OXFORD ECONOMICS

10 August 2023

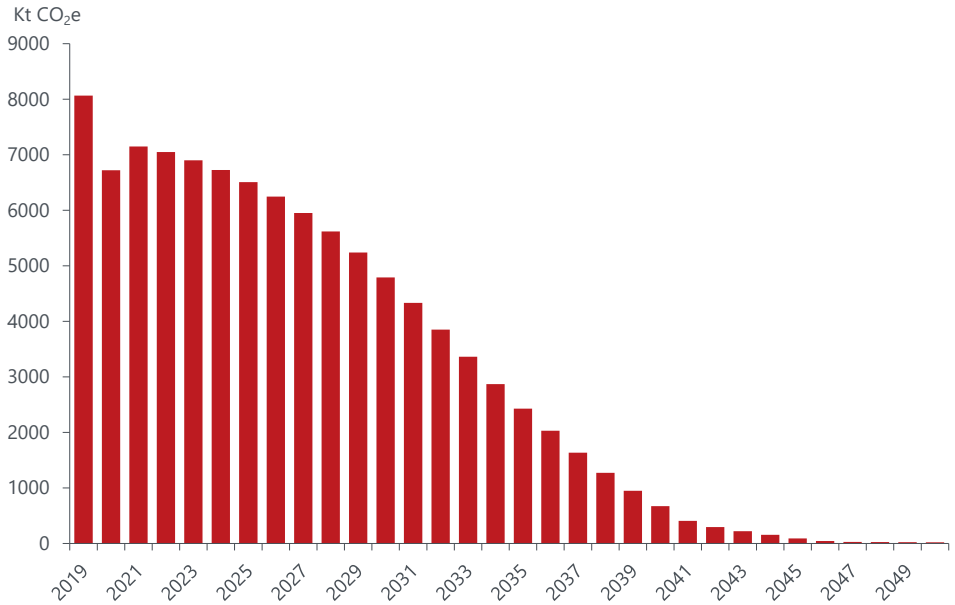
Research Briefing | London

London roads will become net zero, but not until 2050

- **Greenhouse gas emissions on London's roads have fallen historically, despite a rise in traffic. And on the basis of current policies and technological trends, we think it reasonable to expect that emissions from road transport in London will reach net zero by around 2050. That is fully in line with the UK government's aspirations for the UK as a whole, but far behind what the Mayor of London would like to see happen.**
- **Some progress may be achieved by encouraging shifts in behaviour, away from private road transport to either public transport or active travel such as walking or cycling. However, we are sceptical about the likely scale of such transitions. Similarly, neither working from home nor more widespread adoption of shopping locally is little to make much difference to net emissions on London roads.**
- **Progress to net zero will therefore be heavily reliant on removing the most polluting vehicles from London's roads, and boosting the uptake of electric and perhaps hydrogen vehicles. For cars, this will depend on costs, capabilities, and convenience. We expect to see progress on all fronts, but not fast enough to achieve the Mayor of London's aspiration of net zero by 2030.**
- **The same is true for light goods vehicles. For buses and coaches, progress is already rapid. But for heavy goods vehicles, some significant technological improvements are likely to be needed.**
- **Our modelling, based on cautious assumptions, suggests that emissions on road transport in London will be approximately 4,800 kilotons (kt) CO_2e in 2030, down from 8,100 kt CO_2e in 2019. The rate of decline is then likely to accelerate significantly, supported by a falling share of non-fully electric vehicles (down from 65% to 5%). And we expect London road transport emissions to reach net zero by around 2050.**

Chart 1: London road emissions likely to reach net zero by around 2050

Greenhouse gas emissions from road transport in London, 2019-2050: Oxford Economics modelling



Source: BEIS/Oxford Economics

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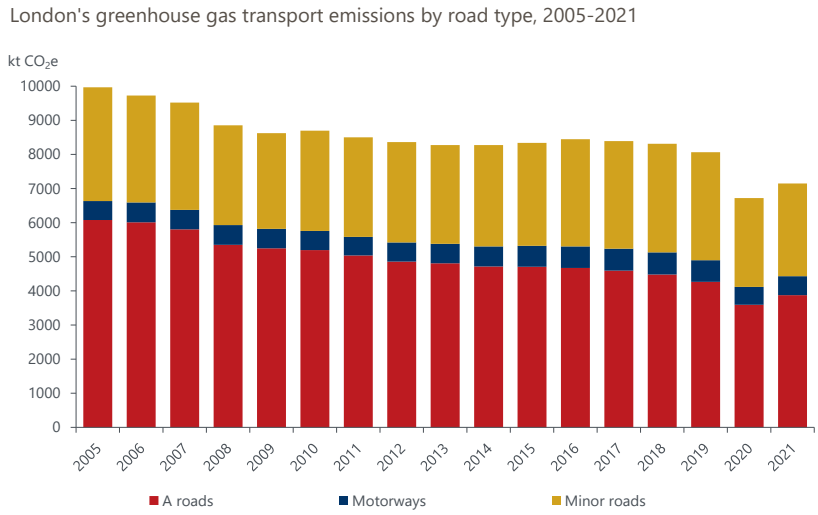
Road transport emissions have been falling in London

In a previous Research Briefing, we discussed the likelihood that London will become net zero by 2030, as the London Mayor, Sadiq Khan, hopes. We noted the contributions that various sectors are currently making to reduce greenhouse gas emissions, and we suggested that, although the transport sector is likely to see continuing declines in its CO_2 equivalent (CO_2e) emissions, it will probably not get to net zero by 2030, or anything remotely like it. Possibly reinforcing that, July's by-election in Uxbridge and South Ruislip highlighted some of the political challenges involved in achieving a shift to net zero, for road transport in particular. And since then, there have been suggestions that the current UK government may abandon its commitment to require all new cars sold in the UK to be electric-powered or zero-emission by 2030, something that would clearly make the Mayor's target harder to meet.

Chart 2: Greenhouse gas emissions from road transport have been declining in London



Source: BEIS

Recent history provides very modest reasons for optimism. Chart 2 shows the historical decline in London's road transport emissions over the 2005-21 period. Emissions from transport on main roads ("A" roads) and minor or local roads both declined significantly, while emissions from vehicles using the motorway network changed little (although this masks some fluctuations over the period). Within that there was a sharp falling away in 2020, because of the pandemic, and a partial rebound in 2021. The latest Climate Change Committee (CCC) progress report to parliament suggests that transport emissions, at the UK national level, in 2022 were higher than in 2021, but still 8% below 2019 levels, and the CCC describes that as potentially a new "steady state".

That is despite a rise in traffic

The rate of progress is driven by two factors. The first is the replacement of petrol and diesel vehicles with less polluting models or with hybrid or pure electric vehicles, which has so far been modestly helpful. The second is the reduction in the amount of use that is made of those petrol and diesel vehicles that do continue to exist, which has been less helpful. The Mayor's ambition, as captured in his Accelerated Green Scenario, is for a 27% reduction in car vehicle kilometres (VKM) by 2030 relative to 2018. Unfortunately, in recent years the distance travelled by road vehicles in London has been rising, not falling, as Chart 3 shows. Between 1993 and 2019, it increased by 1.2 billion vehicle miles travelled (VMT), reaching an estimated 20.3 billion vehicle miles travelled in 2019.

To be fair, this does mask fluctuations across the period: from 1993, when records began, to 2006 there was a steady rise, followed by a downward trend until 2013, before a pick-up once again through to 2019. The onset of the pandemic reduced the figure to 16.6 billion VMT in 2020, but since then there have been two consecutive upticks in 2021 and 2022. According to DfT's latest Road Traffic Statistics, the distance travelled

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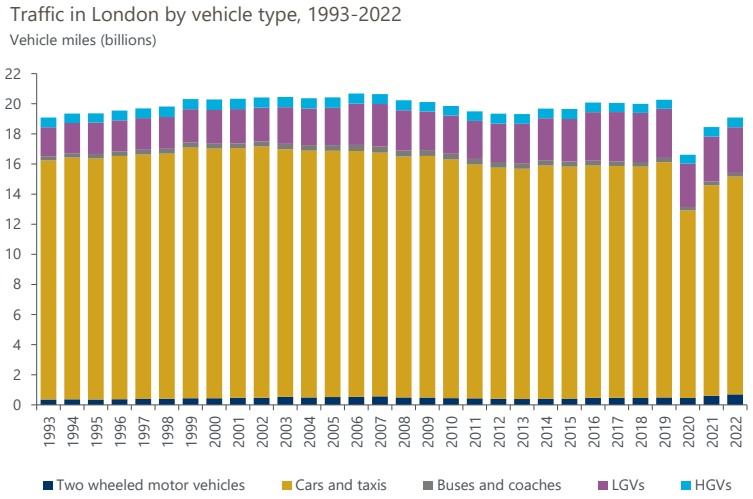
by motor vehicles on London roads in 2022 is estimated at 19.1 billion VMT, similar to levels recorded in 1993.

It is striking to see an increase in road traffic across London given that, during this period, the congestion charge and, more recently, the Ultra-Low Emissions Zone (ULEZ) were introduced, with many people assuming that these would significantly reduce road traffic. Part of the explanation for why that has not happened is that the congestion charge produced a decline in the number of vehicles driving into the relevant zone from outside, but had little impact on vehicle use at the very local level. In particular, the growth in road traffic since the introduction of the congestion charge in 2003 was exclusively in outer London between 2003 and 2019, whereas it fell by 13% in inner London. Furthermore, ULEZ is not designed to reduce traffic: the policy is intended to reduce the number of highly polluting vehicles driving within these areas.

Chart 3: London road traffic was increasing prior to the pandemic



Source: DfT

Another potential explanation for the increase in London road traffic is the sharp rise in the use of taxis and similar hire vehicles. The latest statistics published by the DfT show that since 2005, the number of licensed vehicles (including both taxis and private hire vehicles operated by companies such as Uber and Bolt) in London increased by more than 70%, as shown in Chart 4. Some of that was probably coincidental (a mix of growth in population, incomes, and economic activity, and changing consumer preferences), and some of it was provoked by the congestion charge and ULEZ, which caused people to move out of car ownership, but not cut down on journey numbers or lengths. Certainly, the Census 2021 results show that the proportion of households with access to a car or van (57.9%) was virtually the same as in 2011 (58.4%) while the number of households and people in London has grown over the last decade.

There was also an increase in delivery vehicle traffic (27% between 2009 and 2019), partly for the same reasons, but also associated with the switch to online retailing. Meanwhile, the number of bus (and coach) journeys changed little.

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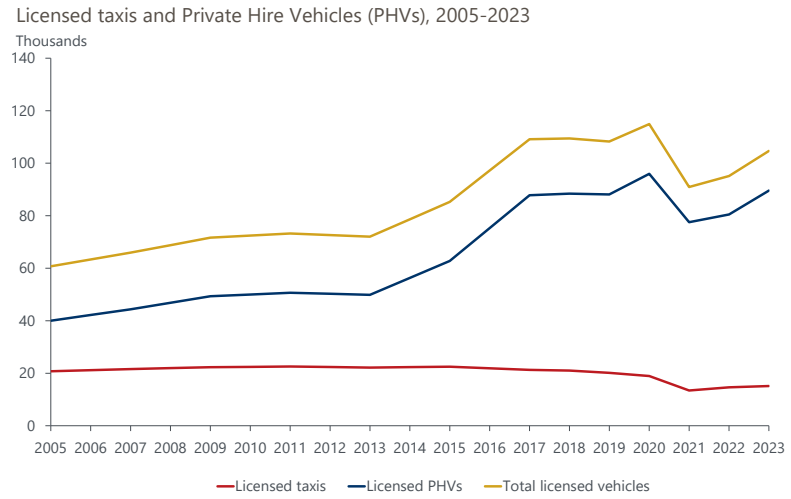
Chart 4: The number of licensed vehicles grew significantly in the past 20 years



Source: DfT

Shifting travel from roads to public transport will be difficult

Something that would help to speed up progress to net zero would be if Londoners made more use of public transport. Success here depends on the cost of using the bus, tube, and rail transport network; the scale and reach of that network; the frequency of services; and any problems with congestion on the network deterring travellers. In recent decades there have been significant gains in these metrics which have been a key part of the Mayor's Transport Strategy.

Looking forward, however, the scope for future improvements is likely to be small. The Covid-19 pandemic severely weakened the finances of Transport for London (TfL) and pushed up some fares. It meant that planned investments, notably Crossrail 2 and the extension to the Bakerloo Line, have effectively been cancelled. TfL's total capital expenditure on enhancements in 2022/23 fell by £247 million (2023 TfL Business Plan compared to the 2023/24 Budget). Meanwhile, our forecasts for London's population show it rising from around 9 million in 2020 to 9.7 million in 2030 and just over 10 million in 2040. While this population rise may be beneficial to revenues, it will clearly also increase congestion. There is a risk that future under-investment in public transport will make it even harder to persuade residents to switch away from private cars.

Switching to active travel will only suit a small minority

As far as persuading residents (and to some extent businesses and other employers) to switch to active or public transport from private cars, the challenges mostly revolve around convenience, cost, and comfort. Most journeys in London are quite short, which should suit them to walking, running, or cycling. TfL research on car usage suggests that around 50% of trips are less than three kilometres long. The last decade has seen some growth in walking and cycling in London but the overall growth of active transport in the capital has been small: rising from 31% of all trips in 2011/12 to 36% in 2018/19. There is evidence that the pandemic caused an uptick in cycling but a large share of the increase has probably been people moving away from public transport, with the switch from private cars rather smaller. That is partly because large proportions of car journeys involve ferrying children, shopping, or night-time journeys, and it is hard to persuade people to change to active travel for these.

Shifts to working from home and shopping locally will not make much difference

Another possible way to reduce emissions from road transport is that people simply make fewer or shorter journeys. This has already happened very dramatically, thanks to the closure of workplaces that occurred

during the pandemic. For many people in employment, that behaviour is now likely to remain in force, at least partly so, facilitated by modern digital technology. Within London, 37% of workers say they worked at least one day a week from home before the pandemic took place while research by King's College London shows this proportion having doubled, reaching 75%, in 2022.

However, many—perhaps most—of these journeys involve a switch away from public transport, not car journeys. In addition, the shift towards home working has not been completely beneficial. It has been associated with a rise in home deliveries of groceries, household items, and takeaway meals. This has added to the number of journeys undertaken, and to the extent that public transport trips have been replaced by deliveries using carbon-emitting vehicles, the situation may have partially worsened.

People can also reduce the length of journeys, by for example shopping more locally. But here too we need to consider the whole supply chain, from factory or farm to home. Local shopping does not in itself reduce the distance that a physical good needs to travel. But if shopping locally—or indeed working, studying, or socialising locally—means more active travel, then that ought to reduce emissions, unless longer journeys made by any staff involved have an offsetting impact.

So, for road transport, electric vehicles must lead the way to net zero

On balance it seems likely that for London, and probably for all other cities too, significant progress to net zero will depend on a mixture of forcing the most polluting vehicles off the road, and vehicle electrification. London's Mayor would like to develop a smart road user charging system, whereby users are charged on a per mile basis, at a rate that varies depending on how much they pollute, the level of congestion, and access to public transport. But the controversy generated by the extension of the ULEZ scheme to places outside the North and South Circular roads makes that seem unlikely. Indeed, ULEZ itself is much milder than it has been portrayed: in the first month of the zone's earlier expansion, 92% of cars driving into it were compliant, up from 87% prior to the zone's widening. TfL estimates that the number of non-compliant cars in outer London will decline from 160,000 to 46,000 because of the 2023 expansion of the ULEZ. In the London context that is a small number: at the end of 2022Q4 there were 3 million vehicles registered in the region, according to statistics published by DfT and the Driver and Vehicle Licensing Agency (DVLA). So from a climate change perspective, ULEZ is not a game-changer.

Electrification will depend on cost, capability, and convenience. At the moment **cost** is a major issue. In June 2022 the UK government ended its Plug-In Car Grant that offered funding towards the purchase of electric vehicles. According to figures published by NimbleFins, the average cost of a new electric car is around £50,000, more than double the cost associated with a new petrol or diesel car. And although an electric vehicle's running costs are typically lower than a petrol or diesel vehicle, the surge in electricity prices since 2021 has narrowed the gap.

Going forward, however, prices are likely to converge, simply because of economies of scale as demand for electric vehicles rises. The speed of that is hard to predict: the faster the rise in demand, the faster the fall in relative prices, and hence the faster the rise in demand. In the short term, the cost-of-living crisis means demand for even cheap new cars is depressed, let alone ones selling at a premium. But according to the latest CCC progress report, the market share of electric cars continues to grow ahead of its balanced pathway scenario. And while our modelling assumes that EVs take a growing share of the market, the speed of that will be constrained by price, particularly since in the UK, the EV market is skewed to higher priced models, and the government has scrapped the plug-in car grant scheme.

Where **capability** is concerned, the main issue is battery life. The average electric car range is now 236 miles, according to the Society of Motor Manufacturers and Traders (SMMT). While most car trips in London are under seven miles in length, consumers could still be deterred by the fact that electric vehicles currently provide less flexibility than petrol vehicles for longer journeys. That is likely to improve by 2030, and by 2050 the technology may well be radically different, making this challenge much easier to address.

In the meantime, **convenience**, and specifically the availability of charging points, is a major consideration. London's housing density means that public charging points are essential if electric vehicles are to predominate. Figures from DfT show that there were 145 public charging points per 100,000 of population

in London in April 2023. The UK government estimates that 300,000 public chargers will be available by 2030, nationally, while the Mayor forecasts that London will need between 40,000 and 60,000 public charging points by 2030, of which at least 4,000 will need to be rapid. To put this into perspective, the latest figures show that there are just under 13,000 charge points across London and to reach the target provision, London will need to install between 450 and 675 additional chargers per month. According to DfT, an average of almost 200 chargers were installed in each month in 2022, and nearly 500 a month between January and July 2023.

The situation with cars is largely replicated for light goods vehicles (LGVs). To the extent that cars can and will become electric, so too with LGVs. But that is much less so for heavy goods vehicles (HGVs), which typically travel long distances and weigh between 17 and 44 tonnes (excluding the weight of the goods they carry), depending on the type of vehicle and its number of axles. Current battery technology cannot really cope with powering such vehicles. Hydrogen power may be an alternative, but requires an infrastructure for supplying the hydrogen, which itself is problematic. At the COP26 Climate Summit in late 2021, the UK became the first country to commit to removing new, non-zero emissions heavy goods vehicles weighing 26 tonnes and under by 2035; with all HGVs sold to be zero emission until 2040, a decade later than the UK's target date for phasing out the sale of new petrol and diesel cars. So, progress here will be slow.

With buses and coaches, contrarily, progress is likely to be rapid. Indeed, London's fleet of around 9,000 buses is already ULEZ compliant, supporting the Mayor's overall ambition of running a completely zero-emission bus fleet across London by at least 2037.

Modelling possible progress towards net zero road transport in London

We have undertaken some modelling to assess how long it might take for London's road transport to reach net zero. To some extent, of course, that depends on what happens to London's economy and to the size of the population. Underlying our model however, and reflecting the discussion above, is the assumption that CO_2e savings will come predominantly from a cleaner stock of vehicles, rather than less traffic. This is in line with historical trends, that have shown a somewhat steady increase in vehicle miles travelled since 2009 in outer London, and since 2013 in inner London.

We also assume that, in line with historical trends observed since 2013, future growth in vehicle miles travelled will be largely driven by private hire vehicles, as well as by LGV use, which has boomed along with online shopping.

And we assume that the planned embargo on the sale of new petrol and diesel cars and vans will be imposed as planned in 2030, and that all new cars and vans will be zero emission by 2035. Since there is no plan to force the scrapping of existing fossil-fuelled vehicles, these, will initially remain in the fleet, until they are gradually retired. Based on vehicle sales forecast from the OBR, our model suggests that London's stock of private cars will be zero or ultra-low emission by 2047, and fully zero-emission by around 2050.

On that basis we model the emissions from cars and taxis to decline by 4.8% y/y between 2019 and 2030. This is slightly faster than LGVs (-3.6% y/y) as it will take more time for the LGV stock to decarbonise given its current fuel composition.

HGV emissions will decline more slowly, falling by -0.5% y/y by 2030, due to the greater challenges to decarbonise. In our modelling, we effectively assume a delay of five years in the deployment of electric or hydrogen HGVs in the London stock, in line with the government's ambition to end the sale of new petrol and diesel rigid HGVs by 2035, although we also understand that this ban could be extended to 2040 for articulated HGVs. To support this transition of HGVs we assume a faster rollout of national refuelling infrastructure, and also other supportive policies to reduce vehicle costs.

Taking all of that together, our modelling suggests that CO_2e emissions from road transport in London could plausibly fall from approximately 8,100 kilotons (kt) in 2019 to 4,800 kt in 2030, equivalent to an average decline of 4.6% a year. That decline might then accelerate significantly between 2030-40, to a rate of 17.8% a year. Alongside that, the stock of non-fully electric vehicles in London would still be significant in

2030 at 65% of the total. But our assumptions on sales trends and stock replacement would mean that by 2040, they would only represent 5% of the total stock.

Overall, and as shown in Chart 1, we therefore think it is reasonable to expect that emissions from road transport in London will reach net zero by around 2050. That is completely in line with the UK government's aspirations for the UK as a whole. But it is far behind what the Mayor would like to see happen.

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