Department for Transport

Transport and Environment Statistics 2021 Annual report

About this release

This release presents statistics on the impact of transport on the environment, including greenhouse gas emissions from transport, air quality and electric vehicles. Greenhouse gas and air quality data is drawn from National Statistics. Chargepoint data and journey emission comparisons are classed as experimental statistics. We invite feedback on the presentation and information supplied in this release.

Carbon Dioxide equivalent (CO_2e)

Different greenhouse gases, such as methane, nitrogen oxides, etc., have different impacts on the greenhouse gas effect. All gaseous emissions are converted to the amount of CO_2 needed to create the same effect, and presented in this report as CO_2e.

Key Findings:

- This publication provides estimated GHG emissions from example journeys across the UK, comparing different modes of transport. Using 2020 estimates of carbon emissions, we estimate that a petrol car journey from London to Glasgow emits around 4 times more CO_2e per passenger than the equivalent journey by coach.
- It also provides guidance for third parties on how to develop such comparisons, through the supplementary materials available here.
- In 2019, domestic transport was responsible for emitting 122 $MtCO_2e$ (million tonnes of carbon dioxide equivalent). This means transport is the largest emitting sector of greenhouse gas (GHG) emissions, producing 27% of the UK's total emissions in 2019 (455 $MtCO_2e$). This is a 1.8% reduction in emissions from 2018.
- There has been little change over time in transport emissions, either by mode or across the sector. 2019 transport emissions were 3% down on the total in 2009.
- International aviation emissions (which are not counted towards the UK's total domestic emissions) have more than doubled from 16 $MtCO_2e$ to 37 $MtCO_2e$ in the period 1990-2019, a 138% increase.
- In 2018, 34% of Nitrogen Oxides (NO_X) emissions and 13% of Particulate Matter ($PM_{2.5}$) emissions came from transport.
- As of 1 April 2021, there were 22,790 public electric vehicle charging devices available in the UK. Of these 4,259 were rapid devices.

RESPONSIBLE STATISTICIANS: Seymour Millen 020 7944 3077 environment.stats@dft.gov.uk
Ellie Page 020 7944 3077 environment.stats@dft.gov.uk
FURTHER INFORMATION: Media: 020 7944 4833

Follow @DfTStats

Greenhouse Gases: Journey emission comparisons

The following analysis presents the carbon emissions of a set of representative journeys a person in the UK might take, via a wide range of transport modes, and their consequent emissions. See overleaf for visualisation.

Emission-releasing activity considered here includes:

- ► Direct emissions: emissions produced by the vehicle itself.
- ► Indirect emissions: emissions produced by the extraction, refining, and transportation of the fuel used to power the vehicle. For electric vehicles, this includes the generation and transmission of electricity.
- ► Indirect effects: complex effects produced by greenhouse gases interacting with the atmosphere, e.g. contrails produced by planes in the atmosphere, which reflect sunlight. Due to their complexity, their GHG effect is uncertain and what is presented here is a central estimate. Indirect effects are only included in the calculation of air travel in our analysis. These are sometimes referred to as 'radiative forcing' or RF.

Results

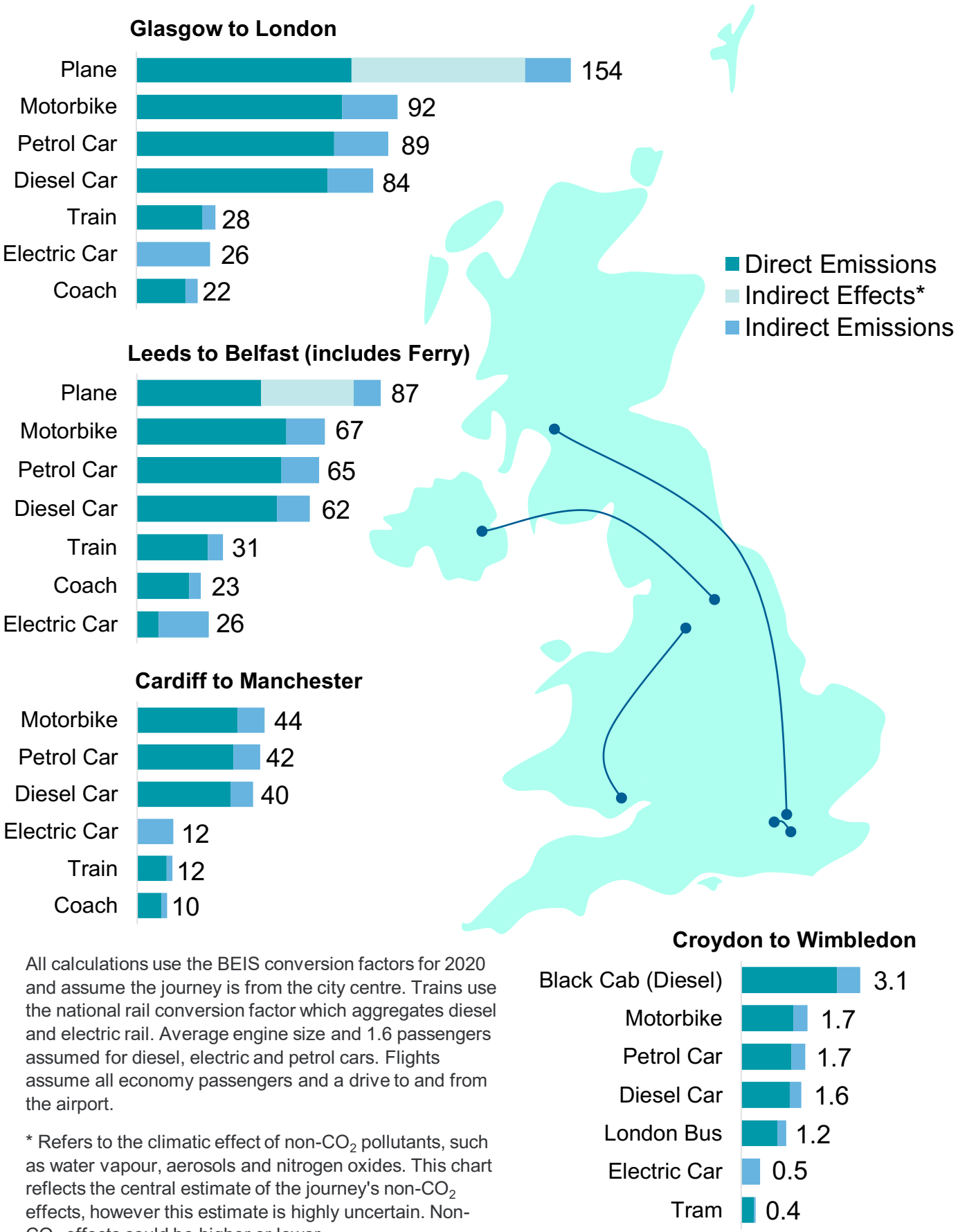
The statistical estimates developed using this method suggests that cars emit more GHGs per passenger mile than trains and coaches that convey more people, and so maximising the number of people per vehicle can reduce emissions per person.

For an example journey between London and Glasgow (see figure 1 overleaf), a journey via the **average petrol car emits around 4 times more CO_2e per passenger** than the equivalent journey by coach, or 3.4 times more CO_2e per passenger emitted by the average electric car (taking into account emissions from electricity generation and distribution).

The same journey by plane would **emit over 7 times more CO_2e per passenger** than by coach, and 70% more CO_2e per passenger than a journey by the average petrol car.

Plane journeys that transport many passengers also emit very high levels of GHGs, require transport to and from the airport, and have uncertain climatic effects beyond this (e.g. the reflection of sunlight on contrails), so can produce more GHG emissions than cars. However, for our Leeds to Belfast example, car journeys must go further to reach the ferry terminal, and so cars end up emitting comparable GHG emissions to the more direct plane journey. A journey can be more efficient in terms of emissions by being more direct, which is another reason why our example train journeys emit less overall.

Figure 1: Indicative GHG emissions ($KGCO_2e$) for a single passenger, 2020 (table ENV0701)



All calculations use the BEIS conversion factors for 2020 and assume the journey is from the city centre. Trains use the national rail conversion factor which aggregates diesel and electric rail. Average engine size and 1.6 passengers assumed for diesel, electric and petrol cars. Flights assume all economy passengers and a drive to and from the airport.

* Refers to the climatic effect of non-CO_2 pollutants, such as water vapour, aerosols and nitrogen oxides. This chart reflects the central estimate of the journey's non-CO_2 effects, however this estimate is highly uncertain. Non-CO_2 effects could be higher or lower.

Caveats

Our methodology is under continuous development to improve accuracy and utility. However, we are aware of areas where estimates will be imprecise. In general, the BEIS conversion factors rely on the construction of averages from regular travel patterns, and so individual behaviour is likely to vary from this central estimate. For example, if a car is older than average, the journey may be more polluting. If the journey encounters less traffic than average, the journey may be less polluting. Likewise, the journeys DfT have designed may not reflect every journey. For example, some journeys may be longer between the locations listed here if different routes are used to avoid traffic, or refuel.

For more information, and for guidance on how to develop such comparisons, consult the supplementary materials published alongside this report.

Greenhouse gas emissions from transport

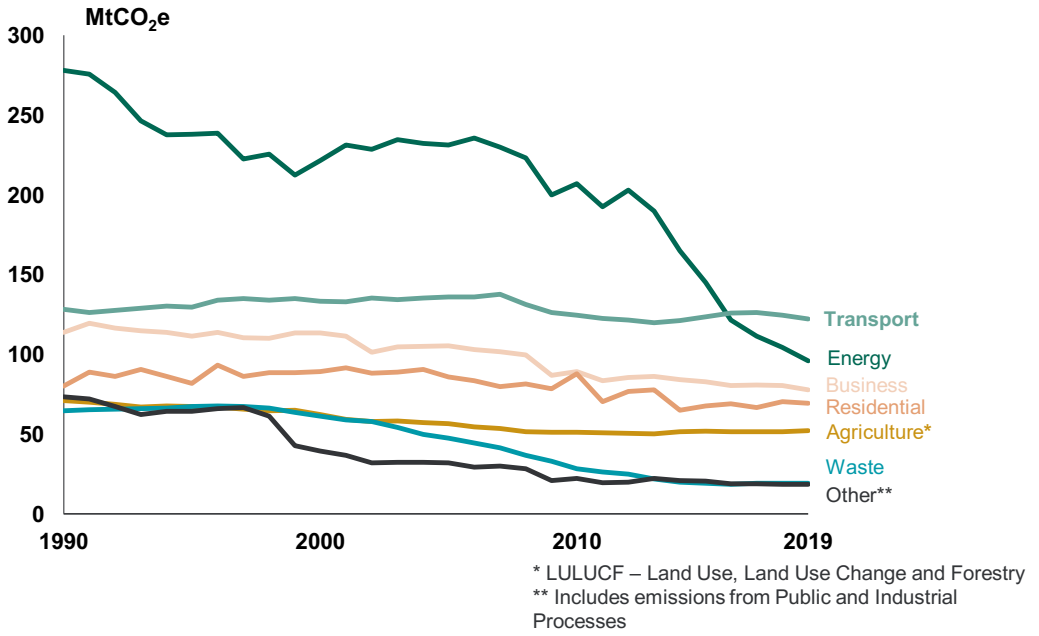
Data sources

The data we present on greenhouse gases comes from the Department for Business, Energy and Industrial Strategy (BEIS) GHG Inventory collected and modelled by the Ricardo Consortium (a third-party contractor). To calculate transport emissions, Ricardo combine data on fuel consumption with transport data to model emissions. It covers the period 1990-2019.

In 2019, the UK produced 455 $MtCO_2e$ of GHG emissions. Transport was responsible for 122 $MtCO_2e$. This is down 1.8% from 2018 despite a 2% increase in vehicle miles. Domestic transport emissions have decreased by 5% since 1990 while total UK domestic emissions fell 44% in the same period.

Transport became the largest emitting sector in 2016. This follows large decreases in energy emissions as the UK switched away from coal power and towards gas, while transport emissions have remained relatively static.

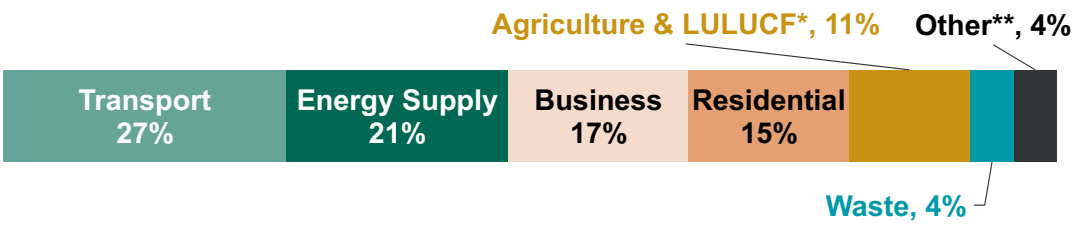
Figure 2: Greenhouse gas emissions by sector, 2019 (BEIS, 2021)



* LULUCF – Land Use, Land Use Change and Forestry
** Includes emissions from Public and Industrial Processes

Transport produced 27% of the UK's total emissions in 2019. Of this, the majority (91%) came from road transport vehicles (111 $MtCO_2e$). The biggest contributors to this were cars and taxis, which made up 61% of the emissions from road transport (68 $MtCO_2e$), followed by Heavy Goods Vehicles (HGVs) (18% of road transport emissions, 19.5 $MtCO_2e$) and vans (17% of emissions, 19 $MtCO_2e$).

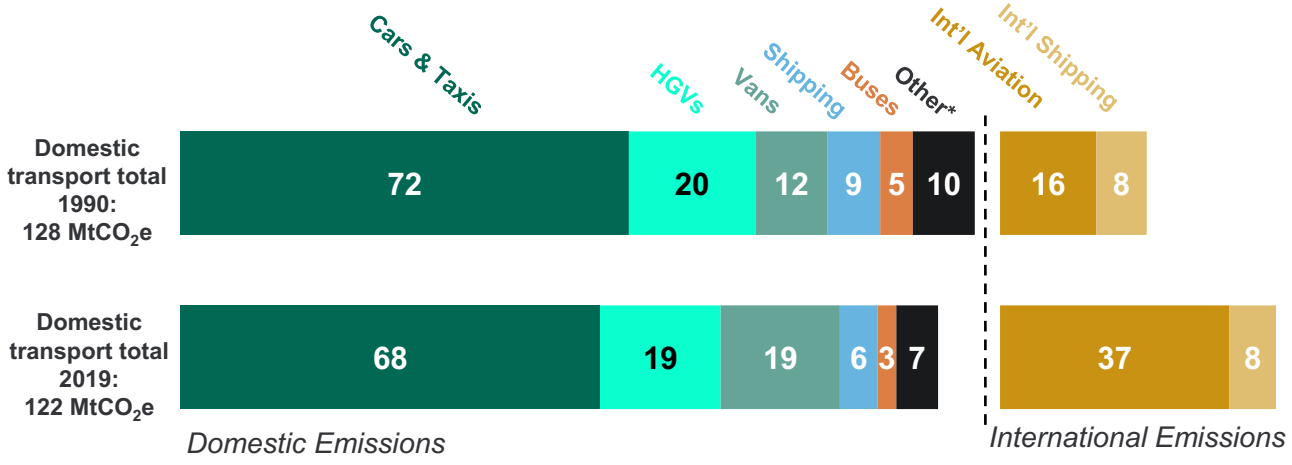
Figure 3: Greenhouse gas emissions by sector, 2019, by proportion (BEIS, 2021)



There has been little change over time in domestic transport emissions, either by mode or across the sector. Emissions increased until a peak in 2007, before decreasing year-on-year until 2013, when emissions started increasing again. Emissions started declining again in 2018; 2019 transport emissions are equivalent to those of 2011. Improved fuel efficiency of cars has generally seen emissions from cars decrease since the mid-2000s, while bus and rail emissions have also decreased in this period. Van emissions have increased by 8 $MtCO_2e$ since 1990 (a 65% increase).

Though most transport modes have seen relatively little change in emissions from 1990 to 2019, International aviation emissions have more than doubled from 16 $MtCO_2e$ to 37 $MtCO_2e$, a 138% increase.

Figure 4: Greenhouse gas emissions by transport mode, 1990 and 2019 (table ENV0201)



Comprises, in 2019: Rail, 1.8 $MtCO_2e$; Domestic Aviation, 1.5 $MtCO_2e$; Military vehicles, 2.3 $MtCO_2e$; Motorcycles, mopeds and other road transport, 1.2 $MtCO_2e$.

Provisional data for the UK's domestic GHG emissions from the transport sector for 2020 have been released. These data suggest that domestic transport carbon dioxide emissions have fallen 19.6% since 2019, to 97.1 million tonnes in 2020. This is associated with falls in transport usage during restrictions introduced in response to the COVID 19 pandemic. These estimates also suggest that domestic transport carbon dioxide emissions were 23% below the 1990 figure.

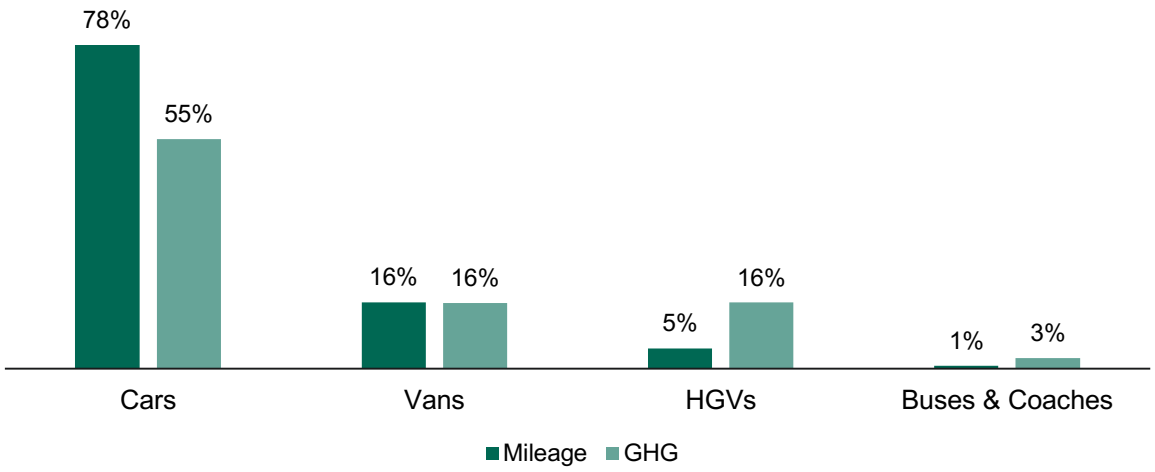
Domestic emissions

This report largely focuses on UK domestic GHG emissions, which excludes international aviation and shipping. Emissions are estimated following the guidance set out by the Intergovernmental Panel on Climate Change (IPCC), as required for the UK's submissions to the United Nations Framework Convention on Climate Change (UNFCCC) each year. Under this guidance, international aviation and shipping emissions are reported but not included within the UK total. The UK Government has recently announced that from Carbon Budget 6 (2033 – 2037), these emissions will be counted within the UK total.This report focuses on 'territorial' emissions, which are those emitted within the UK's borders. Alternative presentations, on a residency or a consumption basis, are also available (ENV0201)

Mileage and fuel use

In 2019, cars made up 79% of the road vehicle miles travelled within the UK, but produced 55% of transport emissions, while HGVs made up a much smaller proportion of the vehicle miles (5%) and their emissions were disproportionately greater (16%). This is mainly because smaller vehicles are more fuel efficient.

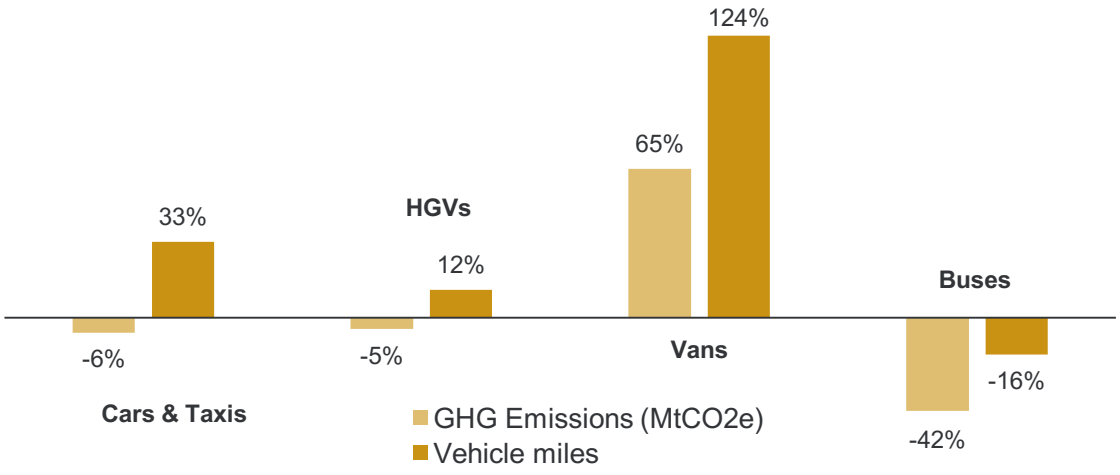
Figure 5: Emissions and Mileage for Cars, Vans, HGVs and Buses (tables ENV0201 and TRA0101)



Between 1990 and 2019, new vehicles have generally become more fuel efficient. As a result, emissions for road vehicles have tended to increase at a slower rate than total vehicle miles, or even decrease despite increased mileage. This effect is stronger for some road vehicles than for others.

Increased fuel efficiency in HGVs have been offset by an increased proportion of larger/heavier HGVs amongst new registrations (DfT, VEH0506). In addition, new car fuel efficiency has decreased since 2016 after a period of growth. This is largely due to increase in the proportion of SUVs and other large vehicles amongst new car registrations (DfT, VEH0220).

Figure 6: Change in mileage and emissions, 1990 to 2019 (tables ENV0201 and TRA0101)



Air Pollution from Transport

Data sources

Air pollution figures for the UK are measured by the National Atmospheric Emissions Inventory (NAEI). Data here covers the period of 1990-2018. Unlike GHG emissions expressed as CO_2e, there is no agreed way of comparing relative effects of different air pollutions. As a result, this report does not include a summed total of all air pollutants. Policies and targets to reduce air pollution are set out in the Clean Air Strategy (2018).

Transport vehicles also emit gases or other substances which don't have a significant greenhouse gas effect, but do have significant health consequences. The most significant air pollutants from the transport sector are nitrogen oxides (NO_X) and particulate matter (PM).

Transport contributed a substantial portion of these air pollutants to the UK's domestic total: 34% of NO_X emissions, 13% of $PM_{2.5}$ emissions, and 11% of PM_{10} emissions came from transport in 2019.

Air pollutants from transport have decreased since 1990, largely because newer vehicles emit less nitrogen oxides and methane. However, emissions are also dependent on vehicle type: in the decade 2008-2018, cars reduced NO_X emissions by 43%, while total NOx emitted by vans increased by 39%.

Figure 7: Nitrogen Oxides emitted by transport mode, 1990-2018 (table ENV0301)

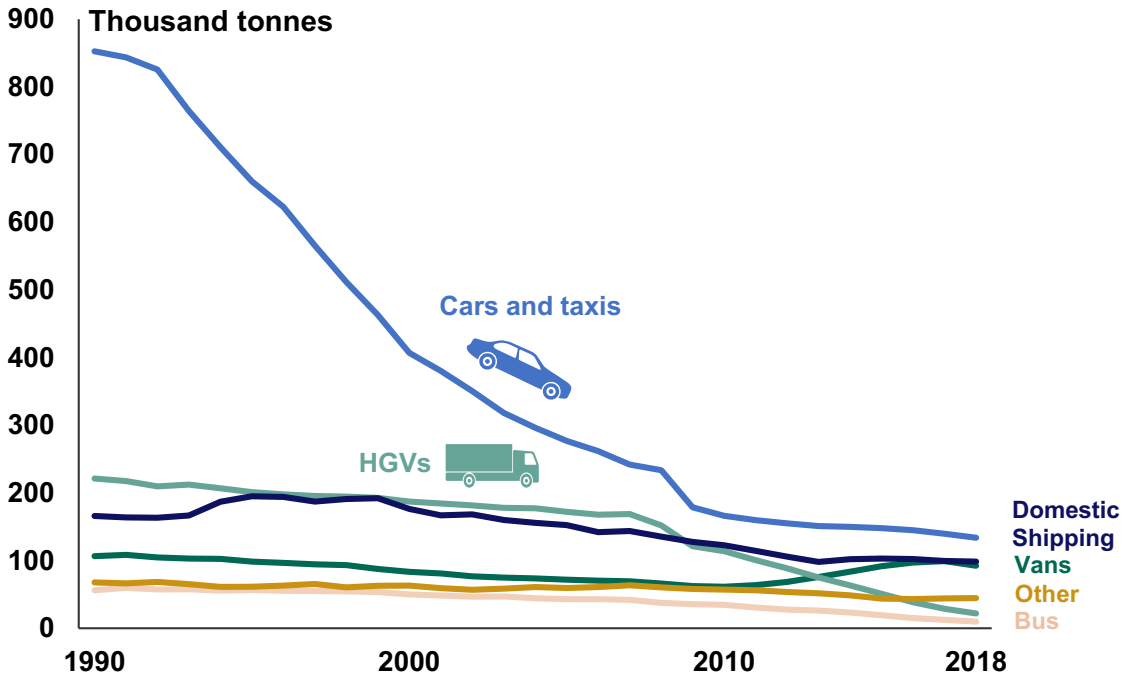
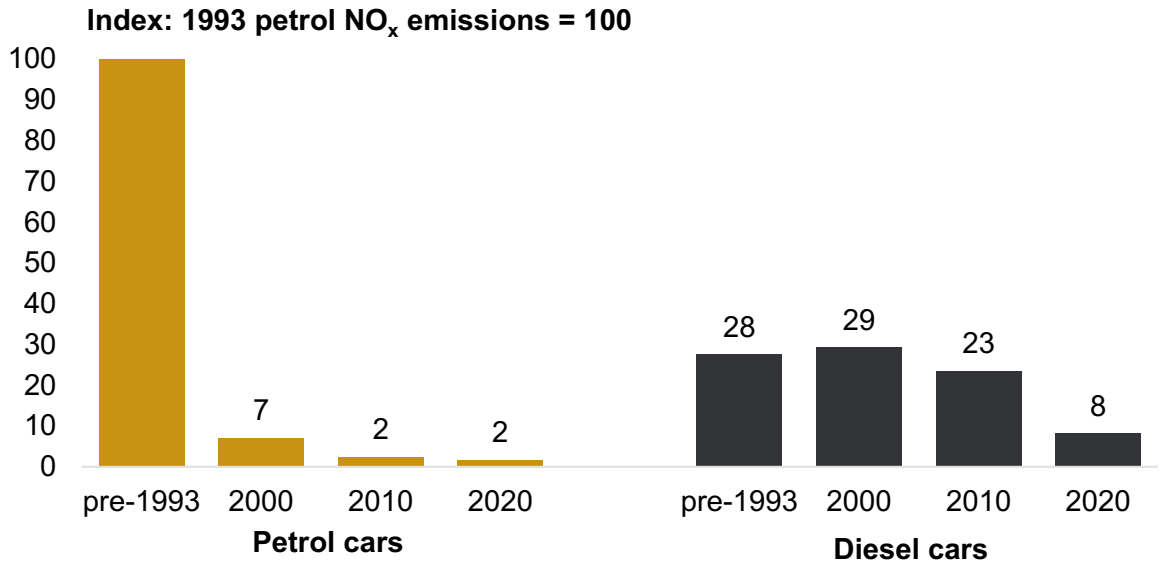


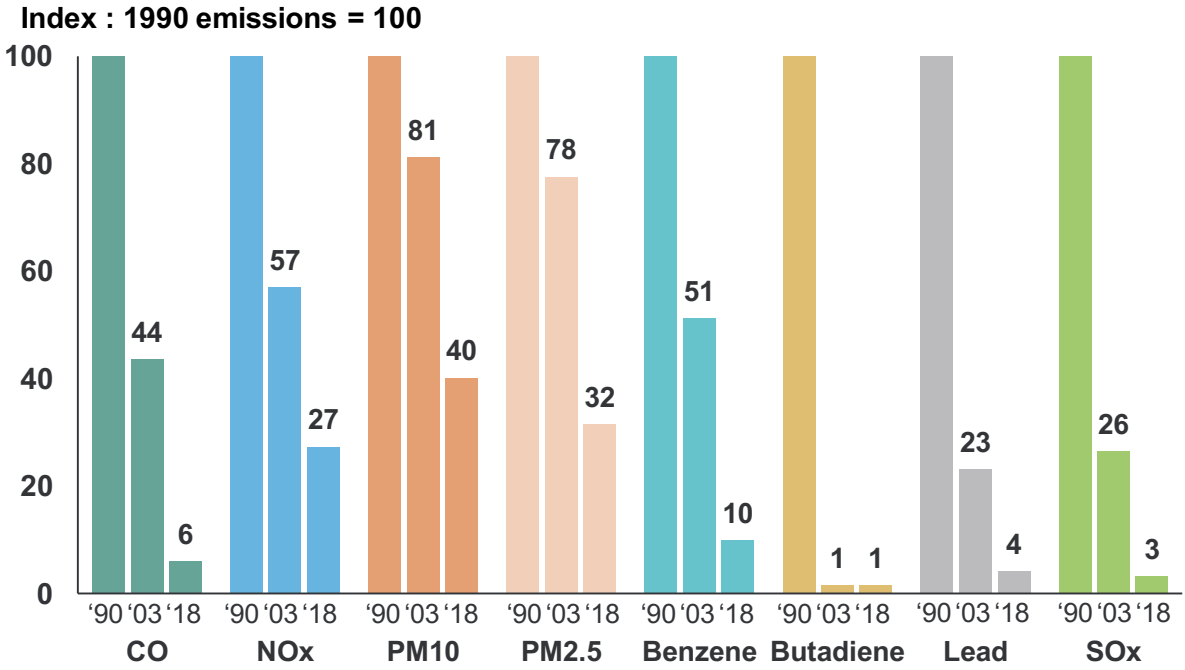
Figure 8: Average NO_x emissions from petrol and diesel cars in urban conditions, 1993-2020 (table ENV0301)



The reduction in NO_x emissions among cars has been driven primarily by petrol cars since 1993, with the introduction of legislative vehicle emission standards. From a lower base, diesel cars have shown less of a reduction in NO_x emissions and on average emit 4 times as much NO_x in urban conditions in 2020.

By contrast, particulate matter has proved more difficult to reduce. PM_{10} from brake and tyre wear has increased by 23% from 1990-2018, and PM_{10} from road abrasion has increased by 25%. These two sources together represent two-thirds of PM_{10} emissions from transport in 2018.

Figure 9: Air pollutants from transport, from 1990-2018 (table ENV0301)



Electric Vehicles and Charging Devices

In recent years, sales of low or zero emission vehicles have increased. Data up to the end of Q3 2020 shows over 113,000 Ultra-Low Emission Vehicles (ULEVs) were registered in 2020 (DfT, VEH0170). Statistics recently compiled by the Society of Motor Manufacturers and Traders (SMMT) suggest that as of April 2021, there were more than 500,000 ULEVs in the UK.

UK charging point infrastructure has grown alongside this expansion of ULEVs. Since 2015, the number of public charging devices in the UK has grown by over eight times to 22,790 as of 1 April 2021. However, there has been a noted uneven geographical distribution of charging devices within the UK. Of the 10 local authorities with the greatest number of devices, seven of them were in London as of April 2021. Growth in the number of installed devices slowed in 2020 due to the COVID-19 pandemic.

Numbers of rapid charging devices have increased to 4,259 devices as of 1 April 2021. These devices are less concentrated in specific areas, and the local authorities with the most rapid charging devices in 2020 were in Milton Keynes, the Highlands of Scotland, Leeds, Nottingham and Northumberland.

More information can be found in DfT's charging device publication.

Figure 10: Growth in the UK charging devices 2015-2020, by local authority (table EVCD_02)

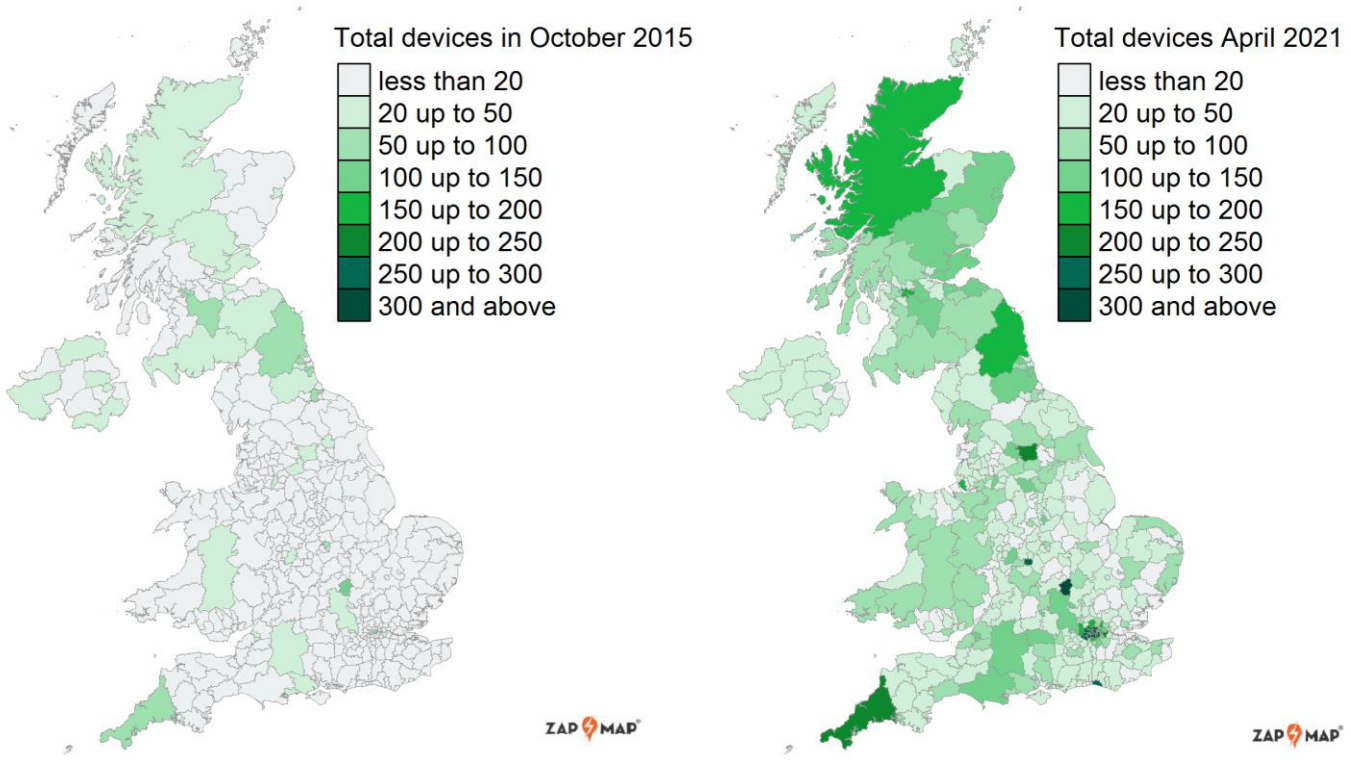


Figure 11: Growth in the UK rapid charging devices 2015-2020, by local authority (table EVCD_02)