EXPLORING NET ZERO

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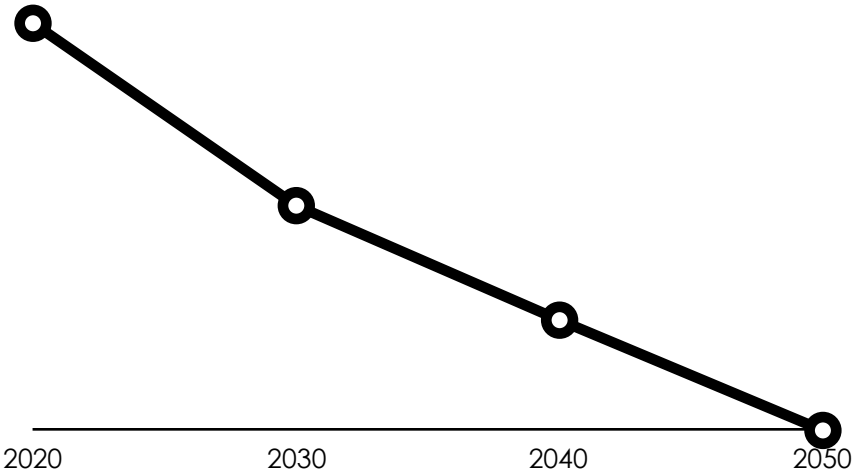


Net zero: cars, lorries, buses and trains

The technology for zero emission cars, lorries, buses and trains largely exists and is improving all the time. Broadly, electricity and hydrogen are key, both of which can be generated from zero-carbon energy.

As demand increases and innovation drives forward, the cost of these technologies continues to fall. Beyond reducing carbon emissions, cutting air pollution is also a driver for the uptake of cleaner modes of transport.

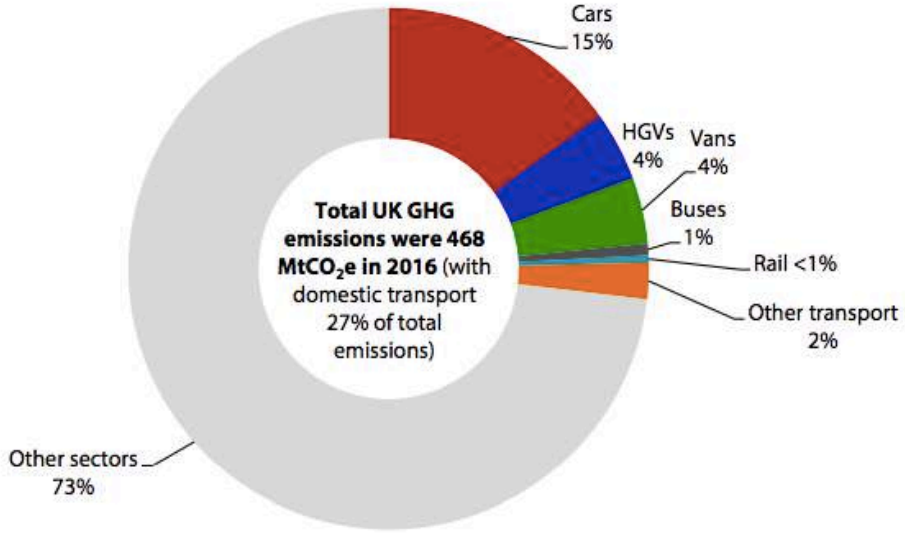
Where are we now?

In contrast to other sectors, transport has seen its emissions rise in the last five years and now accounts for 27% of UK greenhouse gas emissions. Over half of this comes from cars. HGVs and vans each account for 15%, while buses and rail emit less than 5% each. International aviation and shipping are accounted for separately.

Road Vehicles

In the UK, battery electric vehicles (BEVs) will probably become the norm for passenger vehicles, particularly as the charging time shortens, the range increases and more charging points become available. Ranges for BEVs are increasing, with the 2018 Chevrolet Bolt (a mid-sized car) set to have a 238 mile range.

As of June 2018 there were approximately 150,000 plug-in cars on the roads, up from just 3,500 in 2013. This number includes plug-in hybrids, but sales of these are expected to fall over time as BEV technology improves.



Source: BEIS (2018) *Final UK greenhouse gas emissions national statistics 1990-2016.*
Notes: Other transport includes domestic aviation and shipping, mopeds and motorcycles, liquid petroleum gas fuelled vehicles and other road vehicle engines. A detailed breakdown is only available up to 2016.

Sector emissions as a share of UK total, 2016. Image: Committee on Climate Change Progress Report 2018

Currently combustion engine vehicles (diesel and petrol cars) are, on a like-for-like basis, less expensive to buy than BEVs, but that is expected to change in the mid 2020s.

Running costs of BEVs are already a lot cheaper than comparable combustion engine vehicles. Electricity is cheaper than fuel; and with fewer moving parts, BEV maintenance costs are lower.

Taking purchase and running costs into account, BEVs have similar overall costs to petrol and diesel cars in the first few years of ownership. UBS predicted in 2017 that the cost of owning an electric car would draw level with that of a traditional combustion engine vehicle as early as 2018 and doubled its expectations for global electric vehicle sales as a result.

The Government has announced plans to end sales of new conventional petrol and diesel cars and vans by 2040, but has left the door ajar for hybrid electric combustion vehicles. A net zero target could likely mean that all vehicles would need to have zero tailpipe emissions by then.

For true net zero emissions, cars depend on their power supply being clean at source (see briefing on net zero power). If all cars are battery electric models in 2050, a National Grid scenario shows an extra 6GW of peak electricity demand (compared with a current annual peak for UK power demand of 62.3GW).

Smart charging will help to 'smooth' peak demand by shifting charging times to when overall demand for electricity is lower, with market mechanisms driving this shift. Large numbers of BEVs connecting to the grid could require some local electricity networks to be upgraded, although trials have shown that the costs can be reduced using new technologies. Electric vehicles could also help to support the grid by providing electricity back when parked - this is known as 'vehicle-to-grid', and a number of Government-funded trials are underway.

The Nissan Leaf is the world's best selling BEV, and its European manufacturing site is in Sunderland. In 2016, one in five battery electric cars driven in Europe was built in the UK, and low-emission vehicle exports were estimated to be worth nearly £2.5 billion in 2015. London is already deploying electric taxis that have been manufactured in Coventry, which are now also being exported to the Netherlands.

The drive towards BEVs is global. China is in the lead, having deployed more than half a million electric vehicles in 2017. It has ambitious plans to produce two million 'new energy' (ie BEVs and fuel cell) vehicles by 2020, and is predicted to have 50% of the global EV market in 2025. Within Europe, Norway is the out-and-out leader: in 2017 sales of BEVs made up 21% of the total.

Buses

The UK boasts a number of electric bus manufacturers including Alexander Dennis, Optare and Wrights Group, and electric buses operate in cities across the UK. London is soon to expand its fleet of double decker electric buses. Roughly 13% of the total global municipal bus fleet was electric in 2017. Shenzhen, in China, has already electrified 100% of its bus fleet, which numbers 16,359 buses.

Electric buses are becoming a common sight in London. Image: Daniel Wright, creative commons licence

Lorries

Whilst it is expected that smaller vehicles will be battery powered, the likely technology winner for decarbonising larger vehicles is a lot less certain. Known for its sporty electric cars, America's Tesla has announced the imminent launch of the electric 'Tesla Semi', a lorry capable of a 500 mile range on a single charge. Chinese firm BYD has electric trucks already commercially available in China.

Other potential solutions include hydrogen-powered fuel cell propulsion, and electrifying some of the strategic road network.

Hydrogen can be generated through electrolysis, using an electric current (eg from renewable or nuclear energy) to split water into hydrogen and oxygen. It can also be made by steam reforming of methane, with the carbon dioxide generated being captured and stored.

The world's first electrified road opened in Sweden in April 2018. In the UK, a feasibility study was conducted in 2015 on behalf of Highways England. The study found that road electrification was technically feasible, but there were other social barriers to uptake.

Shifting freight away from the congested road network and onto railways for longer journeys is also an option.

Trains

The British Government has announced that all diesel trains will be removed from the rail network by 2040. Around 42% of the UK's rail network is currently electrified, with the vast majority of the rest being diesel-powered. This is relatively low compared to electrification rates in the Netherlands (76%) and Italy (71%).

Electrifying lines carries high upfront capital costs. The Great Western electrification scheme is estimated to cost £2.8 billion (£3.54m per mile), which is partly why the £38bn rail electrification programme announced in 2012 was abandoned by Government in July 2017.

Potentially the most likely alternative to full electrification of the rail network is to use hydrogen fuel cells to power trains. Train-manufacturer Alstom plans to introduce hydrogen trains to the UK imminently by retrofitting existing stock, and Germany recently began operating a hydrogen train service.

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