternatively, there is a substantial potential of offshore wind generation. Long term contracts for clean electricity generation in Wales, will help increase clean energy production e.g., from wind, nuclear and tidal.

Further reading

Public sector decarbonisation

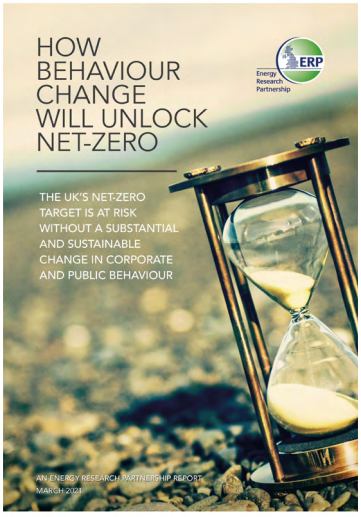
In July 2017, the Cabinet Secretary for Environment and Rural Affairs called for the evidence to seek information on an ambitious target of Welsh public sector to become carbon neutral by 2030. ***"The Decarbonisation of the Public Sector – a Call for Evidence"*** summarises these responses. Public sector includes the 44 public sector bodies including local authorities. However, many responses recommended that other bodies who receive funding from the Welsh Government also be included in this definition. Local authorities and NHS Wales will also have a key role to play in decarbonising the Welsh public sector by 2030

Housing



In 2019, the advisory group on decarbonisation of homes in Wales presented their independent report to the Welsh Ministers ***"Better Homes, Better Wales, Better World"***. The report highlights that Wales has some of the oldest and least thermally efficient housing stock in the UK and Europe. 32% of the Welsh housing stock was built before 1919, without any thermal performance standards. 43% of people are living in these pre-1919-built private rented houses. In last couple of decades, the standards for energy performance of buildings have improved a lot, but only 10% of Welsh homes have been built in last 18 years. The average Energy Performance Certificate (EPC) rating in Wales, falls into category D. The report also highlights that fuel poverty is prevalent in Wales and recommended that the Welsh Government should publicly commit to pursuing a 30-year residential decarbonisation programme. From 2025, all new homes in Wales must be built to be low carbon, energy and water efficient and climate resilient. All homes built with public sector funding should meet these standards no later than 2021. For existing stock, all homes must reach EPC A rating, through retrofitting. Retrofitting must be prioritised in communities suffering from fuel poverty.

Behaviour change



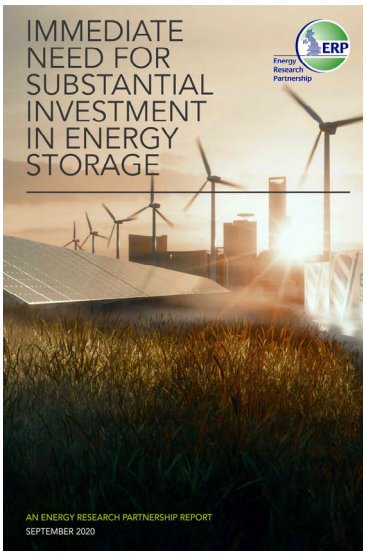
The Energy Research Partnership (ERP) UK has published their timely report ***"How Behaviour Change Will Unlock Net-Zero"*** in March 2021. The UK's ambitious net zero targets will be way off track without a substantial and sustainable change in corporate and public behaviour. Behaviour change is crucial to hit targets on emission reduction on the demand side, e.g., increasing uptake of electric vehicles, consuming less meat and dairy products, recycling with care and reducing household waste.

In the Welsh scenario, behaviour change will be even more vital as most of the Welsh commitments on carbon reduction are on the demand side. Early efforts targeted at behaviour change will help be on the track to net zero pathway. For example, the sale of gas boilers is expected to be phased-out by 2033. A behaviour change in this context will result in increased early adoption of low carbon technologies, e.g., heat pumps instead gas boilers.

Land use policies

In January 2020, the CCC presented their first ever in-depth advice on UK agricultural and land use policies in the ***"Land Use: Policies For A Net Zero UK"*** report. The report assesses the way our land is used today and the changes required in farming and land use, to deliver the UK Government's Net Zero greenhouse gas emissions target by 2050. Farmers and landowners will face many challenges over this transition. However, the framework set out in this report attempts to make it a fairer transition by creating new opportunities and revenue streams. Examples of private benefits include the value of harvested timber, the value of thinnings from forest management, revenue from the sale of bioenergy products and lower fertiliser costs. There will be other social and environmental benefits including improved air quality, flood alleviation, recreational activities, improved health, improved biodiversity and improved water quality etc.

Energy storage

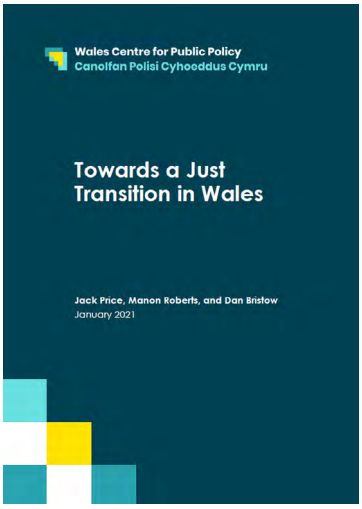


The recent ERP UK report ***"Immediate Need For Substantial Investment In Energy Storage"*** identifies the need for energy storage options in the future. In a net zero environment a significant amount of our energy will be sourced from renewable resources, e.g., wind, solar, tidal and hydro. These technologies are highly weather dependent, and the fluctuation in energy generation is currently being covered by reciprocating gas and diesel generators. As our energy generation shifts more towards these weather dependent resources, the fluctuation will increase. But in a net zero environment it will not be possible to fill the gap with reciprocating gas and diesel generators. Therefore there is a need for timely investment in seasonal and short term energy storage technologies, e.g., hydrogen, ammonia, battery storage and heat storage etc.

Greenhouse gas removal

The balanced pathway to reach net zero by 2050 accounts for CO2 removal, capture and storage options. In 2017, the UK Government asked the Royal Society and Royal Academy of Engineering to consider scientific and engineering views on greenhouse gas removal. In response, a report ***"Greenhouse Gas Removal"*** was presented to the UK government in 2018. The report identifies a range of available greenhouse gas removal methods and the factors that will affect their deployment and use to meet climate targets, both in the UK and globally. These options include forestation, habitat restoration, soil carbon sequestration, bioenergy generation with carbon capture and storage, mineral carbonation, ocean alkalinity and direct air capture and carbon storage techniques.

Just transition in Wales



The Wales Centre for Public Policy (WCPP) published their report ***"Towards a Just Transition in Wales"*** in January 2021. The report highlights that Wales's economy is more difficult to decarbonise, with higher reliance on agriculture and heavy industry than the rest of the UK. The process of decarbonisation, the impacts of climate change and its mitigations will all have socio-economic impacts, e.g. increasing unemployment in heavily industrialised zones. A just transition seeks to ensure that decarbonisation is carried out without creating or exacerbating existing inequalities. The report also focused on the importance of stakeholder engagement for effective policy and decision making in this context and highlights the importance of alternate lenses to consider transition. Bringing geographical variations into the context and considering different timelines for different regions rather than a national sectoral approach.

This handbook was put together for Infuse, a programme that aims to create innovative future public services in the Cardiff Capital Region. It is a living document and we welcome any feedback or comments you have.

Please contact infuse@monmouthshire.gov.uk if you'd like to get in touch. You can also follow us on Twitter @infuse2023.

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