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Getting the green light

The path to a fair transition for the transport sector

Adam Corlett, Zachary Leather & Jonathan Marshall

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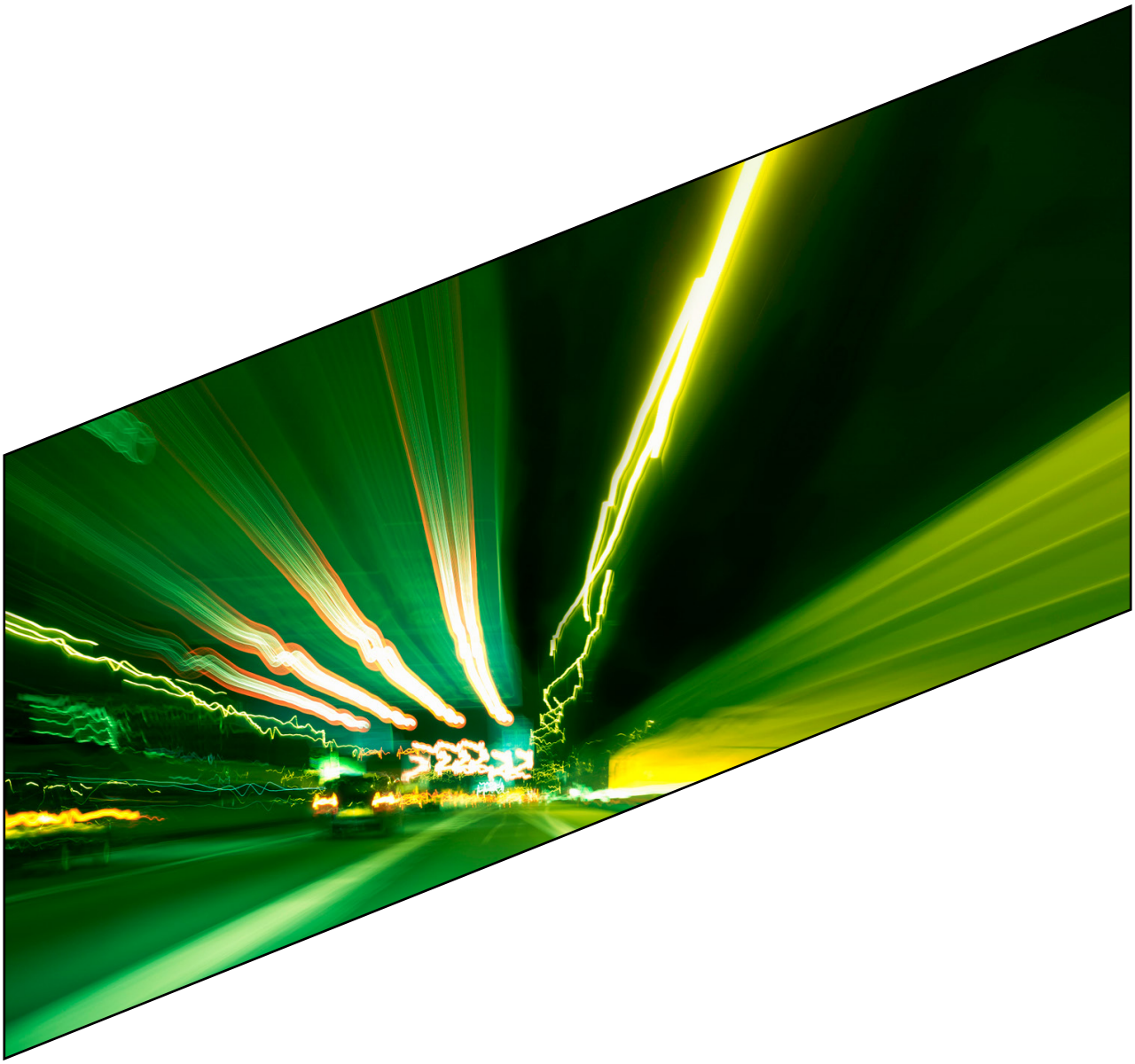

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Executive Summary

There has been significant progress in decarbonising some parts of the UK economy, but transport is a glaring counter-example. Emissions from passenger travel are higher than in 1990, and transport is now the largest single contributor to UK carbon emissions, accounting for over a third of the total in 2023. To remain on course for net zero in 2050, Britain will need a more-than five-fold increase in the rate of decarbonising travel over the next decade. This pace of change will inevitably have a big impact on households who, on average, spend around £1 in every £6 on travel (or around £4,800 a year), making it the largest item in family budgets after housing costs. In this report we take up the challenge of zero carbon transport, focusing on how policy makers can deliver a fast and fair transition for the three main types of travel – cars, public transport and planes.

Cutting travel emissions means focussing on cars first

Cars produced two-thirds of UK travel emissions in 2023, and they also dominate household expenditure on transport: buying, fuelling, maintaining and insuring cars is the largest component of transport spending for the average family, accounting for nearly £9 in every £10 spent. Large-scale decarbonisation requires a rapid replacement of petrol and diesel cars with electric vehicles (EVs). The policy challenge is that cars are expensive, and electric ones particularly so – currently commanding a large (40 per cent) premium over an equivalent non-electric model. But EVs are much cheaper to run. Indeed,

over 60 per cent of projected operational cost savings associated with the wider net zero transition are linked to transport – worth £22 billion in 2035, and more than £500 billion from 2025 to 2050.

To date, the strategy for delivering rapid EV take-up has been focused on the small number of families buying new cars (just one-in-twenty do so each year). The primary aim of intervening here is to increase manufacturer confidence through ensuring demand for EVs. This will have three implications: developing the market and infrastructure, bringing forward the point at which economies of scale kick in, and lowering the price of new EVs. As the richest fifth of households account for the majority (58 per cent) of all spending on new cars, this approach inevitably means targeting wealthier drivers: more than £4 in every £5 spent by the Government through subsidies like the Plug-in Car Grant scheme went to households in the top two income quintiles. As richer drivers (especially those with new cars) tend to drive more – people in households in the highest income quintile drove three times as many miles in 2023 as those in the lowest income quintile – the impact on emissions was also more immediate than if the subsidy had been spread more widely.

Arbitrary tax breaks for EVs should be wound down

We are, however, now entering a new era for the EV market. Subsidies for EVs, both in the UK and abroad, have driven rapid cost reductions. In the UK, lease payments – the way the vast majority of new cars are purchased – on entry-level EVs are now in the region of £150 per month, close to the average level of vehicle spending by middle-income households. This suggests that policy should move away from providing subsidies. Indeed, falling vehicle prices – along with the rising cost of grants, which topped £1 billion by 2021 – explain why the previous Government wound down its universal grants scheme. Mandates that require manufacturers to ensure that a certain proportion of all vehicles sold are EVs have instead become the main policy tool, shifting the cost of the transition away from the public purse and towards either manufacturers' profits or to consumers of new cars (specifically non-electric cars if manufacturers cross-

subsidise). Further, the planned increase in mandate targets during the 2020s should lead to a greater range of cheaper EVs and more affordable models coming to market, allowing lower-income households to benefit from the cheaper costs of running EVs.

But, although universal grants have been removed, long established tax breaks – such as low benefit-in-kind rates, or salary sacrifice schemes – have remained. Both of these tax breaks are somewhat arbitrary. Eligibility for the former is limited to those whose employers provide company cars, who are predominantly on higher incomes: two-thirds of company car drivers earn more than £50,000 per year. For the latter, tax breaks are pegged to employees' marginal tax rate, meaning higher earners get bigger incentives – but only for workers whose employers offer the scheme. Even if all drivers were eligible, nearly three-quarters (73 per cent) of households in the highest-income decile would be able to get a discount of 42 per cent or more on a car lease costing £200 per month, while more than half (57 per cent) of the poorest half of households would not be able to get any discount at all. Further, this forgone income is taxed very lightly: benefit-in-kind rates are currently just 2 per cent, and set to increase to only 5 per cent of the vehicle's value per year by 2027-28.

In light of this unfairness, and of falling EV costs, it is time for the Government to wind down these schemes as EV sales move towards their mandated level. But with 2024 car sales currently sitting 4 percentage points below the mandate target, it needs to be mindful that completely removing support risks causing demand to slump. But instead of offering new cash incentives for EVs, or softening sales targets, as has been suggested by manufacturers, the withdrawal of these tax incentives should be pre-announced, which would bring forward demand for EVs as motorists look to take advantage of them before they expire. If, though, sales concerns persist, then ministers should look to increase taxes on new non-electric cars to reduce the premium associated with purchasing a new EV, rather than subsidise EVs any more.

The market for used EVs should be left alone

Most car purchases are second-hand: 7.2 million used cars changed hands in 2023, compared with 1.9 million new ones. But used EVs remain expensive – currently around £6,000 more than equivalent (non-premium) petrol and diesel models – and this has prompted calls for subsidies or tax breaks in the second-hand market. Such an approach would mean some lower-income families moving to EVs sooner. But, with the supply of second-hand EVs both low and constrained by past sales of new cars, it would likely also mean significant price rises for everyone else. Instead, government efforts to expand the use of EVs should remain upstream, ensuring that both the sales mandate delivers on its overall targets and, crucially, that sales of smaller, non-premium cars increase substantially. This will in time feed through into the used car market, to provide affordable alternatives for drivers on lower incomes.

Access to EV charging is improving quickly but the price of public charging needs to fall

The main benefits of EVs are those that accrue from cheaper driving costs, with total annual savings forecast to top £22 billion (in 2024 terms) by 2035. But banking these savings depends on access to at-home charging. At the moment, 19 in 20 of all chargers are installed in residential buildings, but a third of families in England – and almost half (48 per cent) of those in the poorest fifth – lack access to off-street parking and thus cannot charge at home. This means the public charging network has a key role to play in the fair distribution of savings from EVs.

The good news here is that there has been a dramatic increase in the size of the public charging network, doubling to more than 60,000 chargers in the past two years. Further, around half of all public chargers installed in the first half of 2024 were low-voltage, low-priced kerbside chargers that drivers can plug into near their homes, up from just 17 per cent in 2017. These chargers are also being installed in places where they are needed: 47 per cent of those installed since 2022 are in places where off-street parking is the most limited, with twice as many installed in poorer neighbourhoods.

But the cost of using a kerbside charger remains far higher than charging at home, and has increased by half since January 2023, despite wholesale electricity prices falling considerably. The cost of driving an electric car that is refuelled away from home is now double that of one charged at home (11.5 pence per mile compared with 5 pence per mile), amounting to a £425 difference each year based on average mileage.

This penalty dampens incentives to move to EVs, and should be a key focus for policy makers. One key difference is that VAT is levied on public chargers at a higher rate (20 per cent) than on electricity at home (5 per cent). These should be aligned, and would cost the Exchequer £700 million to do so. But even if the VAT cut were fully passed through, it would still leave a 4.5 pence per mile (or 85 per cent) price premium. To address this, the focus should be on easing supply issues, and increasing competition. In particular, the Government could help lower operators' costs by streamlining the planning process and reducing costs associated with obtaining a connection to the electricity grid. But weak competition among providers is also a concern: two-fifths (41 per cent) of neighbourhoods where chargers are installed are served by only one company. This proportion is even higher in poorer parts of cities (other than London), where 60 per cent of less-affluent neighbourhoods have only one provider. London shows how things could be better, with just 29 per cent of neighbourhoods subject to local monopolies. But if the situation does not improve, then regulation should be stepped up – for example, by introducing a cap on the price that providers can charge.

Public transport is not the answer to decarbonising travel, but we must make sure those without a car don't miss out

Some argue a mass migration away from cars and towards public transport should play a key role in decarbonisation. But such a 'modal shift' is becoming less important for climate change, and will yield carbon savings only in the short term: electrification means that by the late 2030s, the emissions from average car and public transport journeys will be similar. The

act of decarbonising public transport – which accounts for 1 per cent of UK emissions – should also be considerably easier than for private transport, given the role that government plays in coordinating its provision.

But this does not mean that public transport users – who are disproportionately on lower incomes, with around a quarter of adults and two-in-five in the lowest-income fifth of the population lacking regular access to a car – should miss out on the benefits of decarbonisation. A rise in the relative cost of public transport will likely see more opt to drive instead, increasing congestion and potentially triggering a vicious cycle if this in turn reduces the viability (and so availability) of public transport.

One remedy could be larger subsidies to public transport. Indeed, some have suggested that the UK should follow the example of recent high-profile subsidies for train travel implemented in countries such as Germany. But it is buses that poorer households use most, not trains – those on lower incomes take nearly three-times more bus journeys. So a better approach would be to implement a system of targeted discounts for buses (as well as trains). Currently, discounts for buses and rail are primarily enjoyed by those of particular ages or that travel in certain regions. But these discounts aren't effective in targeting support to those on lower incomes. Ministers could improve this by linking discounts to those claiming benefits, or even to those that don't own a car, to ensure a fairer distribution of transport savings in the future.

The importance of public transport to low-to-middle households – and its other roles like reducing congestion, fostering growth and improving cities – means that a well-functioning public transport system will always be a valuable policy focus, even if rail and buses can only play a bit part in the transition to net zero.

Aviation emissions will become more important and policy change is needed to deliver a consistent 'polluter pays' principle

The rise of EVs means that aviation's emissions are projected to surpass those from surface transport by 2036. What's more, aviation's climate impact is estimated to be three-times greater than headline carbon metrics suggest, due mainly to the warming role of some contrails. As such, flying will become increasingly important for decarbonisation policy in the coming years. And, with planes often remaining in use for decades, clear direction should be provided sooner rather than later.

The global aviation industry is committed to reaching sectoral net zero by 2050, and the UK has a key role to play here, as the third-biggest aviation emitter. Electrification should be feasible for some short routes. There are hopes for bio- or synthetic fuels (although these also come with high land or production costs). Efficiency improvements are possible, and re-routing can reduce contrail production – but none of these represents a silver bullet. All plans for reaching 'jet zero' by 2050 therefore involve offsetting the remaining aviation emissions through carbon capture, an expensive endeavour (and for which there is currently little clarity as to who will pay).

There will be a range of ways in which policy can support all of these goals. But – in contrast to the example of cars – aviation is not a sector with a stand-out regulatory solution. Instead, theory tells us that the complicated mix of options and trade-offs is exactly the situation where proper carbon pricing is the most economically-efficient solution. What's more, the principle that the 'polluter pays' is particularly sensible here: there are few justifications why we should all be asked to pay to decarbonise or offset the emissions of a small number of (relatively well-off) frequent flyers. We estimate that, by 2040, annual aviation emissions from the top fifth of the income distribution will exceed the poorest fifth's road transport, electricity, building and aviation emissions combined.

Unfortunately, current policy is some way from the ideal of a consistent carbon price. At present, the UK Emissions Trading

Scheme (ETS) covers emissions from flights within the UK and departures to the Europe, with a current carbon price of around £40 per tonne. Notably, carbon prices levied on any gas used to power electric cars, buses and trains are higher than this, due to the additional £18 per tonne Carbon Price Support. And routes not covered by the UK ETS face a far lower carbon price, if any. A new global scheme (called CORSIA) covers emissions from most international flights, but offsets are only required for marginal emissions above a generous baseline – 85 per cent of 2019 emissions – and at a relatively low carbon price (currently below £20). Meanwhile, flights to the Crown Dependencies and British Overseas Territories, excluding Gibraltar, are not covered by either pricing scheme.

Options have been suggested to better reflect the externalities of flying through tax changes, with debates around reforming Air Passenger Duty; applying VAT (particularly for domestic flights); introducing a Frequent Flyer Levy; and applying forms of Fuel Duty. Some of these options have merit, but the priority should be reforming carbon pricing to focus on the key harm of flying, incentivise all forms of emission reductions, remove unfair biases between different flights and ensure that the relevant costs are paid when people fly rather than by all households.

We highlight three potential reforms to deliver more consistent carbon pricing. First, we should tackle flying's non-carbon effects, given their scale and the low cost of contrail impact abatement: small changes to flights could potentially halve contrail formation. The UK should match the EU in introducing reporting requirements next year, ahead of extending the ETS to non-carbon impacts. Second, the UK ETS's aviation scope should be expanded to include the Crown Dependencies and Overseas Territories. Finally, and crucially, the scope of the UK ETS should be further extended to cover all international flights, meaning that extra-European departures would face the same carbon price as within-Europe flights. Ideally, this would be done in tandem with the EU, which will be reviewing its own position ahead of a potential ETS extension from 2027 in order to treat all flights equally.

Decarbonising transport is important but far from straightforward

Decarbonising transport is one of the UK's main policy priorities for the 2020s and 2030s, a change that will impact almost everyone in the UK. But the share of household budgets taken up with travel costs, coupled with highly variable travel patterns means that the distributional consequences of cutting carbon could be considerable. We need to ensure that policy reflects that the majority of journeys are made by car, that EV take-up continues apace, and that charging is fair – not currently the case for those using public chargers. People reliant on public transport mustn't be excluded from the financial spoils of decarbonising travel, and a more robust carbon-pricing regime needs to be developed to ensure that flyers pay their way.

Section 1

Introduction

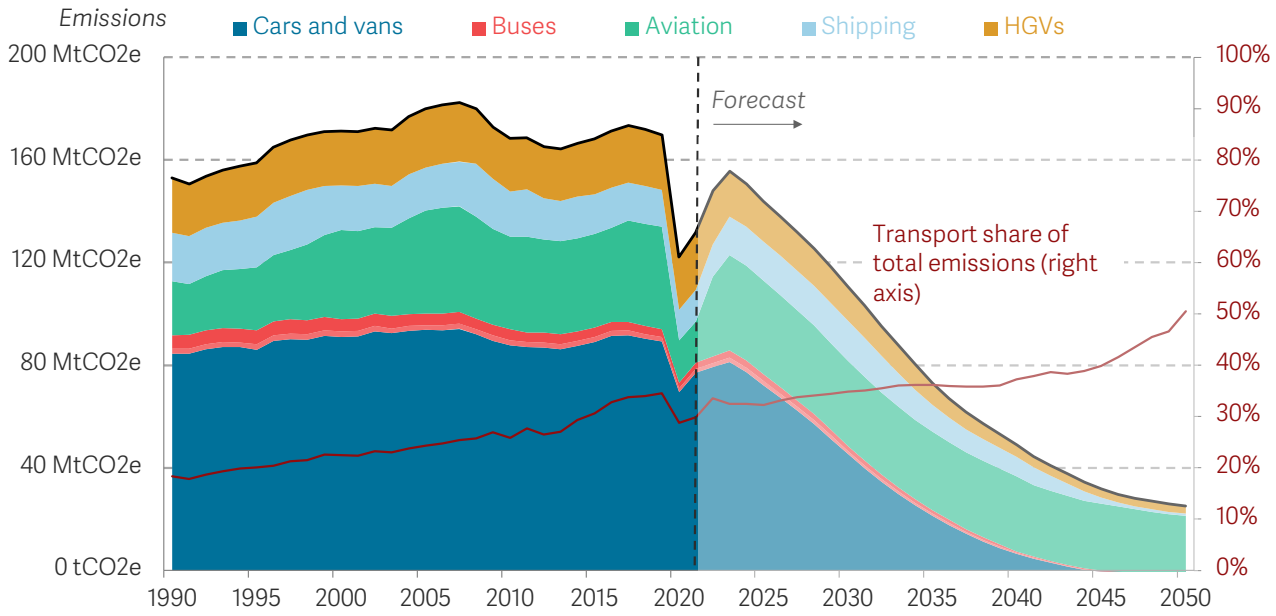
Transport emissions are the largest single contributor to the UK's carbon footprint, and need to fall rapidly

Emissions from transport are now the single largest component of the UK's carbon footprint, accounting for over one third (34 per cent) of all carbon dioxide produced in 2022. Most of that – 26 per cent – is from household travel, and that is the focus of this report.[1] And while other sectors have seen emissions fall – most notably electricity generation, from which emissions have fallen 73 per cent since 1990 – those from travel were actually higher in 2022 than in 1990, with the only notable reduction in recent years a result of travel restrictions imposed during the pandemic.[2] Meeting the UK's carbon budgets will require this to change, and change quickly. Emissions from travel need to fall by 48 per cent in the next decade, a fall of more than five-fold that seen in the last decade (see Figure 1).

1 DESNZ, Final UK greenhouse gas emissions statistics: 1990-2022, June 2024. Other sources of emissions include those from, for example freight and maritime. These have less of a direct link to household living standards so are not discussed in this report.
2 DESNZ, Final UK greenhouse gas emissions statistics: 1990-2022, June 2024 & CCC, Progress in reducing emissions: 2024 report to Parliament, July 2024.

FIGURE 1: **Transport emissions need to fall rapidly over the 2020s and 2030s**

Historical greenhouse gas emissions from transport and projections under CCC balanced pathway, by transport category: UK



NOTES: Dark shaded indicates historical emissions, light shaded indicates projections based on net zero consistent emissions savings. Transport share of total emissions excludes the removals sector, to show transport's share of positive emissions.
SOURCE: RF analysis of DESNZ, Final UK greenhouse gas emissions national statistics, and CCC, Sixth Carbon Budget dataset.

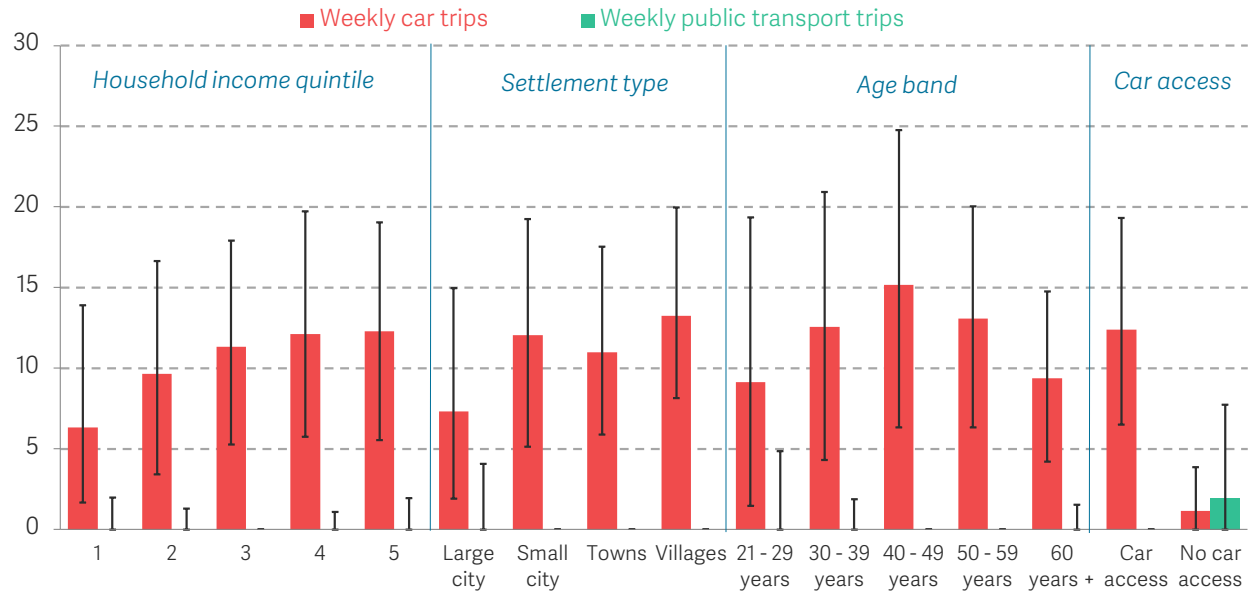
This pace of change will inevitably impact families. The average person in the UK makes 652 journeys per year (excluding walking), and households spend £4,800 on average each year on travel – £1 in every £6 spent, and the second largest component of family budgets after housing costs.[3]

But not everyone gets around in the same way. Travel patterns are complex and depend on myriad factors, such as income, location, age, and whether people have access to a car or not. As Figure 2 shows, there is a lot of variation: while the average household in the lowest-income quintile makes six car journeys each week, those at the upper end of the distribution (i.e. the top of the interquartile range) make more car journeys than the median household in the highest income band (14 compared to 12). And while public transport is used more by low-income households, young people and those in large cities, even the typical person in each of these groups doesn't use public transport at all.[4]

3 RF analysis of DfT, National Travel Survey & ONS, Living Costs and Food Survey.
4 RF analysis of DfT, National Travel Survey.

FIGURE 2: **There is wide variation in the amount people travel**

Median trips made by mode per week, and interquartile range, England: 2019



NOTES: The median value for weekly public transport trips is zero for all categories apart from households without car access. Due to the impact on travel of Covid-19, 2019 is considered the most recent representative year for which data is available. Household income quintile refers to equivalised real household income, and car access is defined as whether the household owns a car. Age bands are based on the household reference person.
SOURCE: RF analysis of DfT National Travel Survey.

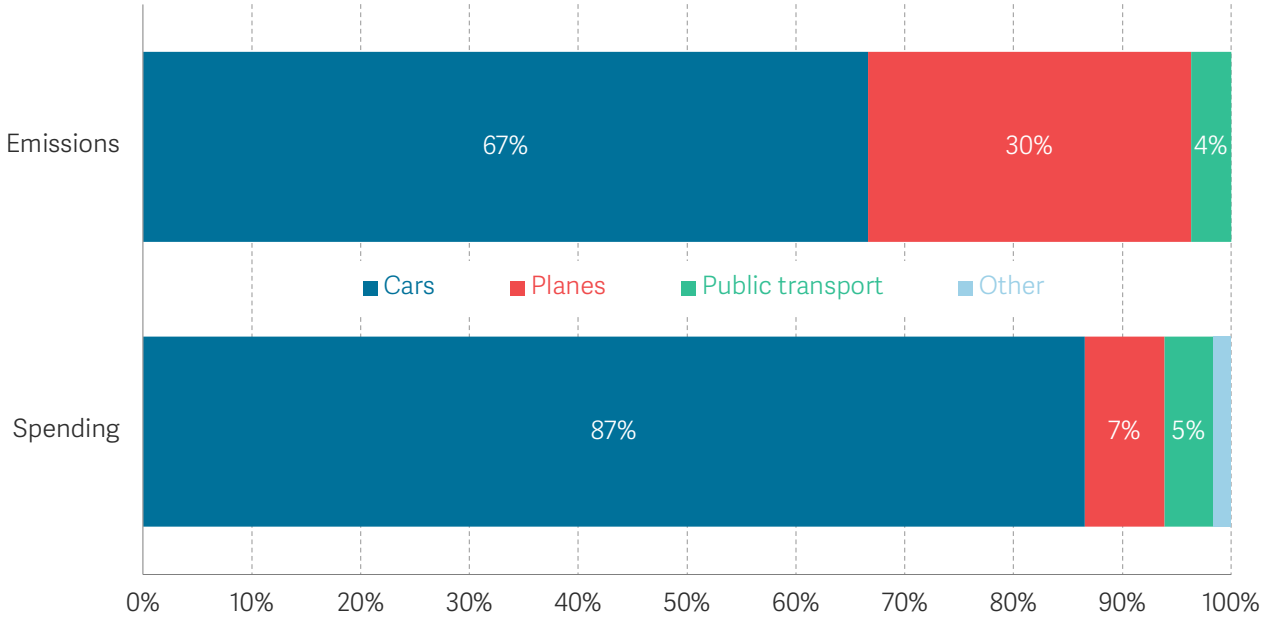
Transport emissions and travel spending are dominated by cars

The vast majority of journeys in the UK – 84 per cent, not including walking – are by car, and these trips accounted for two-thirds (67 per cent) of all UK transport emissions in 2023.[5] The dominance of car travel is unlikely to change in the future: more than four-fifths of households own a car, and seven-in-ten say that their lifestyle means they need a car.[6] So, ultimately, cutting travel emissions means focussing on cars. Spending on cars is also the largest component of households' transport expenditure, with buying, fuelling and maintaining cars accounting for nearly £9 in every £10 (87 per cent) spent on transport – compared with just 7 per cent for planes and 5 per cent for public transport (see Figure 3).[7]

5 Source: RF analysis of DESNZ data. The non-CO2 global warming impacts of aviation are explored separately in Section 4.
6 Source: RF analysis of Understanding Society data.
7 Source: RF analysis of ONS Living Costs and Food Survey data. Note that the figures quoted do not add to 100 per cent, with the remainder evenly split between bicycles, motorbikes, ferries and, 'other personal travel'.

FIGURE 3: **Cars dominate spending on, and emissions from, travel**

Share of transport emissions by source, and household expenditure on travel by transport mode, UK, 2023



NOTES: Emissions data refer to the 2023 calendar year, spending to the financial year ending in 2023.
SOURCE: RF analysis of DESNZ Greenhouse gas emissions statistics and ONS Living Costs and Food Survey data.

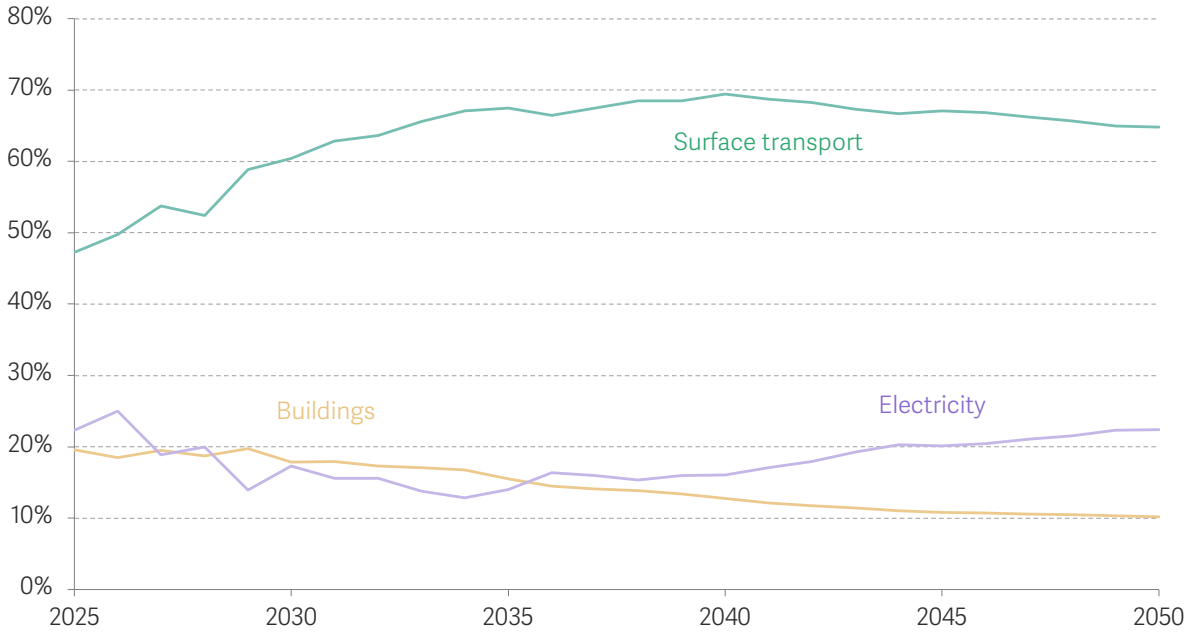
Decarbonising cars means driving a rapid replacement of petrol and diesel cars with electric vehicles (EVs). But household spending on cars is lumpy, irregular and varies considerably by income, complicating policy in this area significantly. Providing incentives for motorists to move quickly towards EVs, especially while they remain priced at a significant premium to their petrol and diesel counterparts – 40 per cent higher for equivalent models in 2023 – can lead to significant winners and losers.[8]

But as well as large upfront costs, decarbonising cars will bring big savings on running costs. Over 60 per cent of the operational cost savings from the entire net zero transition – more than £500 billion from 2025-50 – will come from cheaper transport, as shown in Figure 4, with the lion's share from a reduction in fuel costs. These savings will also accelerate quickly, topping £20 billion (in current terms) by the mid-2030s. So it's important that that the significant benefits from cleaner travel are shared fairly across families.

8 Office for Zero Emissions Vehicles, Electric vehicles: costs, charging and infrastructure, February 2024.

FIGURE 4: **Most of the operational savings from the transition to net zero are in the transport sector**

Proportion of total forecast annual operational savings due to decarbonisation from selected sectors: UK



NOTES: Based on CCC's Balanced Pathway scenario.
SOURCE: RF analysis of CCC, Sixth Carbon Budget dataset.

Not everyone is going to be impacted by transport decarbonisation in the same way

Despite a justified policy focus on cars, the implications of transport decarbonisation will also extend to those who travel by other means. Public transport will also have a role in reducing emissions, and is particularly important for lower-income families. Flying also constitutes a large (and growing) share of the UK's carbon footprint – with limited clarity on the best mix of technology, regulation and taxes to cut emissions – with most flights taken by the rich.

So, there are a number of challenges in delivering a rapid and fair transition for the three main types of travel – cars, public transport and planes. In this report we take these challenges head on, setting out how policy can be used to accelerate the transition to net zero. To that end, the rest of this report is structured as follows.

- Section 2 focuses on cars and particularly on what policy makers can do to accelerate the adoption of EVs.
- Section 3 assesses how substantial changes in how we fuel cars are shaping up, and if we are moving in the right direction in terms of both the availability and price of public charging to ensure that all drivers are able to power vehicles as cheaply as possible.

- Section 4 turns to the role of public transport in decarbonisation, and assesses how those who do not (or cannot) drive can share in the benefits of decarbonising transport.
- Section 5 faces up to the distributional impacts of aviation becoming the largest contributor to the UK's carbon footprint, discussing options for how we can ensure that the costs of resulting externalities are shouldered by those responsible for them.
- Finally, Section 6 sets out our conclusions.

Section 2

Getting more electric cars on the road should be the priority

The dominance of cars in UK travel means that decarbonising the vehicle stock is the clear policy priority for cutting transport emissions. So in this section we examine trends in EV sales and the policy landscape that has been put in place to deliver change. We also look at how and where different consumers buy cars, and the types of cars that are important in broadening access to EVs. We then set out potential changes in current incentives so that the transition continues at the necessary pace, is funded fairly, and so that drivers on lower incomes can move to electric cars when they are ready.

Policy in this area has, to date, focused on the relatively small number of better-off households who buy new cars, convincing them to switch to electric. The point of this is to give manufactures confidence that there will be demand for EVs, so the market can grow. But we are now entering a new era for the EV market where prices have fallen to levels in reach for those on middle incomes. As a result, sales mandates have replaced grants as the main policy tool for driving a swift transition. But despite this, substantial and arbitrary tax breaks remain in place, specifically those linked to company-car ownership and those affecting drivers able to capitalise on salary sacrifice schemes through their employers. Given the changes in the market for EVs and the unfairness baked into these incentives, it's time for the Government to wind down these schemes as EV sales move towards their mandated level. Here we can set out a path for withdrawing these tax incentives that is mindful to current concerns around short term sales targets, using them to bring forward supply instead of offering up new discounts or even relaxing targets.

Despite its importance to lower income motorists, policy makers should resist intervening in the market for used EVs. Subsidies or tax breaks in the second-hand market are likely to lead to a large rise in prices given supply constraints. Instead, efforts should remain concentrated upstream, ensuring larger numbers of smaller and more affordable EVs enter the used-car market in time, as this is the main way in which lower-income drivers will be able benefit from lower costs.

To date, the strategy for boosting EV sales has meant targeting the small proportion of drivers who buy new cars

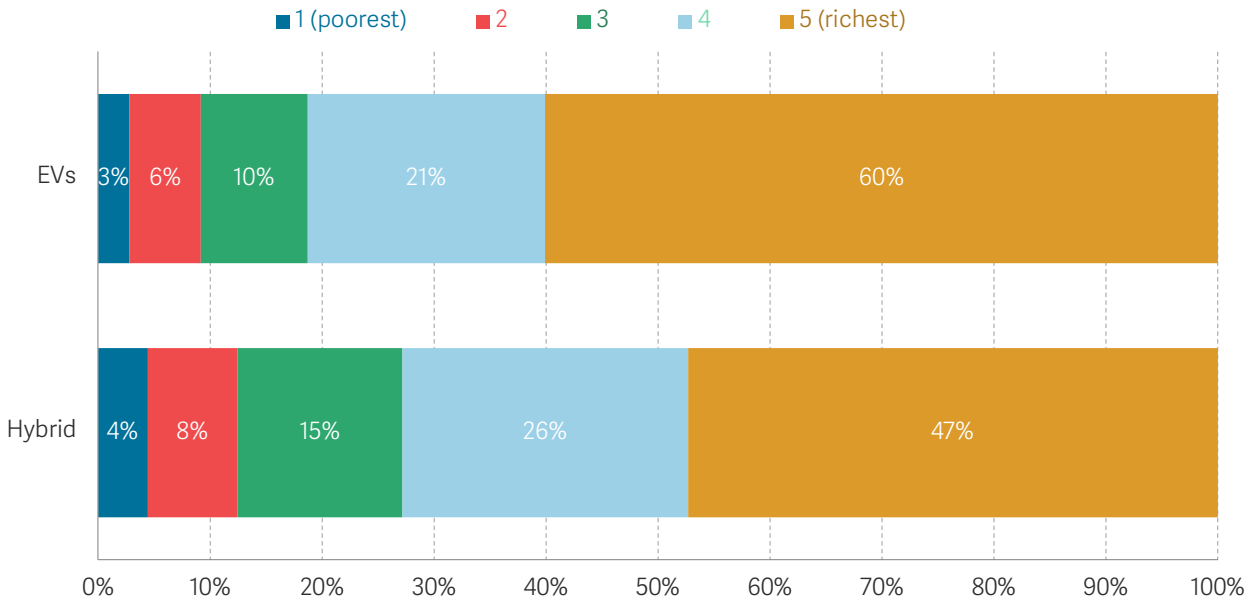
The first policy priority for reducing emissions from cars has been, and remains, getting more EVs on the road. The number of registered EVs topped 1 million in early 2024, a ten-fold increase on 2019, but still a small proportion (3 per cent) of the 34 million cars in use in the UK.[9] It will take time for the stock of EVs to build: just 1.9 million new cars were sold in 2023 – less than 6 per cent of the total vehicle stock – of which 314,000 (16 per cent) were fully electric.[10] The increasing share of new cars that are electric in recent years has been helped by Government interventions designed to give manufacturers confidence that there will be demand for EVs. Such an approach will help to develop the market and associated infrastructure, and in this way bring forward the point at which economies of scale kick in, reducing the prohibitive cost of new EVs.[11]

To date, these policies have been concentrated on the few drivers able to buy a new EV. The Plug-in car grant, introduced in 2011, gave the relatively small number of households who buy new cars – only one in 20 has a car less than one year old – a £5,000 discount on either electric, or plug-in hybrid cars.[12] Subsidies designed to target people who buy new cars means support inevitably going to those on higher incomes: households in the highest income quintile account for more than half (58 per cent) of all spending on new cars, while those in the top two income quintiles are more than twice as likely to own a car that is less than one year old than those in the lowest quintile.[13] As such, the majority of Government subsidies flowed to richer households, with those in the top two income quintiles recouping more than four in every five pounds spent, as Figure 5 shows.

9 DfT, Vehicle licensing statistics: 2023, May 2024.
10 DfT, Vehicle licensing statistics: 2023, May 2024.
11 International Energy Agency, Global EV Outlook 2021: Policies to promote electric vehicle deployment, April 2021.
12 Source: RF analysis of USOC data. Plug in car grant subsidies were initially set at £5,000 for electric and hybrid electric cars, but these subsidies were reduced gradually over time, reaching a low of £1,500 that was only applicable to fully electric cars with a RRP of less than £35,000 before being withdrawn in 2022.
13 Source: RF analysis of Understanding Society data.

FIGURE 5: **Most support for electric car purchases has been captured by richer households**

Share of support delivered through the plug-in car grant scheme received by households in each after housing costs income quintile, by vehicle type: UK



SOURCE: RF analysis of ISER, Understanding Society data.

While some have criticised this approach, it was inevitable given the upfront costs associated with new cars.[14] Supporting the purchase of EVs for poorer drivers would have been either more expensive for the Exchequer – as larger subsidies would have been needed to make new cars affordable for those on lower incomes – or would have seen fewer EVs on UK roads had the budget been fixed. Targeting higher income drivers also means that the impact on emissions has been more immediate (to the extent where it is now driving small reductions in transport emissions, according to the CCC), as richer motorists – as a general trend – cover more miles than their poorer counterparts.[15]

But we are in a new phase of EV development, with new models closer to the reach of middle-income families

While the Plug-in Car Grant was highly effective in driving EV sales, available subsidies became less generous – and restricted to certain models – as the scheme matured. By 2021, grants had been pared back to £1,500 and were only available for fully electric cars with a retail price of less than £35,000, and the scheme was ultimately stopped in 2022.

A number of factors underpinned this reduction in generosity. Most important was increasing public costs: in 2021 alone, EV grants cost the public purse more than £330

14 Previous analysis carried out for the UK Government also found that grants 'may have favoured higher-income households'. For more, see: Frontier Economics, OZEV – Portfolio-level retrospective evaluation: An evaluation of the Plug-in Vehicle Grant, Electric Vehicle Homecharge Scheme, and Workplace Charging Scheme, May 2022.

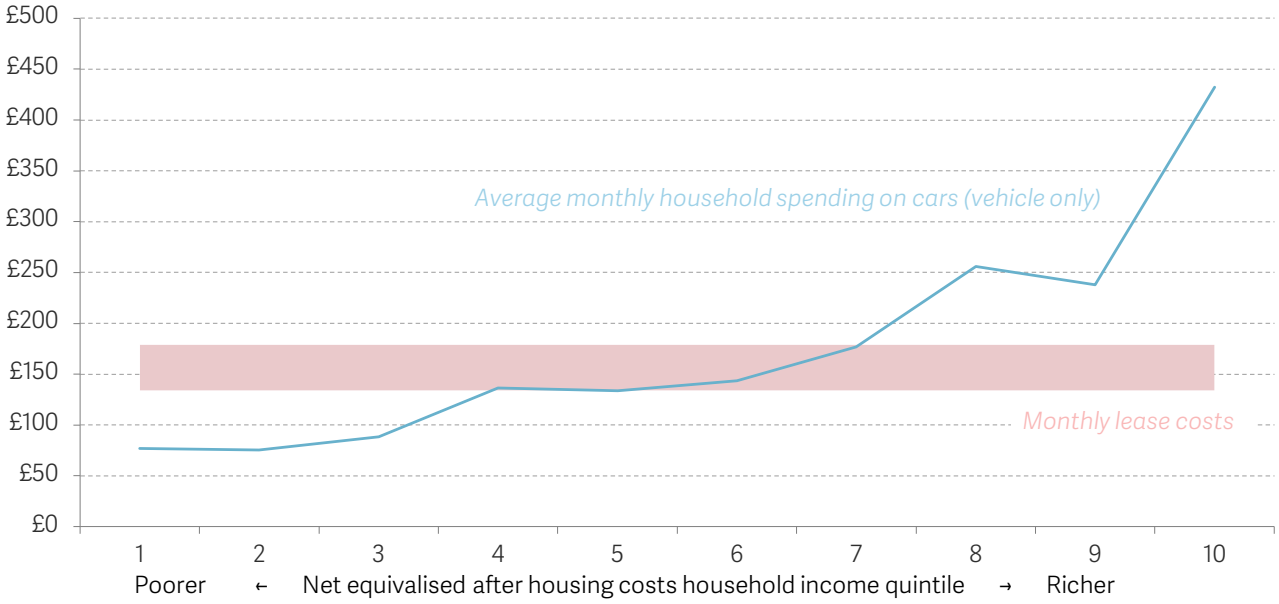
15 CCC, Progress in reducing emissions: 2024 report to Parliament, July 2024.

million, a 25-fold increase on the cost in 2012, and pushing the total cost of the scheme since its introduction to more than £1 billion, and would have continued to accelerate as more EVs are sold each year.[16] But the desired policy outcomes also evolved. The Plug-in Car Grant subsidised the purchase of more than 360,000 (more than a third of) EVs on UK roads. But true mass-market adoption of EVs relies on the stimulation of supply, that is, accelerating the process by which manufacturers move towards the production of cheaper vehicles, rather than the premium models that have grown to dominate EV sales in the UK.[17]

And it is true that there has been a rapid reduction in costs of new EVs (there are now 16 EVs for sale with a list price of less than £30,000), such that a small number of models are now affordable without the need for public subsidy.[18] Indeed, as Figure 6 shows, some electric cars can now be leased – the main way new cars enter the market in the UK, with four-in-five (78 per cent) of new private vehicle registrations financed by leases– at a cost of around £150 per month, an outlay directly comparable to expenditure on vehicles for middle-income households – and very affordable to those further up the income distribution.[19]

FIGURE 6: **New electric cars are now firmly affordable for middle income drivers**

Monthly household expenditure on cars by after housing costs household income deciles, and monthly payments on selected electric cars: UK 2023-24



NOTES: Vehicles in the cluster of lines are the Dacia Expression, MG EV4, Dacia Spring, Fiat 500, Suzuki Swift, Citroen C3 and Hyundai i10, with monthly payment figures taken from manufacturer websites or leasing.com. Household spending on vehicles uprated from 2022-23 LCFS data in line with CPI.
SOURCE: RF analysis of ONS Living Costs and Food Survey, ONS CPI indices, vehicle manufacturer, leasing.com data.

16 Data from FOI request submitted to the Office for Zero Emissions Vehicles.
17 Seven of the ten bestselling EVs in 2023 were premium or larger models, accounting for more than 100,000 vehicles sold, SMMT data shows.
18 Autotrader, The Road to 2035, August 2024.
19 Finance and Leasing Association: FLA Green Manifesto 2024, September 2024.

The price of EVs is likely to fall further still. Battery technology continues to develop and a broader range of manufacturers are now producing EVs. Imported EV prices are falling rapidly, particularly from China (see Box 1). These developments mean new EVs are becoming more affordable for a wider range of drivers. For example, just 7 per cent of households currently have a car worth £30,000 or more (2 per cent of the poorest half of households), whereas 14 per cent own a car worth £20,000 or more (6 per cent of the poorest half of households).[20]

BOX 1: **Cheap Chinese imports could have massive benefits, but not without potential trade-offs**

The EV revolution is becoming increasingly concentrated in China. China has the world's biggest domestic EV market and is the world's largest EV manufacturer, producing more than half of all EV's currently on the world's roads.[21] Chinese manufacturers are producing a greater range of vehicles – including, crucially, many low-priced models – than companies based in the UK or EU, with one of the most popular models – the BYD seagull – available to purchase for the equivalent of just £8,000.[22] Cheap cars are one of the results of China's development strategy (EVs and batteries were identified as areas of focus in its 10th 'five-year plan', covering 2001-05)[23] and companies have received huge levels of state subsidy to develop new vehicles and production facilities, and to build up related supply chains. And while most (88 per cent) of EVs made in China are sold to Chinese drivers,[24] a significant proportion are exported to other markets, including the UK. Three-in-ten (30 per cent) of EVs sold in the UK in 2022 were manufactured in China, one-third of which were made by Chinese manufacturers and two-thirds from western companies that have outsourced production.[25]

This dominance in a key growth industry has not gone unnoticed. In a bid to protect its car manufacturing sector, the EU is imposing significant tariffs on Chinese producers. Imported BYD vehicles will face a levy of 17 per cent, Geely 20 per cent and SAIC 38 per cent – in line with the scale of subsidies that each company has been deemed to have received – on top of an existing 10 per cent duty. The US has gone even further, with tariffs as high as 100 per cent, despite minimal penetration of

20 RF analysis of ONS Wealth and Assets Survey data shows. Figures exclude the value of any loans used to purchase cars.
21 International Energy Agency, Global EV Outlook 2023, April 2023
22 F Page, BYD Seagull is sub-£8000 electric supermini for China, Autocar, April 2023.
23 Chinese Government, National Economic and Social Development Special Plan for the Development of Science and Technology Education in the Tenth Five-Year Plan, 2002.
24 W Song et al, Q&A: The global 'trade war' over China's booming EV industry, Carbon Brief, August 2024.
25 House of Lords Environment and Climate Change Committee, EV Strategy: rapid recharge needed, February 2024.

Chinese EVs into the American market. For now, the UK Government has chosen not to follow the lead of its main trading partners, opting instead to stick to the existing 10 per cent tariff.[26]

UK consumers will benefit from lower prices as a result of this decision. Indeed, an influx of low-cost vehicles could have a significant impact on the UK's electric-car market, putting new EVs within reach of many more drivers than is currently the case. It would also ripple through to the used-car market as vehicles are sold on.

However, opening the UK market to Chinese exports brings considerable trade-offs. The UK's car industry is currently primarily focussed on high-end models, and is therefore less exposed to Chinese imports compared with the EU, where a much larger range of cars are produced.[27] But opening the door to intense competition would make it more difficult for UK manufacturers to expand into the production of a wider range of models and to build up related supply chains – both priorities of the new Government.[28]

There is also likely to be an increase in emissions associated with importing EVs from China. As well as the carbon used in transportation, the Chinese energy sector remains significantly more carbon intensive than that in the UK – producing 580 grams of carbon per kilowatt hour of electricity generated in 2023, compared with 160 grams in the UK (and higher than most EU countries too). This means embedded emissions in imported vehicles will be higher those manufactured at (or closer to) home. There are also geo-political and security risks associated with allowing Chinese imports of EVs. For example, such an approach risks stoking trade tensions and influence future negotiations with the EU, such as on the rules of origin applied to EVs, resulting in the UK potentially facing difficulty exporting domestically-manufactured vehicles to the EU if intermediate components are linked to Chinese manufacturers.

Falling prices means that the EV market is in a new era. The case for continued subsidy is considerably weaker, and a new approach is warranted. It was sensible, therefore, that policy moved away from subsidies: universal grants were ended in 2022, and replaced instead by a sales mandate (the Zero Emissions Vehicle mandate, or ZEV mandate) on suppliers. This policy imparts a minimum share of sales that must be fully electric in each

26 G Parker and Arjun Neil Alim, UK says it is not about to impose tough tariffs on Chinese EV imports, Financial Times, July 2024.
27 The trade body for the UK automotive sector, the Society of Motor Manufacturer and Traders have stated that the UK's strength in vehicle production is in 'specialist, luxury and performance' vehicles, with premium marques such as Jaguar Land Rover a significant contributor to car production, as well as premium smaller models, such as the Mini. See: SMMT, UK car production down but electric vehicle output surges to new record, January 2023 and SMMT, Motor Industry Facts, May 2023.
28 Labour Party, Driving a Growing Economy: Labour's Plan for the Automotive Sector, October 2023.

year. In 2024, this threshold is set at 22 per cent of total sales, but will rise rapidly to 38 per cent in 2027 and 80 per cent by 2030. Permits are tradable and can be purchased from companies that exceed their target, and failure to meet the threshold will be met with heavy fines.[29]

In light of the factors discussed above, the ZEV mandate is a good policy. It will move costs from the Treasury onto either car manufacturers (through lower profits) or to those buying new non-electric cars (through cross-subsidy). These ambitious targets should mean that manufacturers need to expand the number of affordable vehicles on offer. This should bring EV production more into line with consumer preferences: all of the ten bestselling UK cars in 2024 (none of which are electric) have retail prices in the region of £30,000 or less.[30]

Subsidies for new cars have been replaced by large and arbitrary tax breaks

But while blanket subsidies for EVs are no more, a range of substantial and arbitrary tax breaks have continued. In particular, EVs are subject to very generous benefit-in-kind rates (currently 2 per cent of vehicle value and only rising to 5 per cent by 2027-28).[31] These low rates are beneficial to those people receiving company-car benefits – there were 760,000 such people in 2022-23, whose cars collectively had a total taxable value of £3.6 billion. Of these drivers, two thirds (66 per cent) reported earnings of more than £50,000 per year, and one third (32 per cent) of more than £75,000 per year. Just 2 per cent of company car drivers earn less than £20,000 per year.[32] Perks for company cars have not been without merit, leading to the greening of the fleet, which – owing to high mileages covered by those who drive for work – had an outsized impact on transport emissions. Three-in-ten (29 per cent) of company cars on the road in 2022-23 were electric, and the company car stock has become much more efficient as a result – average carbon intensity has halved from 140 grams per kilometre (g/km) in 2011-12 to 70 g/km in 2022-23.[33]

But while higher earners having access to company cars is not a surprising phenomenon, another tax break – the electric car salary sacrifice scheme – avails substantial discounts to drivers who do not necessarily need a vehicle to carry out their work duties. Electric

29 Targets for sales of EVs under the ZEV mandate have yet to be legislated for from 2028 onwards, and the new Government's goal of reinstating the ban on the sale of petrol and diesel cars is likely to see these targets increase, or become defunct. It is also worth noting that there are number of short term 'workarounds' in the ZEV mandate to make achieving goals in its early years easier. These include the ability of manufacturers to 'borrow' credits from later years, and manufacturer-specific reductions in mandate levels based on reductions on the carbon intensity of non-electric cars sold during the year.

30 None of the ten best-selling car models in the first eight months of 2024 – accounting for 240,000 vehicles, or one-in-five of all cars sold in the UK – had a manufacturer RRP of more than £32,000. Source: RF analysis of SMMT and vehicle manufacturer data.

31 Benefits in kind are (non-cash_ goods and services provided to an employee for personal use, in lieu of earnings. Benefits in kind are considered supplementary to a salary, and are therefore subject to taxation.

32 RF analysis of HMRC benefits in kind statistics

33 HMRC, Benefit in kind statistics commentary, June 2024

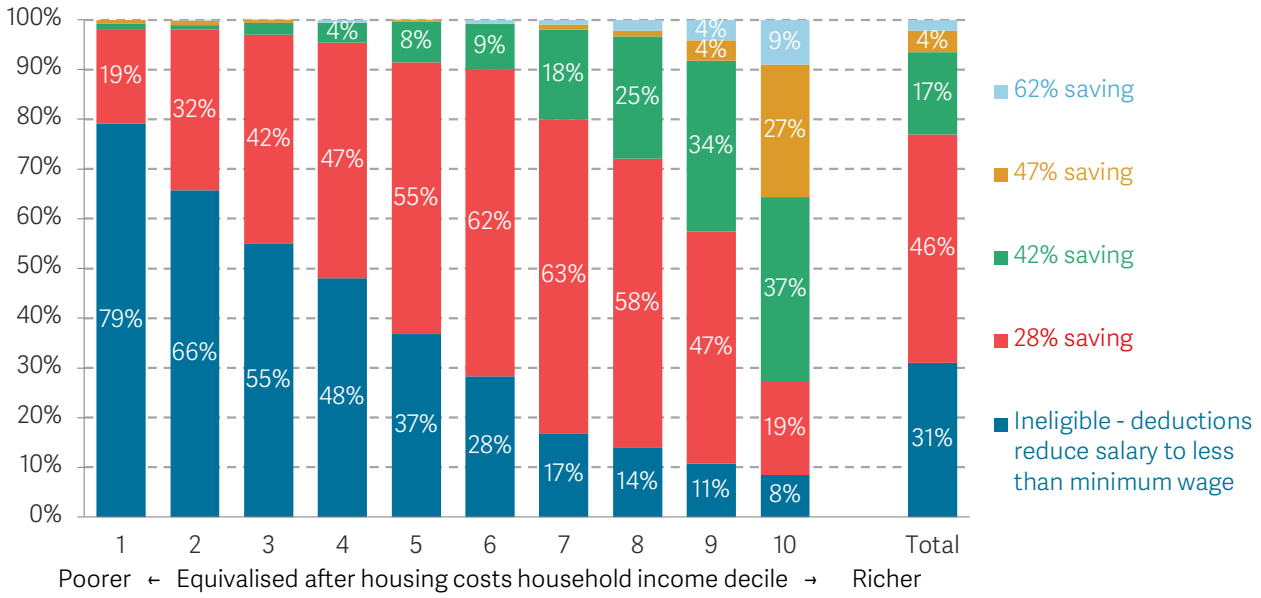
car costs funded through these schemes allow workers (providing their employers are signed up) to pay for vehicles from their gross salary, i.e. before income tax and National Insurance Contributions are deducted. This means discounts are pegged to employees' marginal tax bands, and that higher earners are able to benefit from bigger (taxpayer-funded) discounts on new cars than those who earn less or those whose employers do not provide such a benefit.

This means that actual lease costs are reduced by 28 per cent for basic rate taxpayers, but by 42 and 47 per cent for earners paying tax at higher and additional rates (and an incredible 62 per cent for those earning between £100,000 and £125,140). In contrast, lower earners are also excluded from salary sacrifice schemes by rules that prevent net incomes falling below minimum wage. Figure 7 shows the distribution of salary sacrifice discount rates available to families looking to lease an EV with payments of £200 per month. Assuming equal access to employer-provided schemes, nearly three-quarters (73 per cent) of working-age households in the highest income decile are potentially able to get a discount of more than 42 per cent on monthly payments – reducing £200 per month payments to £116 for those earning more than £50,471 (£50,271 for the tax band cut off plus £200 for gross lease costs) and £106 for those earning more than £125,340 (£125,140 plus £200). At the same time, more than half (56 per cent) of the bottom half of the income distribution, and four-in-five (79 per cent) of the very poorest tenth of households would be entitled to no discount at all.[34]

34 In reality these savings could be higher still. For example, higher earning households can use salary sacrifice schemes to reduce their net adjusted income below thresholds that entitles them to benefits from the state, such as that through Child Benefit or tax-free childcare schemes.

FIGURE 7: **The salary sacrifice scheme offers bigger discounts to higher earners and excludes those on lower incomes**

Proportion of households in each after housing costs income decile eligible for different electric car salary sacrifice discount rates, based on income of the highest earning household member and a £200 monthly lease cost: UK 2022-23



NOTES: Figure shows the proportion of households that would eligible for discounts at the whole rate shown (i.e. without falling into a lower marginal tax band) if £200 per month was paid out of the highest paid resident's gross (pre-tax) salary. Working-age households only.
SOURCE: RF analysis of Households Below Average Income data.

Further, a number of salary sacrifice schemes now allow additional driving costs, such as insurance and maintenance, to be paid for from pre-tax earnings, as part of a package deal. Combined, these two outgoings account for a third (32 per cent) of average household expenditure on private vehicles, representing further potential savings available to people fortunate enough to work for companies that offer electric cars through salary sacrifice (and available at a high rate if on a high salary), but not to drivers who are locked out.

Ministers should call time on these tax breaks, but be alert to EV sales that are currently below targets

As well as the inherently arbitrary nature of these schemes, the fiscal costs are set to build in the coming years as EV sales grow. This presents a good case for winding them down. But making large and abrupt tax changes risks impeding the sale of new cars, making it harder to reach short-term ZEV mandate targets. The EV market is facing a number of economic headwinds, with new sales in 2024 to date around 4 percentage

points below the mandate target.[35] This is largely a function of rapid depreciation and high interest rates putting upward pressure on leasing costs – the means through which the majority of new cars are sold, and has prompted manufacturers and their trade groups to call for additional Government subsidies, or for an easing of mandated targets.[36]

But further incentives would undermine a core tenet of the ZEV mandate: that the capital outlay needed to decarbonise the UK's vehicle fleet should sit with those purchasing non-electric cars or with manufacturers, instead of being a cost to the taxpayer. As such it should be avoided. And while the debate is currently steered by voices pointing to the impact on carmakers being excessive, there is little concrete evidence here: the heavy discounting of EVs currently observed could well be being recouped through higher ticket prices on fossil fuelled vehicles. Also, softening targets so that they are easier to achieve would be suboptimal, in that it would reduce the imperative on manufacturers to both sell more electric cars, but also to develop a more complete suite of electric models.

As such, considering the short-term focus of these apparent concerns (mandate targets in later years are expected to be much easier to achieve as production is accelerated and EVs become cheaper and more accessible) ministers could look to means of bringing demand forward. They could do so by pre-announcing the end of these very generous tax breaks ahead of time (the current framework is set to run until 2027-28, so an announcement could be made in the 2024 Budget with a retirement date of three years hence). This would incentivise motorists to purchase EVs before discounts expire and while concerns over attaining sales targets are most acute. The outsized share of company cars in EV sales (including those purchased through salary sacrifice, which are not owned by their drivers), which accounted for six-in-ten (62 per cent) of cars sold in the first half of 2024, could see this change deliver a sizeable impact.[37]

And policy makers could look to a future strategy that imposes higher taxes on the purchase of polluting vehicles, should sales patterns suggest that EV sales need a further boost after these tax changes are implemented. This could be done either through higher Vehicle Excise Duty rates (although this tax is one that should ultimately be based upon vehicle weight), or by higher company car taxes for non-electric cars, should cross-subsidy through the ZEV mandate not be sufficient.[38] This would reduce the price

35 There are differing views on whether – and to what extent – sales targets will be missed in coming years. Industry forecasts anticipate sales targets being missed in both 2024 and 2025, with the share of cars that are fully electric expected to be 18.5 per cent and 23.7 per cent, respectively. But others have pointed to predictions that targets will be attained, and that an excess of sales credits mean that the onus will be on companies that fall short to purchase allowances from those who sell a greater proportion of electric cars. For more, see: SMMT, UK new car and van forecast – July 2024, August 2024 and New Automotive, UK sees record-breaking electric car sales in September 2024, October 2024.

36 See: British Vehicle Rental and Leasing Association, Industry Outlook 2024, September 2024; J Jolly, Carmakers ramp up pressure on chancellor for EV sales subsidies, The Guardian, October 2024; R Lea, Ford urges Labour to put electric car targets on pause, The Times, October 2024.

37 Source: SMMT, July 2024 New Car Registrations, August 2024

38 For more on VED reform see: A Corlett and J Marshall, Where the rubber hits the road, Resolution Foundation, June 2023.

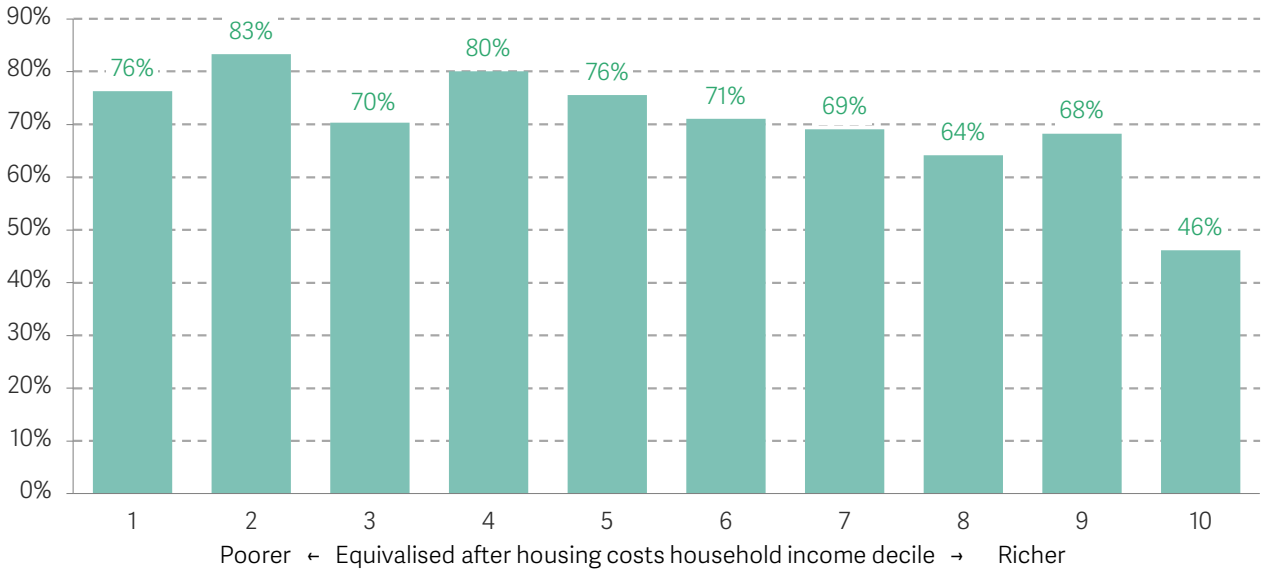
premium associated with electric vehicles, or even make petrol ones more expensive as EV prices fall, providing consumers with a clear signal to move to a low emissions vehicle. These changes would be beneficial on three counts: they would ensure that all drivers face the same incentives when buying a new car; would bolster the Government's fiscal position, as expenditure (via tax breaks) would be replaced with receipts; and would be good for the net zero transition as non-electric cars would be more quickly priced at a premium to their greener counterparts.

Most drivers will make the transition to EVs through the used car market – but policy makers should resist the urge to intervene here

The vast majority of drivers purchase used cars: 7.2 million used cars changed hands in 2023, compared with 1.9 million new vehicles entering the stock. Spending on used cars also dominates vehicle expenditure for all but the highest earning households, accounting for three quarters (77 per cent) of outlay on cars for the poorest half of the UK, compared with less than half (46 per cent) for those in the top income decile, as Figure 8 shows. As such, the used car market is where most drivers – and especially those on low-to-middle incomes – will make the switch to electric.

FIGURE 8: **Used cars are the priority for all but the highest earning households**

Spending on used cars as a share of all expenditure on purchasing cars, by equivalised after housing costs income deciles: UK 2021-22



SOURCE: RF analysis of ONS, Living Costs and Food Survey.

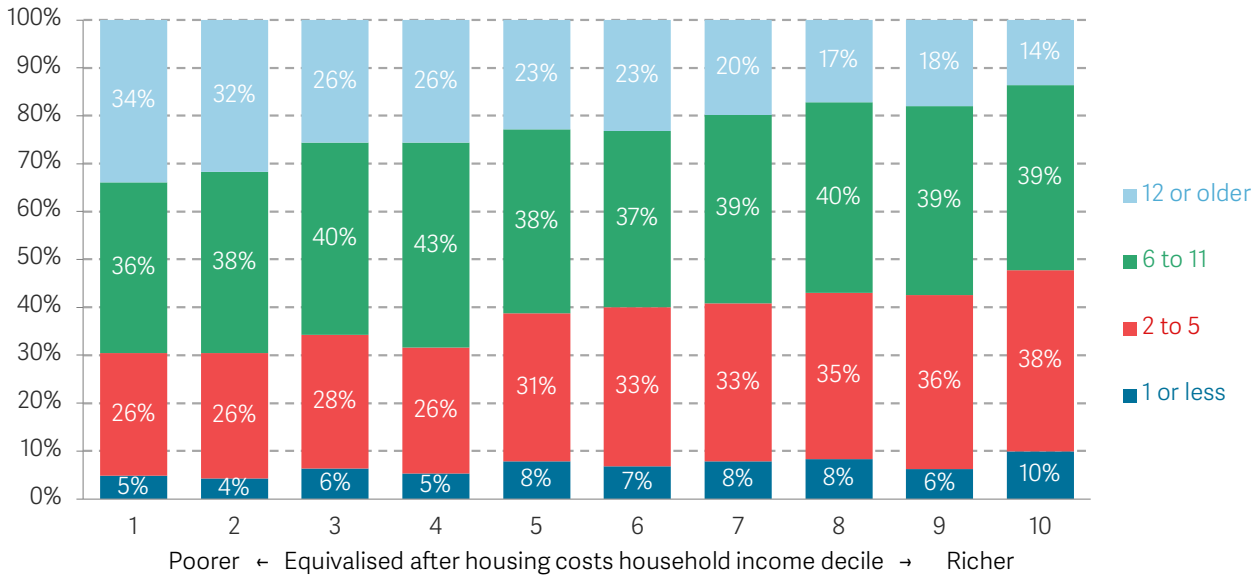
In recent years, though, the used car market has experienced significant turmoil. Prices spiked following the pandemic – jumping by a third (32 per cent) – as a downturn in new

vehicle production saw more drivers look to the used car market. And while prices have since eased off, falling by 13 per cent from their peak in Q4 2021, they remain higher than at any point between 2012 and 2021.[39]

But despite big falls in the price of new EVs, used ones are still expensive. EVs experience much quicker – and deeper – depreciation than fossil fuelled cars, losing half (50 per cent) of their value before they reach three years old.[40] This might suggest second-hand EVs should be cheap. But two-thirds of electric cars in use today are less than three years old, and are generally priced according to their age.[41] As shown in Figure 9, lower-income households generally own older vehicles, with one-in three (34 per cent) of drivers in the lowest-income decile having a primary vehicle that is 12 or more years old, compared with 14 per cent of the top income decile, and 70 per cent have a car 6 years or older, compared with 53 per cent. Lower-income households own cheaper vehicles, too. Just one-in-ten (11 per cent) of the poorest households have a primary car worth £10,000 or more, compared with half (53 per cent) of the richest.[42] As a result, it is unsurprising that used EV are – and will likely remain for several years – concentrated in the hands of the better off.

FIGURE 9: **Poorer households own older cars**

Banded age of primary car, by equivalised after housing costs income deciles: UK 2021-22



SOURCE: RF analysis of ISER Understanding Society data.

39 ONS, CPI Index: second hand cars.
40 Autotrader, Road to 2035, August 2024.
41 RF analysis of SMMT data shows.
42 Source: RF analysis of Wealth and Assets Survey data.

The unaffordability of used EVs for poorer drivers, and therefore their inability to capture the benefits of electric motoring, has prompted calls for intervention in the second-hand market to get poorer drivers into newer and more expensive cars. In theory, measures to achieve this – grants, tax breaks and means-tested leasing schemes, for example – could change the distribution of used cars among drivers and allow a (small) number of poorer drivers to move to EVs sooner than they otherwise would have done.

However, such interventions would bring collateral damage that would more than outweigh these benefits. This is because the used EV market is supply constrained, with the input of new vehicles entirely determined by the number of new cars sold in the past. It's also small (both in terms of models and of outright number of vehicles) and therefore more price elastic than an alternative in which consumer choice is larger. This means that any attempt to stoke demand, even if only for a subset of the population, would push up prices significantly, making used EVs less affordable for those on low-to-middle incomes as well as for higher earners (which is where most of the emissions savings are located). Instead, policy efforts should remain focussed upstream, ensuring that the sale of new EVs continues apace and, crucially, that targets in the ZEV mandate remain robust enough to encourage manufacturers to bring more affordable EVs to the market, reversing trends towards producing larger, higher-price cars, as Box 2 discusses.

BOX 2: **Getting more affordable EVs into the used car market is vital for a fair transition**

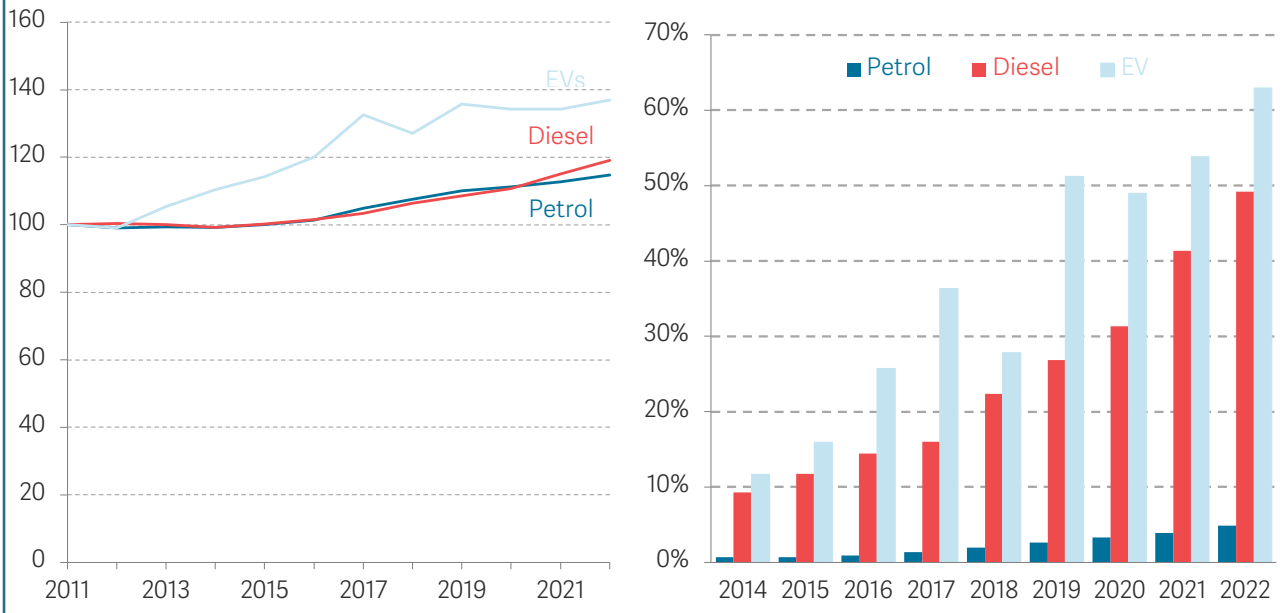
There has been a trend towards all new cars getting bigger and heavier, but this is particularly acute for EVs. The number of electric SUVs sold in the UK increased from 81,000 in 2021 to 189,000 in 2023, and hybrid SUVs are now more popular than petrol alternatives.[43]

As Figure 10 shows, the average weight of new electric cars has been increasing more quickly than those powered by petrol and diesel, and the majority (63 per cent) of new electric cars sold in the UK now weigh more than 1.8 tonnes – more than ten times the share (5 per cent) of heavy new petrol cars sold.

43 Transport & Environment, UK SUV sales have increased by more than a fifth in one year, February 2024.

FIGURE 10: **Cars are getting bigger and heavier, EVs especially so**

Mean weight of new cars sold, by fuel type (left panel, 2011=100), and share of new car sales with a curb weight of 1.8 tonnes or more, by fuel type (right panel): UK



SOURCE: RF analysis of SMMT data.

There are some benefits of larger cars, particularly around safety in crashes, but these only apply to those inside the vehicle. Big cars take up more space on (and cause more wear and tear to) the UK's crowded road network, and they are much more dangerous to pedestrians and other road users than smaller vehicles. More importantly, however, they are much more expensive to buy and to run than smaller alternatives. This price premium carries through when re-sold, slowing the adoption of EVs by lower-income families in the used-car market. For example, the Tesla Model Y and the Audi e-tron are the first and third bestselling electric cars in the UK in 2024 to-date, but both weigh around 2 tonnes and are more than 4.6 metres long. Three-year-old models, even those with high mileage, are seldom available used for less than £30,000 – putting them well out of the reach of drivers with smaller budgets. Bigger and heavier cars also cost more to run, with an Audi e-tron covering around 2.8 miles for each kilowatt hour (kWh) of electricity consumed, compared with 4.2 miles for an electric Vauxhall Corsa (meaning each journey costs 50 per cent more in fuel, even if the fuel is electricity). And they cost more to insure, as parts and repairs for more expensive cars carry a cost premium. As such, a change in the catalogue of EVs coming to market is essential for them becoming affordable used options for lower- and middle-income drivers in due course.

So, getting more electric cars on the road should remain the key priority for decarbonising transport. Significant progress has been made, but policy makers should acknowledge that the EV market is now in a different era. The focus now should be on the supply of vehicles, rather than simply stoking demand, but also ensuring that the current suite of policies used to deliver change – largely through supplier mandates and the tax system – do so with both pace and fairness in mind. But broadening the numbers of drivers benefiting from the cheaper running of EVs also means focusing on how these cars are fuelled. We turn to that issue in the next section.

Section 3

The public charging network needs to be plentiful, geographically dispersed, and fairly priced

There is a clear trajectory for transforming the UK's vehicle stock, and an increasing number of EVs on UK roads. But once EVs are commonplace, motorists need to be able to charge them cheaply. This is important because a core benefit of EVs – and indeed from the net zero transition as a whole – is cheaper driving costs, with total annual savings forecast to top £22 billion (in 2024 terms) by 2035. But the savings depend on access to at-home charging. At the moment, 19-in-20 of all chargers are installed in residential buildings, but many families will not be able to access home charging, with families in the lowest-income quintile more than twice as likely to be in this position than those in the highest.

This means that the public charging network has a key role to play in the fair distribution of these substantial savings. Until recently, the public charging network has been slow to develop, and rollout has been more prevalent in some parts of the country than in others. But there are now very positive signs that new infrastructure is being installed rapidly. Not only is the size of the public network increasing rapidly (doubling in the past two years), but the share of chargers most important to those who cannot charge at home – low-voltage, kerbside devices – is also increasing, and these chargers are being installed in places where both the housing stock imparts a bigger need, and where household incomes are lower.

But while the pace and spread of charging provision is improving, the cost of using the network remains a big issue – with prices currently more than double those enjoyed by drivers who can charge at home. A truly fair transition to electric cars means finding a way to harmonise these costs. To achieve this, action is needed on multiple fronts. Tax discrepancies – mainly the higher rate of VAT on public chargers – should be removed, and upfront costs faced by charge-point companies could be reduced. But the key way to bring down prices is through effective competition between different operators, removing local monopolies and keeping a lid on prices in the same way that competition between approximate petrol stations does today. Fairly priced charging is of such importance that, should these means fail to deliver cheaper electricity for those using public chargers, ministers should not be afraid of enacting new regulations to keep a lid on costs.

The main benefits of the EV transition accrue from lower running costs

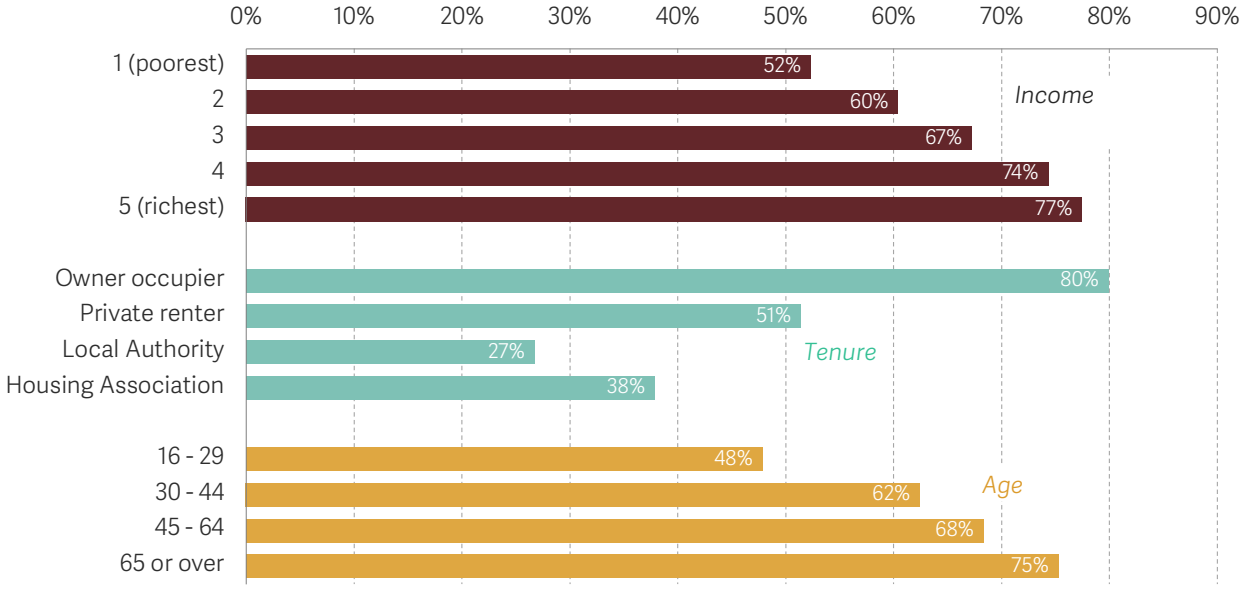
The main financial upside of EVs – and of the net zero transition at large – are those that accrue from the lower running costs associated with electric motoring. The bulk (84 per cent) of the savings that low carbon transport is forecast to bring between 2025 and 2050 are those from cheaper car driving costs (replacing petrol with electricity), with total savings of £22 billion per year by 2035.[44]

However, the ability to tap into these savings is not guaranteed for every household. Instead, access depends on where cars are charged. There are now more than 1 million EV chargers in the UK, but the overwhelming majority (95 per cent) are in people's houses. This matters because, as discussed below, electricity used in the home (including to charge cars) is much cheaper than that from on-street chargers. But one third (34 per cent) of families live in homes without access to off-street parking, meaning that instead of simply plugging in their cars at the end of the day, they will be forced to venture out and locate a public charger. Crucially, parking provision is not equal for all: families in the lowest-income quintile are more than twice as likely as those in the highest quintile (48 per cent to 23 per cent) to live in homes without off-street parking, as Figure 11 shows, while EV drivers in younger households and those in rented accommodation (especially in the social sector) are also much more likely to lean on the public network.

44 RF analysis of CCC data.

FIGURE 11: **Poorer households are much less likely to be able to charge electric cars at home**

Proportion of households with access to off-street parking, by after housing costs income quintiles, tenure, and age of household reference person: England 2021-22



NOTES: Off-street parking defined as having a garage or 'other off-street parking'.
SOURCE: RF analysis of MHCLG, English Housing Survey data.

Therefore, for all drivers to be able to reap a fair share of the savings that the net zero transition brings, they need to be able to access cheap electricity. This means tapping into a public charging network that is plentiful, widely dispersed, and fairly priced.

Recent growth in the EV charging network is encouraging

Sluggish pace in the rollout of public chargers has long been heralded as an impediment to the transition to electric cars. For years, 'range anxiety' and a scarcity of public chargers have deterred potential EV buyers and worried policy makers.

But recent data has been much more encouraging. Over the past two years, the total size of the UK's public-charging network has doubled, with more than 60,000 public chargers now installed across the country – a pace that puts the (previous) Government's target of 300,000 public chargers being installed by 2030 very much within reach.[45]

While this rapid expansion is undoubtedly positive, the type of chargers also matters. Fast chargers, like those found at motorway service stations, are convenient for long-distance travel, but are priced at a premium (reflecting higher costs). Much like petrol stations along motorways today, these chargers are unlikely to become the primary source of energy for everyday EV use. Other charging options, such as those located at workplaces, hotels, or supermarkets, also come with their own limitations. These chargers may incur additional

45 Department for Transport, Electric vehicle public charging infrastructure statistics: July 2024, July 2024; Zapmap, EV charging statistics 2024, October 2024; CCC, Progress in reducing emissions: 2024 Report to Parliament, June 2024.

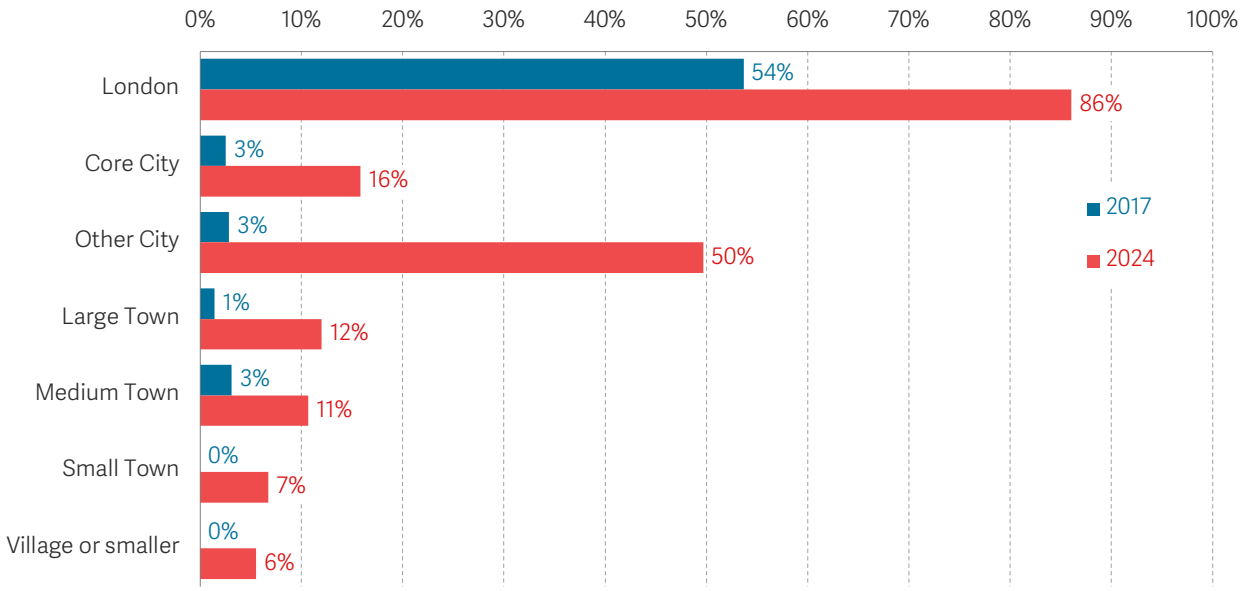
costs, such as requiring drivers to spend money in shops or on parking in exchange for access, or may be reserved for employees or guests. So, the key factor in assessing the effectiveness of the public charger rollout, therefore, is the number of low-voltage, low-cost kerbside chargers that EV drivers can access close to their homes.

Here, again, there is good news: the rollout is increasingly focussing on kerbside chargers. Half (53 per cent) of all public chargers installed during the first half of 2024 were this type, a significant improvement on the 17 per cent that were in 2017.[46] Furthermore, this acceleration is coinciding with an improvement in geographical coverage. In 2017, just 13 per cent of neighbourhoods (defined as lower super output areas, or LSOAs) had at least one kerbside charger installed.[47] By summer 2024, this figure had nearly tripled to 36 per cent – far from equal provision across the country, but certainly a big step in the right direction.

Diving deeper, as we do in Figure 12, we can see that although London is further ahead, with more than four-in-five neighbourhoods now served by kerbside chargers, other parts of the country are catching up, not least 'Other Cities' – settlements with populations of more than 175,000 people – where half of areas now have at least one kerbside charger, compared to just 3 per cent in 2017.

FIGURE 12: **Geographical coverage of kerbside public chargers is improving**

Proportion of neighbourhoods (Lower Super Output Areas) with at least one kerbside charger, by settlement type: England and Wales



NOTES: 2024 values are for the first half of the year only.
SOURCE: RF analysis of Zapmap; ONS, 2021 Census; ONS, National Statistics LSOA IMD lookups 2019; Settlement types are from C Baker, City & Town Classification of Constituencies & Local Authorities, House of Commons Library, June 2018.

46 RF analysis of ZapMap data.
47 RF analysis of Zapmap; ONS, 2021 Census; ONS, National Statistics LSOA IMD lookups 2019. Lower Super Output Areas are small geographic units used in the UK for statistical purposes. They are typically composed of around 1,500 people and are used to analyse data at a local level.

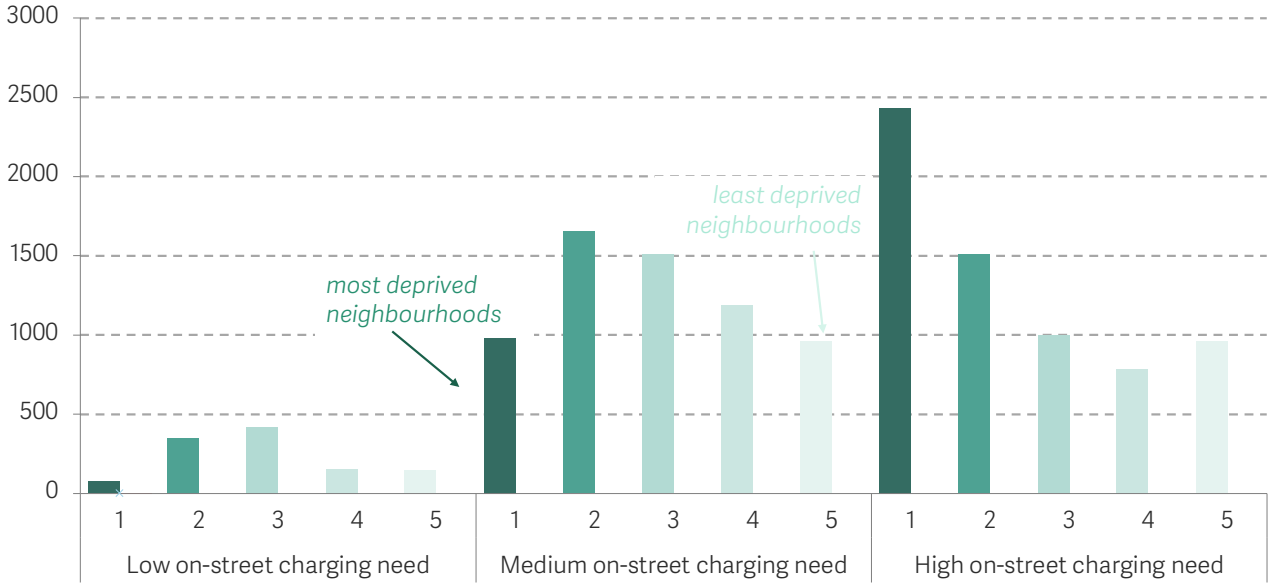
And while Figure 12 may suggest that less urban parts of the country are being left behind, this misses the point that there is greater inherent demand in some areas, and these places are overwhelmingly concentrated in cities. Two-thirds (63 per cent) of homes in London, and more than half (57 per cent) of homes in other British cities are either terraced houses or flats, and are therefore much less likely to have off-street parking than other housing types.[48] For smaller towns and villages these shares are much lower, at 33 and 30 per cent, respectively.

When we look at the most recent acceleration in charger provision across areas grouped by charging need, it is encouraging that an outsized share (47 per cent) of chargers installed since 2022 have been in the places where the housing stock imparts the biggest need – i.e. where more than two thirds (65 per cent) of homes are terraced houses or flats.[49] Not only that, within these areas of high need, installations are happening fastest in more deprived neighbourhoods – nearly 2,500 kerbside chargers have been installed in the poorest places with the highest need since the start of 2022, as Figure 13 shows.[50]

48 RF analysis of ONS, Census 2021.
49 Areas with high on street charging need are defined as those in LSOAs with the highest share (tertile) of homes that are flats or terraced houses, corresponding to 65 per cent or more of properties. And those with medium need are those in the middle tertile, with 40-65 per cent. Using these figures means that each band of housing need contains a similar number of households.
50 Chargers are also being installed in areas where more households own vehicles: 73 per cent of onstreet chargers installed in the first half of 2024 were in LSOAs where at least 50 per cent of households owned one or more cars, compared with 62 per cent in 2017. Source: RF analysis of Zapmap, 2021 Census, ONS National Statistics LSOA IMD 2019 lookup data.

FIGURE 13: **On street charger installations are being concentrated in poorer places and in those where off-street parking is most limited**

Number of on-street (kerbside) electric car chargers installed, by Index of Multiple Deprivation income deprivation quintile of the neighbourhood (Lower Super Output Area) in which the charger is located, and need imparted by the housing stock: England and Wales Q1 2022-Q2 2024



NOTES: Areas with high on street charging need are defined as those in LSOAs with the highest share (tertile) of homes that are flats or terraced houses, corresponding to 65 per cent or more of properties. And those with medium need are those in the middle tertile, with 40-65 per cent. Using these figures means that each band of housing need contains a comparable number of households.
SOURCE: RF analysis of Zapmap; ONS, 2021 Census; ONS, National Statistics LSOA IMD lookups 2019; Settlement types are from C Baker, City & Town Classification of Constituencies & Local Authorities, House of Commons Library, June 2018.

This is what might be expected given that developers have strong incentives to locate chargers in areas with the most promising future yields – predominantly those where off-street parking is the most limited. But it is likely that policy, such as the Local Electric Vehicle Infrastructure Fund, has also played some role.[51] Either way, these positive trends suggest policy makers should focus less on charging provision and more on the challenge of fair pricing.

The cost of using a kerbside charger remains far higher than charging at home

A fair distribution of the savings from electric motoring requires access to fairly-priced energy. The pricing structure for EV charging differs significantly from that of traditional petrol stations, and presents a more complex landscape for consumers. For example, refuelling with petrol means using a standardised system (all petrol pumps are the same),

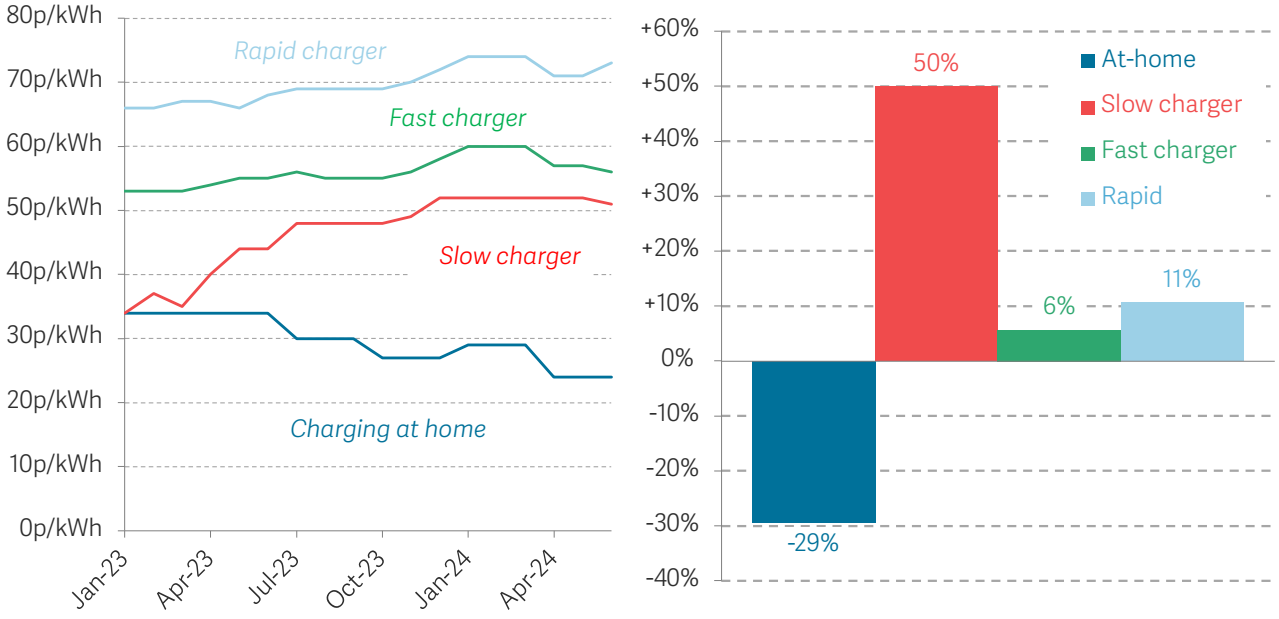
51 For more on the Local Electric Vehicle Infrastructure Fund, see: Energy Saving Trust, Local electric vehicle infrastructure fund, accessed October 2024.

takes only a few minutes, and is dominated by a small number of very large companies. This differs wildly with the public EV charging experience, where charging can take several hours and larger number of companies are vying for business, each with different consumer interfaces, processes, and – in some cases – different physical connections. But the key difference is the increased number of sub-markets for EV charging, primarily differentiated by location and charging speed. These various options cater to different user needs and scenarios, but again it is important to recognise the importance of kerbside chargers for drivers without access to off-street parking, and to ensure that the process of using them is not only straightforward, but good value for money.

It is therefore concerning that the cost of kerbside charging has increased rapidly, with each kilowatt hour of electricity now costing 50 per cent more than it did at the peak of the energy crisis in January 2023 (see Figure 14). This is despite wholesale electricity prices falling by 54 per cent over the same period, a development that has resulted in cheaper prices for EV drivers who can charge at home, for whom electricity is now close to a third (29 per cent) cheaper.

FIGURE 14: **The cost of charging at an on-street charger has increased dramatically**

Average EV charging prices by charger type (left panel), and change in price between January 2023 and June 2024, by charger type (right panel): UK



NOTES: Charging prices shown are based on flat rate pricing.
SOURCE: RF analysis of AA Recharge data.

The result of these price swings is a stark disparity between the costs of home and public charging. It now costs more than double to drive an electric car that is refuelled using kerbside chargers – approximately 11.5 pence per mile – while home charging costs are around 5 pence per mile (for reference, a typical petrol car has fuel costs of around 15 pence per mile).[52] At-home charging can be cheaper still, with costs closing in on 3 pence per mile, if drivers use tariffs that allow them to take advantage of lower priced off-peak electricity, or utilise energy when wholesale prices are depressed (such as when wind generation is at high levels). To put this into perspective, a publicly-charged electric vehicle that covers the average annual mileage of a UK motorist, around 7,400 miles, will cost its owner approximately £425 more per year in fuel costs compared to an identical vehicle that can be charged at home.[53]

The higher cost of using public chargers is concerning for three key reasons. First is the clear and obvious impact on family budgets that additional expenditure on fuelling vehicles will bring. Second, lower running costs are a significant factor in encouraging EV adoption, so reducing this price incentive risks slowing take-up of electric cars and slowing the pace of overall transport decarbonisation. And third is making it politically more difficult to implement a road-pricing system, as doing so at a level proportionate with the (non-carbon) externalities of driving – we have proposed a 6 pence per mile charge in previous work – could leave those reliant on the public charging network spending more to drive electric cars than the petrol ones they have at the moment.[54]

On street charging needs to be made cheaper

To make EV charging more affordable to those without off-street parking, policy makers need to focus on reducing public charger costs – and ideally before more drivers become dependent on them. Currently, significant barriers prevent public EV chargers from being cost-competitive with at-home charging. One key factor is that public chargers are subject to a higher rate (20 percent) of VAT than electricity used at home (5 percent) – these rates should clearly be equalised at the lower level, at a cost to the Treasury of around £700 million.[55] But even were this discount passed on fully to consumers, it wouldn't be transformational – public charging would still be 85 per cent more expensive than charging at home, an equivalent extra cost of around 4.5 pence per mile.

Another area worthy of focus is the fixed costs that operators face (which are, in turn, passed on to drivers through higher electricity prices). Some of these are more straightforward to reduce than others. For example, installing public chargers requires

52 RF analysis of AA Recharge data.
53 Source: RF analysis of DfT, National Travel Survey; AA Recharge data.
54 For more on road pricing, see: A Corlett and J Marshall, Where the rubber hits the road, Resolution Foundation, June 2023.
55 A Corlett and J Marshall, Where the rubber hits the road, Resolution Foundation, June 2023.

planning permission whereas (for the most part), home chargers do not.[56] Lengthy and burdensome processes make developing new sites more expensive, as well as slower. Planning constraints have been frequently highlighted as an impediment to building infrastructure, with growing momentum for widespread overhaul.[57]

Another area deserving of attention is the cost of connecting to the electricity grid, which manifests through much higher standing charges for charge-point operators than was the case a few years ago.[58] Addressing these will be more complicated as the cost of electricity grid upgrades need to be paid for by someone, but ministers (and the energy regulator) have a number of options here, from spreading more of these costs to households or firms, or looking to the numerous benefits associated with funding network infrastructure through the public balance sheet, and subsequently using the tax system to recoup costs fairly from driving and non-driving households, and companies instead.[59]

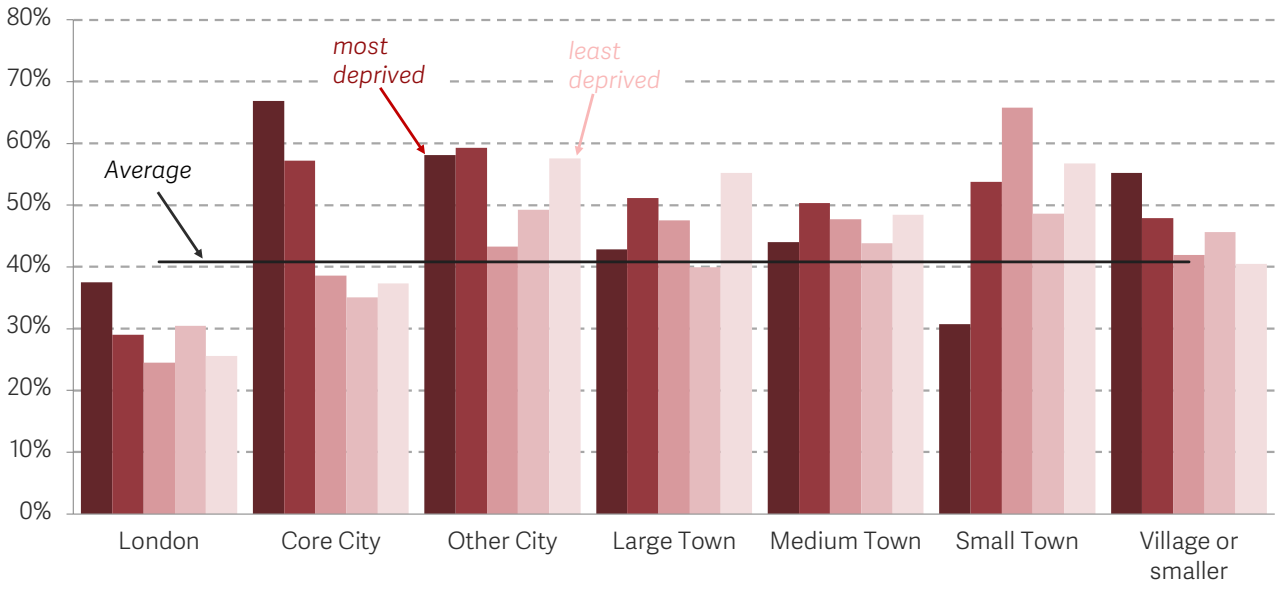
Improving competition is vital to keep a lid on charging costs

For all that policy and tax changes can intervene, the main priority for keeping charging prices in check over the long-term must be increasing effective competition between operators, thereby mirroring the current approach in petrol and diesel prices. Healthy competition is developing between rapid charge-point operators (i.e. those at motorway service stations), limiting the price changes since January 2023 shown in Figure 14 to 11 per cent. But a similar situation is, unfortunately, yet to develop in the lower voltage kerbside market. Worryingly, then, even though the rollout of these chargers is still nascent, we can see that the formation of local monopolies is a major concern. Two-fifths (41 per cent) of neighbourhoods in which at least one charger is installed are only currently being served by one company. This share is worryingly higher in poorer parts of cities (excluding London), where 60 per cent of neighbourhoods in less well-off areas only have one provider in operation, as Figure 15 shows. The experience in London – where the rollout is more advanced – suggests some reason for optimism here, with just 29 per cent of neighbourhoods are subject to local monopolies and therefore a greater share of drivers having a choice of more than chargepoint operator in their neighbourhood.

56 S Dumitriu, How to make EVs work in Britain, Britain Remade, July 2023.
57 Here ministers could look for inspiration in recent rule changes that made installing telecoms infrastructure easier – with local authorities now compelled to authorise new masts under a certain height unless there are justifiable reasons to reject them.
58 I Johnston, Given the thread of headlines in the broadsheets over the last few days, let's address this up front: why is public charging not currently cheaper in the UK?, September 2024
59 E Fry and J Marshall, Electric Dreams, Resolution Foundation, April 2024. Ministers may also point to current low utilisation rates of kerbside chargers – on average they are used for only about three hours per day and provide less than 10 per cent of their maximum potential energy output than if they were operated continuously – as a rationale for spreading these fixed costs over a greater amount of electricity provided. In theory, this would lower the overall cost per kilowatt hour. However, while this idea holds in principle, the current high prices for public charging are likely to hinder the rapid increase in usage needed to make this approach effective. So, instead, focus should be on the underlying cost issues. For more on utilisation rates see: Green Finance Institute, Demystifying Utilisation, July 2023.

FIGURE 15: **Local charging monopolies are particularly prevalent in poorer areas in cities, apart from London**

Proportion of neighbourhoods with public chargers provided by only one network, by index of multiple deprivation income deprivation quintiles and settlement type: England and Wales, Q2 2024



NOTES: LSOAs with no kerbside public charger provision not shown.
SOURCE: RF analysis of Zapmap, 2021 Census; ONS National Statistics, LSOA IMD lookups 2019. Settlement types are from C Baker, City & Town Classification of Constituencies & Local Authorities, House of Commons Library, June 2018.

A comparable imbalance of power between suppliers and consumers (even in the short term), however, would surely not be tolerated in the petrol and diesel market.60 So ministers should both keep a close eye on levels of competition, and ensure that any policies they enact do not worsen the situation. And on the latter of these, there is reason to suspect that the Government's Local Electricity Vehicle Infrastructure Fund programme may be making things worse. This scheme sees Local Authorities partner with a single charge company to increase coverage in under-supplied areas, thereby actively incentivising the creation of local monopolies rather than seeing companies compete for new custom. If this scheme, rather than the free market, ends up being a significant driving force in the rollout of chargers in some places then there is a tangible risk of local monopolies remaining unchecked, or even worsening in severity.

60 The Government keeps a close eye on competition between retailers of petrol and diesel, see: Competition and Markets Authority, Road fuel market study, July 2022, and Competition and Markets Authority, Interim road fuel monitoring update: July 2024, July 2024.

Regulating prices would be a nuclear option, but it may be needed if on street charging costs do not fall

So while there are numerous routes through which kerbside charging prices could be reduced, if the premium associated with charging away from home does not fall then ministers must be prepared to step in and cap prices. This should clearly happen before more families without off-street parking start to drive electric cars. One possible solution would be the introduction of price regulation, perhaps in the form of a price cap similar to the one that currently protects household energy consumption.

It could be administered in the same mould so that profits are capped and that different elements of charging prices – wholesale energy, network and policy costs, taxes, and suppliers' other costs – are passed through to consumers in a proportionate way.

A price cap would help prevent the cost of public charging from rising to levels that would be prohibitive for many users: by setting a limit on the price per kilowatt hour that operators can charge for electricity at public charging points, a cap would ensure that charging costs remain within a reasonable range and prevent overcharging in areas where the availability of public chargers is limited.[61] Ofgem's price cap on domestic gas and electricity prices shows that such a mechanism can be an effective tool for protecting consumers from unfair pricing, and would provide a clear signal to charging operators that the Government is serious about keeping public charging affordable, encouraging them to find efficiencies and innovate in order to reduce their operating costs. However, regulation of this sort will lessen the profitability of new installations, and could impede the pace of rollout – as such other means of cutting prices, specifically competition, should be the main focus.

Overall, then, it is fair pricing that is set to be the main issue in charging electric cars. An accelerating rollout, and growing provision across the country, is very welcome news, but, if the cost of using these chargers does not fall, then the spoils of decarbonising car transport will not be fairly shared across society – with those unable to charge at home missing out. But, while cheaper driving costs will be a major boon from the net zero transition, many households do not or cannot drive, and rely on the public transport system instead. The next section focuses on this issue.

61 The model currently applied to households could also be tweaked such that different price bands are available for peak and off-peak hours, incentivising the use of electricity when it is cheapest and increasing utilisation rates overnight to further reduce additional operating costs that a significant subset of drivers could face in the future.

Section 4

Households reliant on public transport risk missing out on big savings

Reflecting the dominance of cars in household travel, some argue that replacing car journeys with those by bus or train is the way to bring down emissions. But such a 'modal shift' will only have a temporary effect as electrification means that, by the late 2030s, the emissions from average car and public transport journeys will be similar. There is also reason for thinking decarbonising public transport – which accounts for 1 per cent of UK emissions – should be easier to deliver, given the role Government plays in coordinating its provision – and so should proceed at pace.

But this does not mean public transport users – who are disproportionately on lower incomes – should miss out on the financial benefits of from decarbonisation. Around a quarter of adults don't have regular car access, rising to two-in-five in the lowest-income fifth of the population. A rise in the relative cost of public transport – through motoring getting cheaper – is undesirable in its own right as it further increases incentives to drive, making congestion even worse. But it should also be resisted on equity grounds: why should those reliant on public transport face higher costs than those who drive? Blanket subsidies are one way to address this problem. But these tend to be badly targeted (especially for trains), while the current ways of discounting public transport – through rail cards and concessionary bus passes – is not designed with distributional consequences in mind. As such, this section will explore how public transport's role in decarbonising travel could impact living standards, and how to ensure that financial savings from lower carbon travel could be more fairly distributed over the population.

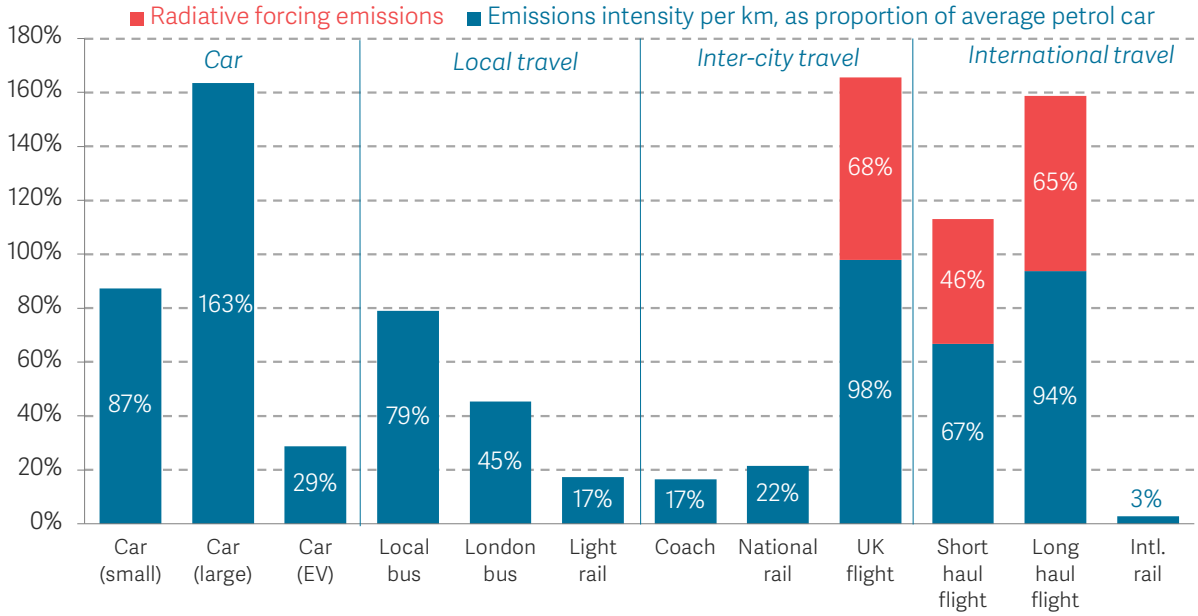
'Modal shift' could cut emissions, but only in the near term

There are those who argue that a shift to public transport should play a central role in the transition to net zero. Some point to so-called 'modal shift' – the substitution of cars

for trains and buses – as a key part of this.[62] Indeed, this was even part of the previous Government's thinking on transport decarbonisation and was part of the policy package recommended to the Government by the CCC in 2020.[63] And it is certainly the case that cars are more carbon intensive than most public transport alternatives – around five times so in the case of rail travel and coaches (Figure 16).[64] Shifting from a typical petrol car to a train saves 78 per cent of carbon emissions on a per-passenger-mile basis, and doing the same journey by coach would save 83 per cent of emissions. But in some cases the benefits are much smaller: a journey by local bus, for example, would save just 21 per cent of emissions from that in a car.

FIGURE 16: **Modal shift from cars to lower carbon modes can theoretically provide big carbon savings**

Emissions per mile by transport mode, as a proportion of an average petrol car: UK, 2024



NOTES: Radiative forcing emissions are additional emissions produced by aviation that are not related to the burning of fossil fuels, rather the radiative forcing impacts of aeroplane contrails. Local bus excludes London buses. Light rail includes trams and other non-bus public transport networks. Car (small) and car (large) refer to differing sizes of petrol cars, split by market segments defined by The Society of Motor Manufacturers & Traders (SMMT). Small cars are mini and supermini segments, standard size cars are lower medium and upper medium segments, and large cars are all other segments.
SOURCE: RF analysis of DESNZ, Greenhouse gas reporting conversion factors, 2024.

But carbon savings from modal shift will prove temporary. The uptake of EVs will rapidly reduce the average carbon intensity of driving over the 2020s and 2030s, cutting

62 For some examples see the following reports and papers: R Allen et al., Moving on: greener travel for the UK, Green Alliance, April 2023; Sustainable Transport Alliance, Accelerating modal shift: evidence on carbon savings and co-benefits, August 2023; G Marsden & T Schwanen, Planning to fail? How science can respond to reduced climate mitigation ambition, npj Sustainable Mobility and Transport 1 (2), May 2024; C Brand et al., Road to zero or road to nowhere? Disrupting transport and energy in a zero carbon world, Energy Policy 139, April 2020.

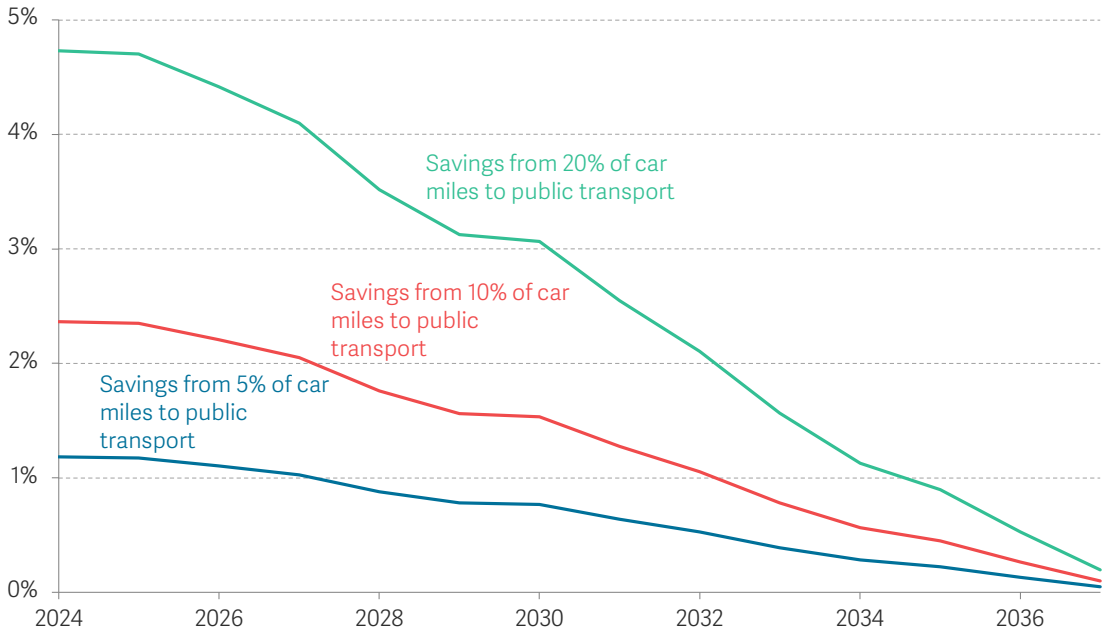
63 For example, the 2021 'Bus back better' strategy stated that "substantial modal shift away from the car will soon be needed if […] the Government's broader climate goals are to be met", while the in the CCC's Sixth Carbon budget, the CCC recommended that the Government "strengthen schemes to support […] public transport to reduce demand for higher carbon travel". See: Department for Transport, Bus Back Better, March 2021, and CCC, Sixth Carbon Budget, December 2020.

64 DESNZ, Greenhouse gas reporting: conversion factors 2024, July 2024.

gains that can be made by passengers switching to buses or trains. The Department for Transport estimates that up to 47 per cent of road miles will be driven by electric vehicles by 2030, while public transport decarbonisation isn't anticipated to get going in earnest until the 2030s and 2040s.[65] Taking these together means that the average carbon intensity of public transport is expected to be similar to that of car travel by the late 2030s. So, as shown in Figure 17, any carbon savings will be relatively short lived. This is true even if extreme levels of behaviour change are observed: shifting 20 per cent of car journeys onto public transport mitigates 5 per cent of transport emissions, but only if delivered now. This falls to 3 per cent in 2030 and to virtually nothing at all by the late 2030s. Delivering change on this scale is highly improbable, though, requiring a more than doubling of miles travelled by public transport – well beyond the reach of current infrastructure.[66]

FIGURE 17: **Shifting journeys from cars to public transport will only cut emissions in the short term**

Forecast share of 2019 transport emissions saved through modal shift: UK



NOTES: Assumes that the increase in public transport miles causes proportional increase in public transport emissions, that bus and rail travel increase by the same proportion, and that overall travel demand remains constant.
SOURCE: RF analysis of DfT, Greenhouse gas emissions by transport mode; DfT, Passenger miles on local bus services by metropolitan area status and country; Office of Road and Rail; Passenger kilometres by sector; DfT, Assumed levels of road traffic and percentage of road traffic from zero emission vehicles, in decarbonising transport upper and lower bound scenarios; DfT, Transport Analysis Guidance data book; CCC, Sixth Carbon Budget dataset; DfT, Average car or van occupancy by trip purpose; DfT, Road traffic (vehicle miles) by vehicle type in Great Britain.

65 DfT, Assumed levels of road traffic and percentage of road traffic from zero emission vehicles, in decarbonising transport upper and lower bound scenarios, January 2023; and CCC, Sixth Carbon Budget - Dataset, December 2021.

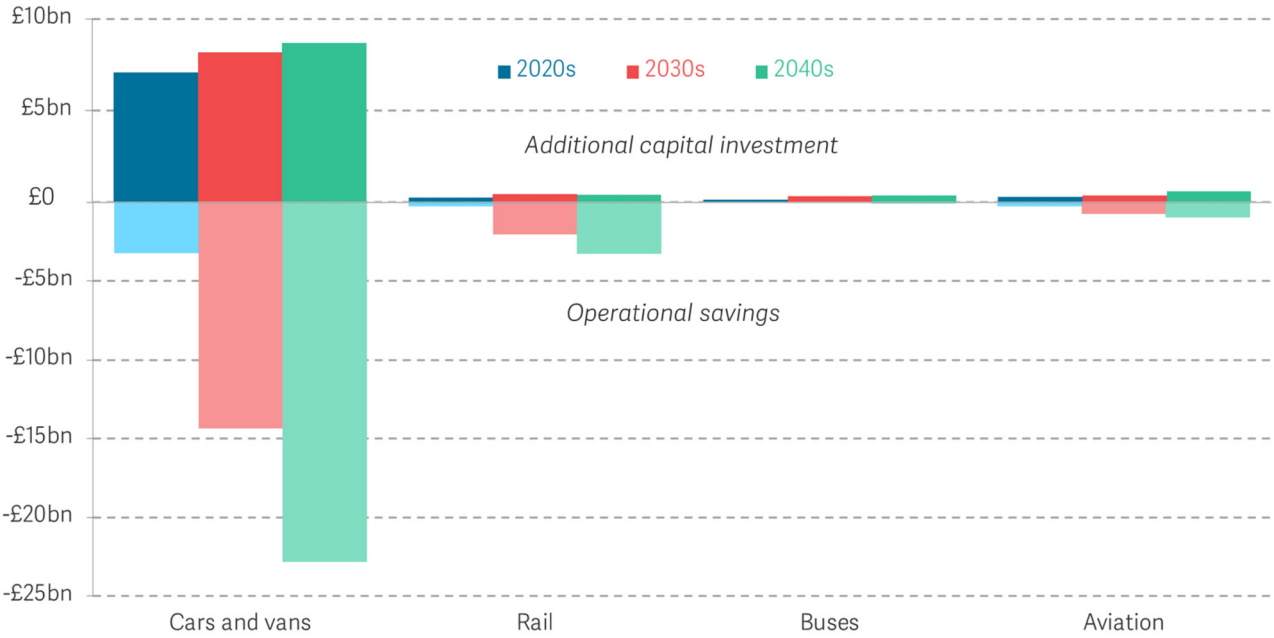
66 Levers to achieve this kind of change in just a few years are limited. It is infeasible to build major rail infrastructure in time – the Channel Tunnel took 8 years from approval to completion, HS1 11 years, Crossrail 14 years, and East West Rail, due to open next year, has been on the table since 1995. Improving bus connectivity is quicker than rail and makes use of existing infrastructure – roads – but as we've already seen, the carbon savings of modal shift onto buses would be limited if not accompanied by swift electrification. For more see: Global Infrastructure Hub, The Channel Tunnel, November 2020; National Audit Office, The completion and sale of High Speed 1, March 2012; National Audit Office, Crossrail, January 2014; East West Main Line Partnership, The Consortium, accessed 3 October 2024.

Decarbonising public transport is necessary, but this won't hugely shift the dial on emissions

Instead of modal shift, we could look to decarbonising public transport itself: electrifying rail track and replacing diesel buses with electric ones. But public transport only accounts for 3 per cent of transport emissions, or 1 per cent of the total across the UK.[67] And while the net zero target means that even small pots of emissions have to be mitigated eventually, change here will be much more focussed on companies instead of individuals, and will be much easier to coordinate given the Government's role in the provision of public transport.[68] The effects on companies will be familiar to them – bus and rail operators already make capital investments in vehicles and infrastructure that are covered by future fares, and are, therefore, better equipped than individuals to balance larger capital costs now and fuel savings later. Further, as Figure 18 shows, overall investment levels in public transport will also be much lower than that for cars and vans, which require more than 10 times the additional capital expenditure than buses and rail combined – and the savings will be smaller too.[69]

FIGURE 18: **Spending on decarbonising rail and buses will be a lot lower than that on cars and vans, but it also comes with smaller savings**

Forecast additional capital expenditure and operational savings resulting from transport decarbonisation, by mode and decade, UK



SOURCE: RF analysis of CCC, Sixth Carbon Budget dataset.

67 CCC, Sixth Carbon Budget - Dataset, December 2021.
68 See, for example, investments being made by companies in electrifying bus fleets: BusinessGreen, Go-Ahead revs up £500m investment in zero emission buses, accessed 9 October 2024.
69 CCC, Sixth Carbon Budget - Dataset, December 2021.

And while it may be reasonable to assume that investment will see costs passed through to fares, this is not necessarily the case. In the rail sector, operating savings should exceed capital investment by the 2030s, and while costs in the bus sector are expected to rise modestly – additional capital investment from decarbonisation will average £130 million over the 2020s, rising to £340 million over the 2040s, with negligible operational savings – the policy framework for managing impacts on consumers already exists.[70] For example, buses are currently regulated by a £2 fare cap, are subsidised through the Bus Service Operator Grant, and it is common for councils to subsidise routes that need support to continue operating: Cambridgeshire and Peterborough directly support 10 per cent of the most rural routes, for example.[71]

So there is a case for getting on with public transport decarbonisation, as it can make a small but valuable contribution to net zero without hurting public transport users. But importantly, it also won't create big savings.

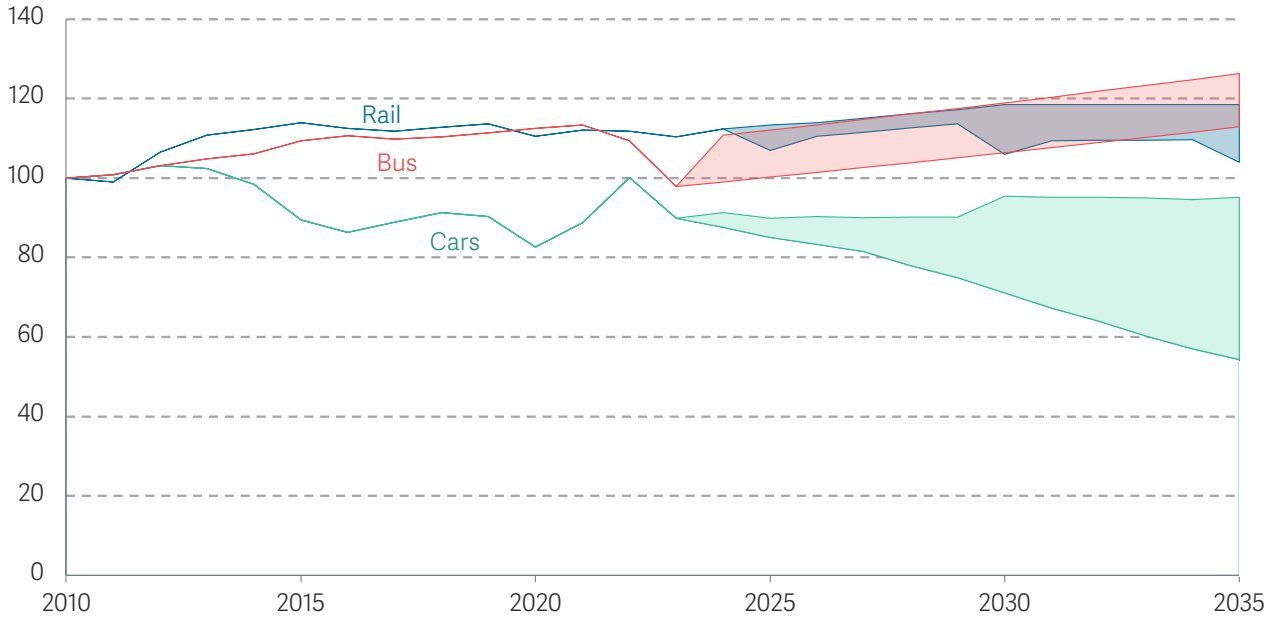
The real problem is that poorer households will miss out on the big savings from EVs

This does not mean public transport users – who are disproportionately on lower incomes – should miss out on the lower costs from zero-carbon transport. As Figure 19 shows, the cost of driving is set to decline substantially – by up to 61 per cent by 2050 – but bus and rail fares are anticipated to rise with inflation.[72] This means that a typical driver could bank savings of £1,400 per year, or 4.7 per cent of total household expenditure, while those without cars will miss out.[73]

70 These costs are expected to be manageable, representing around 5 per cent of bus operator revenue or 7 percent of Government spending on local transport. Source: RF analysis of DfT, Annual bus statistics: year ending March 2023, March 2024; CCC, Sixth Carbon Budget - Dataset, December 2021; and DfT, Public expenditure on transport by function, May 2024.
71 Cambridgeshire and Peterborough Combined Authority, Subsidised Bus Services, accessed 3 October 2024.
72 While the CCC estimates that there will be savings from electrification in the rail sector equivalent to around 14 per cent of current system costs, these will inevitably be eroded by inflation in other costs like wages and overheads that are big parts of public transport fares but don't exist for private transport: 82 per cent of the costs of running a bus company are labour and overheads, compared to just 18 per cent for maintenance and fuel. For more, see: CCC, Sixth Carbon Budget – dataset, December 2021; Confederation of Passenger Transport, Bus Industry Costs in Summer 2023, February 2024.
73 Source: RF analysis of ONS, Living Costs and Food Survey.

FIGURE 19: **The relative costs of driving and public transport are set to diverge**

Marginal real cost of car and public transport journeys: 2010 to 2050, UK, 2010=100

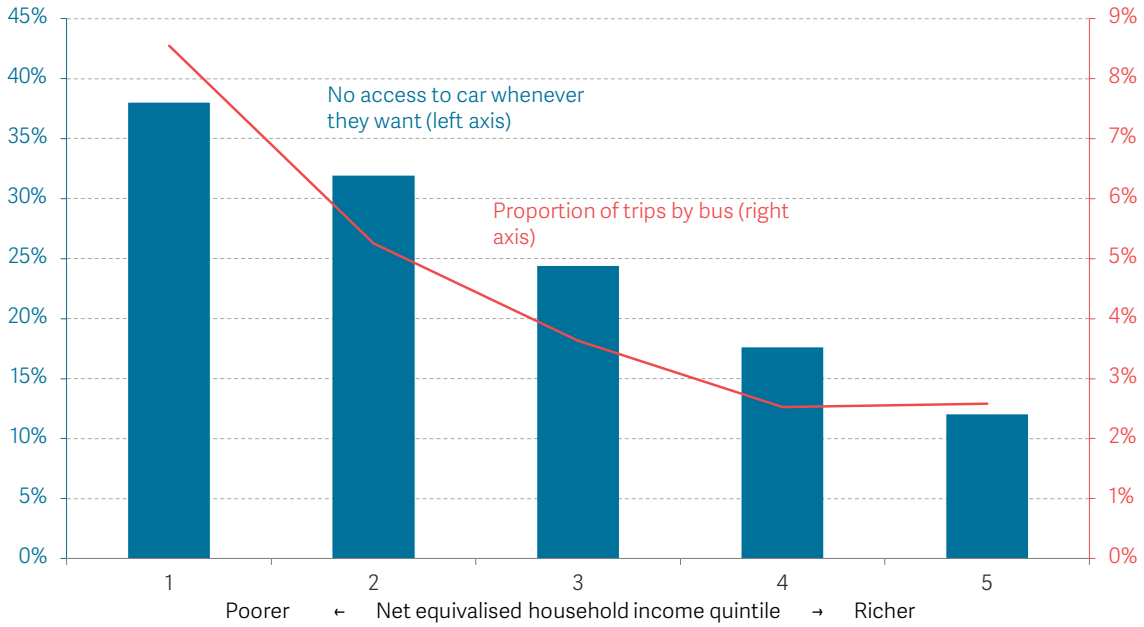


NOTES: Rail projections are of fare prices including scenarios of fare uprating by RPI with and without projected operational savings from rail electrification. Bus projections are of fare prices including scenarios of pre-Covid-19 trends with and without the £2 bus fare cap. Car projections are of marginal cost of driving (fuel and maintenance) with and without the rollout of EVs, road pricing of 6p per mile, high prevalence of expensive fast charging, and low electricity prices.
SOURCE: RF analysis of DfT, Transport Analysis Guidance data book; Office of Road and Rail, Rail ticket statistics; CCC, Sixth Carbon Budget data; DfT, Bus Price Index Statistics.

A rise in the relative cost of public transport compared with driving has two implications. First, it has distributional consequences. Around a quarter of adults do not have regular access to a car and so are dependent on public transport. But, as shown in Figure 20, this rises to two-in-five adults (38 per cent) in the lowest-income quintile. This group is much more dependent on public transport, using buses for 8 per cent of all journeys. In the top quintile just 12 per cent don't have regular car access and only 2 per cent of journeys are by bus – almost three quarters less in both cases.

FIGURE 20: **Those on lower incomes are less likely to own a car and more likely to take the bus**

Proportion of people in England with no access to a car whenever they want, and UK bus trips taken per person, by equivalised net household income quintiles: 2023



SOURCE: RF analysis of DfT, National Travel Survey and ISER, Understanding Society.

Second, a higher relative cost for public transport could also reduce its use, increasing road congestion and reducing the viability of public transport. This would carry costs for drivers and public transport users – as while driving tends to be a better experience when fewer people are doing it, as fewer drivers means less congestion, public transport tends to get worse when fewer people use it (see Box 3).

BOX 3: **A growing gulf between the cost of private and public transport could lead to clogged roads and higher fares**

A reduction in the resource cost of driving risks piling further pressure on the UK's already congested roads. And the externalities from congestion can be huge – the average social cost of congestion for one mile driven in the UK is 8.7 pence, a figure that increases to 55 pence for an A road in London.[74] DfT forecasts are wise to the implications of cheaper driving on journey times, anticipating an 85 per cent increase in the cost of congestion by 2050 as per-mile driving costs fall.[75] And because congestion is most acute in urban areas, where building density makes it much more difficult to expand the road network, there seems little scope to avoid increasing delays in

74 Even the UK average congestion externality is twice the private cost of vehicle fuel and maintenance; in London it is more than twelve times this cost. Source: DfT, Transport Analysis Guidance data book, May 2024.
75 Source: RF analysis of DfT, Transport Analysis Guidance data book, May 2024.

getting from A to B if the cost of driving gets significantly cheaper.[76]

Meanwhile, the logical consumer response to buses and trains getting more expensive relative to cars would be for people to use them less. Here, the issue is that the costs of running a public transport system are broadly fixed by the frequency and quality of services, not the number of passengers: whenever there are empty seats the marginal costs of taking one additional passenger is zero. So, smaller ridership will bring uncomfortable choices for the public transport network, and could mean a mixture of higher fares, less frequent – or worse – services and the need for bigger public subsidies. The first two of these options would leave the system worse for those dependent on it, while the latter would incur significant costs to the exchequer: when rail and bus ridership cratered during Covid-19, Government spending on railways and local transport rose from £8.4 billion in 2019 to £21.6 billion in 2021, largely to cover the costs of keeping services running with fewer paying passengers.[77]

So policy makers should look to options for making the cost of non-car travel cheaper.[78] One way of doing this would be to keep fares low with ever larger subsidies to public transport, but this has been tried elsewhere, without a substantial reduction in carbon emissions (see Box 4 for more information).

BOX 4: **Large subsidies increase public transport use but have had little impact on emissions**

One intervention that has been used to drive modal shift towards public transport is large-scale subsidisation. In the UK, public transport is already subsidised to the tune of £211 per person in 2019 (a figure that more than doubled during the pandemic).[79] Some countries have gone much further, however, subsidising it to the point where it is free, or almost free, at point of use, largely focussing on travel by rail. During the pandemic, Germany introduced a €9 (subsequently increased to €49) ticket that covered all regional rail journeys for a month. Tallinn (Estonia's capital) has introduced free public transport. And in the UK, ScotRail scrapped peak fares in 2022, offering substantial savings on top of existing subsidies for affected journeys.

76 A Corlett & J Marshall, Where the rubber hits the road: Reforming vehicle taxes, Resolution Foundation, June 2023.
77 DfT, Public expenditure on transport by function, May 2024.
78 Making car travel more expensive as a means of reducing price differences comes with both a political risk - France experienced widespread 'yellow vests' protests in response to fuel tax policies aimed at reducing driving – but would also only stop savings flowing to the better off, instead of specifically helping those reliant on public transport.
79 Source: RF analysis of ONS, Effects of taxes and benefits on household income, 2019.

None of these schemes have been very successful in reducing emissions. The main impact of the largest of these schemes, Germany's, was to increase overall public transport use without changing driving patterns, and therefore transport emissions: studies have shown only 10 to 20 per cent of those with a €9 ticket (around half of German adults made use of the scheme) decreased their use of private transport at all.[80] Instead, the main direct impact was to increase overall travel demand, driven by a 27 per cent increase in daily rail journeys.[81]

Even the most optimistic estimate of emissions reductions, which found the policy caused 1.8Mt of carbon savings, equated to just 1.2 per cent of German transport emissions in 2023.[82]

This result is similar in other places. ScotRail found no evidence that abandoning peak fares reduced emissions.[83] Free public transport in Tallinn increased the modal share of public transport by 14 per cent, but by reducing active travel (walking and cycling), so car use actually increased overall.[84]

Despite the main outcome of widespread rail subsidy being an increase in the overall distances travelled, there remain calls for a similar approach in the UK, if not to reduce emissions then to support poorer households with their travel bills.[85] But it should not be assumed that these subsidies will have progressive outcomes. Such demands miss the fact that poorer households travel by bus three times more often than they do so by train.[86] In fact, in 2019, rail subsidies were worth five-times as much to households in the top income quintile than the bottom quintile, while bus subsidies were worth 70 per cent more to the bottom income quintile than the top.[87] This reflects the tendency for poorer households to travel long distances much less frequently than richer households.

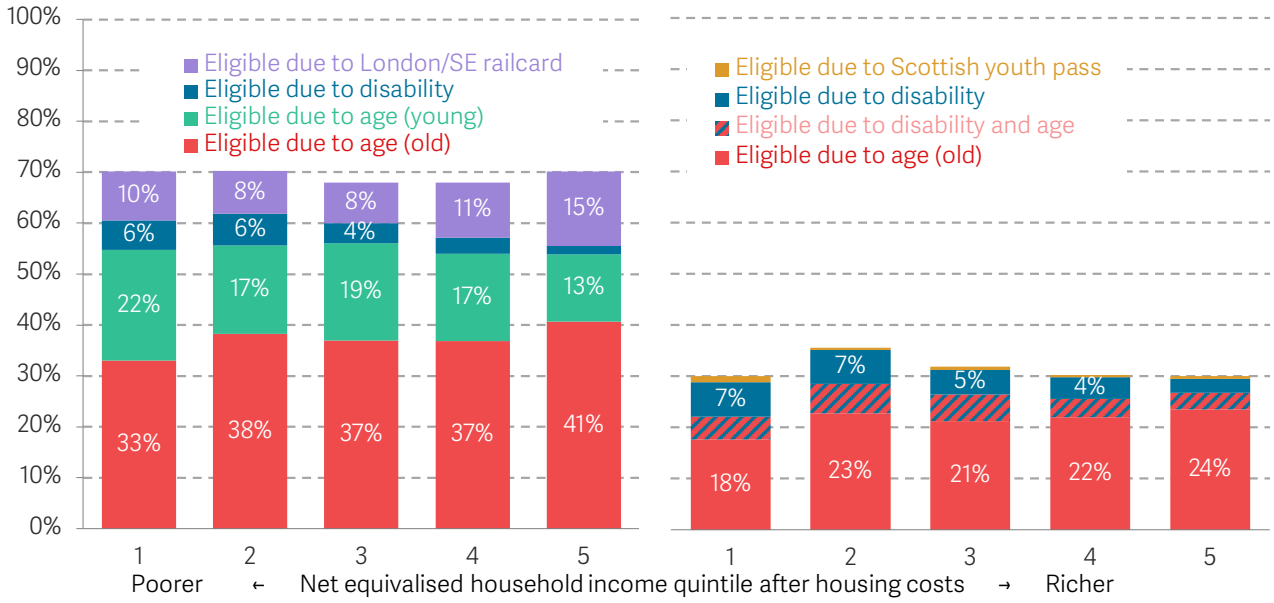
Instead, we should look to a more targeted approach. Currently, discounts for buses and rail are enjoyed by those of particular ages, with particular disabilities and, unusually, by region – but mainly for those travelling in London and the South East.[88] There are numerous good reasons for offering discounted travel, but it is notable that the current

80 Source: RF analysis of A Loder et al., Observing Germany's nationwide public transport fare policy experiment "9-Euro-Ticket" - Empirical findings from a panel study, Case Studies on Transport Policy Volume 15, March 2024; and A Loder et al., Germany's Newest Fare: The Deutschlandticket - First Insights on Funding and Travel Behavior, September 2023.
81 Telefonica, The Deutschlandticket results in significantly more commuter and weekend trips, accessed 3 October 2024.
82 World Economic Forum, Germany's €9 transit ticket cuts 1.8 million tonnes of CARBON, accessed 3 October 2024; and Ifeu, Current data from the Federal Environment Agency on greenhouse gas emissions from transport show a significant shortfall from the target in 2023, accessed 3 October 2024.
83 Transport Scotland, ScotRail Peak Fares Pilot - Interim Evaluation, June 2024.
84 G Prause & T Tuisk, Case study: Free public transport as instrument for energy savings and urban sustainable development - the case of the city of Tallinn, in M Tvaronavičienė & B Ślusarczyk, Energy Transformation Towards Sustainability, Elsevier, October 2019.
85 Greenpeace UK, Fare Britannia: a new approach to public transport ticketing for the UK, September 2024.
86 Source: RF analysis of DfT National Travel Survey data.
87 Source: RF analysis of ONS, Effects of taxes and benefits on household income, 2019.
88 Age-based railcards include the Senior Railcard, 16-25 & 26-30 Railcard, and the 'freedom pass' for buses – which only pensioners are eligible for in most of the UK, but that Scotland extends to under 22s. Those with various disabilities can also get free bus travel and a third off rail tickets. The Network Railcard is available to anyone but is only eligible for journeys in London and the South East.

system isn't effective in targeting support towards poorer households – the same proportion of people are eligible for a railcard or a concessionary bus fare in the top and bottom income quintiles, as Figure 21 shows.

FIGURE 21: **The rail and bus discount systems don't direct support towards lower income households**

Proportion of people in each income quintile eligible for a railcard, by eligibility type (left panel) and the proportion of people in each income eligible for a concessionary bus pass, by eligibility type (right panel): UK, 2022-23



NOTES: Where people are eligible for multiple railcards, they are classified first as being eligible due to age, then disability, then due to living in London or the South East. Older people are eligible for a bus concessionary pass from State Pension Age and a Railcard from 60. Young people are eligible for a Railcard from age 16-30 and in Scotland age 5-21. Eligibility criteria for disabled people differs between railcards and concessionary bus passes. The Network Railcard is eligible for off-peak travel within London and the South East regardless of residence, it is assumed only people who live in London and the South East use it. All railcards provide a third off train travel, and only the Network Railcard excludes on-peak travel. Income quintiles are net equivalised income after housing costs.
SOURCE: RF analysis of ISER, Understanding Society.

Ministers seeking to ensure that those reliant on public transport are not locked out from a significant upside of the net zero transition, therefore, could look to improve targeting of this system. This could involve an expansion of the current system or trying a completely new approach. Options to improve targeting towards those on lower incomes within the current system would be to extend Scotland's free bus travel for under 22s to the rest of the country, or deepen the discounts for the young and disabled people's railcards, groups which are disproportionately in lower income quintiles. New approaches may include linking discounts to receipt of social security benefits, as is done in Paris, where many poorer households receiving income supplements get much of their

train travel free.[89] The Government could even make discounts dependent on whether households have a car or not – using insurance data to determine eligibility – ensuring that support is explicitly targeted at those who do not drive.

So while the role of public transport in decarbonising is more to do with reallocation of savings than cutting carbon itself, we must be aware of its wider benefits. It is important to low-to-middle-income households and has various other benefits like reducing congestion, improving air and noise pollution, fostering growth and improving cities.[90] This means that a policy focus on a functioning and efficient public transport system – such as the new Government ambitions to reform rail and bus networks – will always be a valuable policy focus, even if they should not be expected to make big contributions to climate targets. Another form of travel where decarbonisation (or a lack thereof) will have big distributional impacts is flying – we turn to this area in the next section.

89 Île-de-France Mobilités, Solidarity Free Ticket, accessed 14 October 2024.
90 P Brandily et al., A tale of two cities (part 1): A plausible strategy for productivity growth in Birmingham and beyond, Resolution Foundation, September 2023 and P Brandily et al., A tale of two cities (part 2): A plausible strategy for productivity growth in Greater Manchester and beyond, Resolution Foundation, September 2023.

Section 5

Aviation's share of our carbon footprint is set to grow, so flyers need to pay their way

While there is a clear path to decarbonising cars and public transport, the same cannot be said for aviation. This means that, as road vehicles electrify, travel emissions will become increasingly synonymous with aviation emissions. While the global industry is committed to net zero in 2050, there is no one solution for this. Instead, a range of measures will be needed, likely including offsetting substantial remaining emissions through carbon removals in future. This section explores how policy might broadly support this progress, to ensure that aviation – largely driven by higher-income households – does its fair share in hitting the UK's climate targets.

We emphasise the potential role of clear, uniform carbon pricing. But we are currently far from this ideal, leading to the situation where a flight from the UK to New York may face a far lower carbon price per tonne than a flight to Spain, or indeed local travel via an electric car, bus or train. We therefore propose some specific ways in which the pricing of aviation's global warming impacts can be made more consistent and efficient, with actions that can be taken over the next few years.

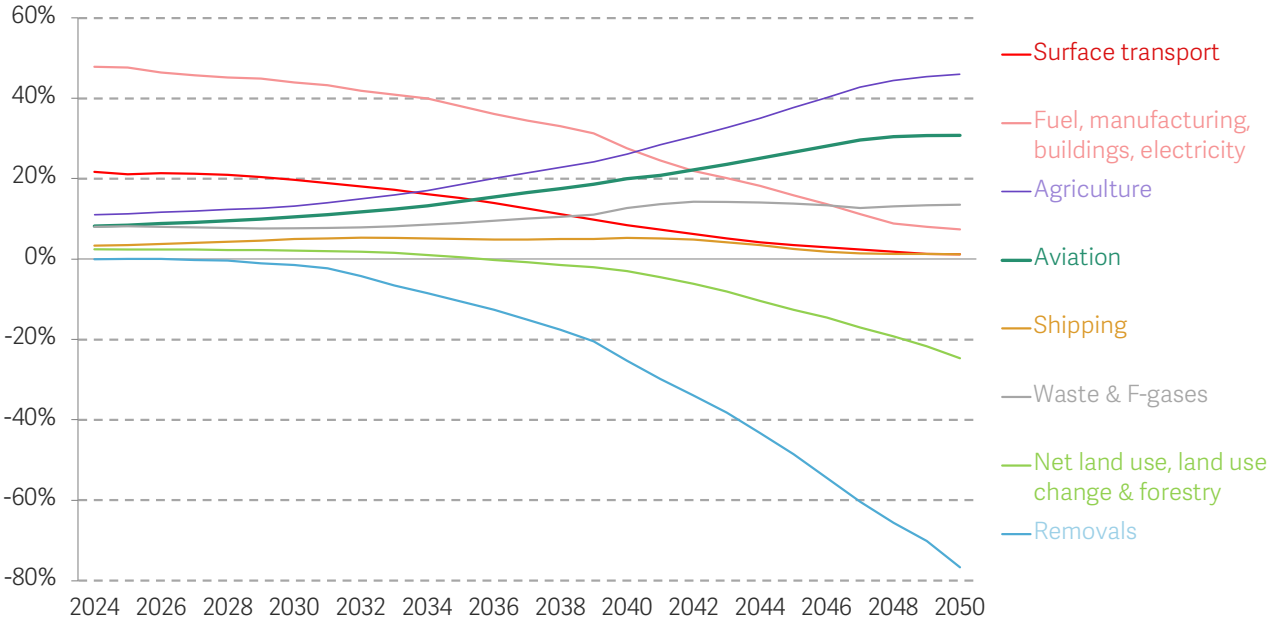
Emissions from flying will make up a growing share of the UK's global warming impact

While road transport currently makes up the clear majority of transport emissions (Figure 1), expectations of success in decarbonising road travel mean that transport emissions will become increasingly synonymous with aviation. As Figure 22 shows, aviation's emissions are projected to surpass those from surface transport by 2036.[91] And with other sectors like electricity and buildings decarbonising too, aviation is expected to become the biggest emitting sector except for agriculture. From a global perspective, the UK is the world's third-biggest aviation emitter, after only the US and China.[92]

91 These CCC aviation figures include outbound but not inbound international flights, in line with convention.
92 J Klenner et al., Domestic and international aviation emission inventories for the UNFCCC parties, Environmental Research Letters, April 2024.

FIGURE 22: **Emissions from flying will make up a growing share of the UK's greenhouse gas emissions**

Sectoral emissions as a share of gross total emissions: UK



NOTES: The gross total is the sum of the sectors excluding removals and LULUCF (land use, land use change and forestry). F-gases are fluorinated gases.
SOURCE: RF analysis of CCC, The Sixth Carbon Budget.

Aviation's climate impact is estimated to be much larger than headline carbon metrics suggest. Indeed, sectoral comparisons are based only on aviation's carbon emissions, but this is a significant underestimation of the industry's global warming impact. Additional 'non-CO2' forms of warming mean that aviation's climate impact is estimated to be three times greater than headline carbon metrics suggest.[93] Nitrogen oxides (NOx) have complicated indirect effects in the atmosphere – both warming and cooling – but the net impact is estimated to be additional warming. Meanwhile, the net impact of contrails (condensation trails) is likely to be even greater than aviation's CO2 emissions, as they can lead to clouds that help trap heat.[94]

Given these carbon and non-CO2 impacts, and expected progress in other sectors, then, aviation is likely to be increasingly central to climate policymaking as the UK tries to get net emissions to zero or below.

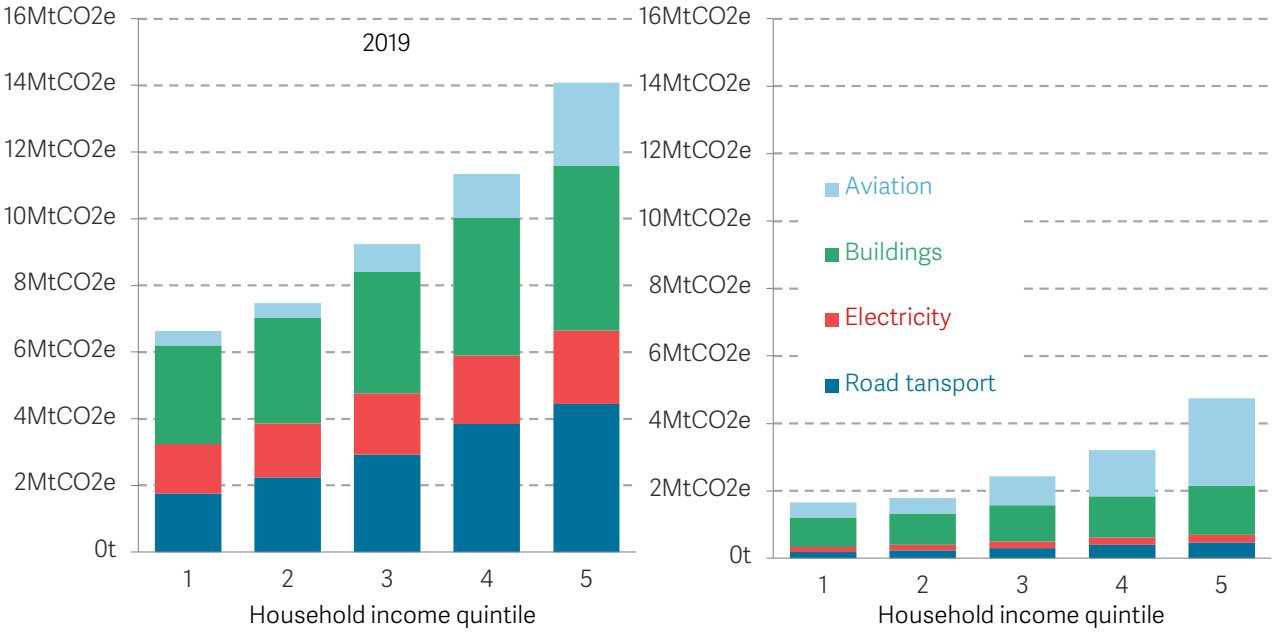
Just as with the country as a whole, aviation will form a growing share of households' carbon footprints. But whereas some impacts such as current electricity use can be spread relatively evenly across the population, flying is a sector where some households

93 D Lee et al., The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018, Atmospheric Environment, January 2021. Note that the relative importance of factors depends on timescales: contrails are relatively more important for medium-term warming and less important in the very long-term.
94 For a further introduction to contrail effects, see: E Gryspeerdt & J Fredenburgh, Clouds created by aircrafts have a bigger impact than the emissions they emit, Imperial College London, 30 November 2022.

will have much larger global-warming impacts than others. Figure 23 shows that aviation in 2019 was – on average – a smaller share of both richer and poorer households' emissions than those from road transport or energy consumed in the home. But by 2040, it will make up the majority of higher income households' easily-attributable carbon footprints (even ignoring non-CO2 effects): those in the highest-income quintile are expected to be emitting more greenhouse gases through flying than through road transport, electricity and heating combined. More than that, aviation emissions from higher-income households will exceed the poorest fifth's road transport, electricity, building and aviation emissions combined – so it would not be equitable to be ambitious in other sectors while giving aviation a free pass. This distribution is relevant as we move on to how policy should most fairly and efficiently deal with aviation's climate impacts.

FIGURE 23: **Aviation will be an increasingly large part of higher-income households' carbon footprints**

Annual household emissions from selected sectors in 2019 (left) and projected for 2040 (right), by equivalised after housing costs income quintiles: UK



NOTES: Sectors are included where emissions are relatively easy to attribute across UK households.
SOURCE: RF analysis of HMT Net Zero Review, CCC Sixth Carbon Budget data.

There are a range of ways to reduce aviation's impacts, or subsequently remove carbon, and carbon pricing seems the most appropriate tool

Before exploring how UK policy should ensure that aviation plays its appropriate role in reaching climate targets, it is worth briefly considering how aviation's emissions might physically be brought down.

The global aviation industry is committed to reaching sectoral net zero by 2050,[95] but there is not yet a dominant single solution. It might be ideal if radically different technology could be used in planes, mirroring the switch to electric road vehicles. Norway wants all of its short-haul flights to be electric by 2040, and the Environmental Audit Committee has called for a minimum number of within-UK routes to be all-electric by 2040.[96] Hybrid-electric planes are also an option.[97] But the prospects for these technologies to make major dents in overall aviation emissions are limited for now, and other technologies such as hydrogen- or ammonia-powered planes are even less developed.

Less radically, there is expected to be scope to reduce emissions simply through improved plane and engine design and operational changes such as flying slower – while warming contrails may be prevented by changing precisely where and when planes fly in specific circumstances.[98]

A lot of emphasis has been placed on 'Sustainable Aviation Fuel' (SAF), which can be used in existing engines (to varying degrees). These fuels substitute for fossil fuels but are produced either from waste, crops grown for that purpose, or synthetic processes that use renewable electricity to combine water and CO2 to produce liquid fuel. The UK Government has introduced a SAF mandate, starting at 2 per cent in 2025 and rising to 22 per cent by 2040 (including 3.5 per cent from synthetic 'power to liquid' fuel). But, beyond some engineering details, a crucial question is how cheaply such fuel can be produced at very large scales – particularly if we do not want to commit substantial areas of land around the world to growing aviation biofuel.

In the CCC's projections (from 2020), it is expected that aviation's emissions could be cut from 37Mt CO2e in 2024 to 23Mt CO2e in 2050. But the country will still need to have zero or negative emissions overall. Any residual emissions from aviation will therefore need to be counteracted by carbon removals. This is expected to mean engineered removals and storage through direct air capture (DAC) or bioenergy with carbon capture and storage (BECCS).

Finally, a key extra source of uncertainty and flexibility in aviation's future emissions is simply the number of flights. Ideally this would interact with how easy it turns out to be to reduce or offset emissions in other ways.

95 IATA, Our Commitment to Fly Net Zero by 2050, accessed September 2024.
96 House of Commons Environmental Audit Committee, Net zero and the UK aviation sector, December 2023.
97 New Atlas, Full-scale demonstrator paves the way for hybrid-electric airliner, 12 September 2024.
98 University of Cambridge, The 2030 Sustainable Aviation Goals: Five Years to Chart a New Future for Aviation, September 2024.

There is a strong case for aviation carbon pricing

We do not attempt to say what combination of these emission reductions options might be optimal. But the variety of margins of adjustment makes two things clear. First, there is (for now) no obvious silver bullet for reaching aviation net zero – unlike the dominant case for shifting to EVs. And second, there are trade-offs to be made in trying to deliver the necessary emission reductions as cost-effectively as possible. For example, would it be cheaper for planes to burn fossil fuels while offsetting that with DAC, or use DAC to make e-fuel? Would it be better for planes to take longer routes to avoid creating contrail warming, or to simply take the most fuel-efficient route? Would potential customers be happier paying to offset their full climate impact, fly slower, or simply not take that flight at all?

Such considerations, along with the fact that spending on flying is top-heavy relative to income and very heterogenous even within income groups, make a strong case for carbon pricing (including of non-CO2 impacts) to play a key role in UK aviation policy. That is not to say that other policies should play no role, but the traditional economist's argument for carbon pricing as an efficient solution applies; in this sector, there are no strong counter-arguments regarding distributional impacts or the case for much more straightforward regulation.[99]

The 'polluter pays' principle should therefore be a guiding star. Policy should be clear that aviation's global warming impacts will be priced, and that ultimately residual impacts will need to be offset through removals – and that this cost won't be borne by taxpayers or all households. On the other hand, though, such a principle should perhaps steer policymaking from blanket aviation tax increases that do not distinguish between different flights' and planes' increasingly varied footprints. Being clear now about aviation pricing helps provide certainty to the industry (and to the nascent removals sector). Given that planes may remain in use for 20 or 30 years, it is better for everyone if the basic principles of aviation climate policy for 2040 and 2050 are made clear far in advance.

Beyond the theoretical case for aviation carbon pricing, however, there is also the fact that we already have some imperfect systems that can be developed to do the job, but which need to made more efficient and fairer between different travellers.

99 A Bowen, The case for carbon pricing, The Grantham Research Institute on Climate Change and the Environment, December 2011.

Existing aviation price mechanisms are inconsistent across different flights

Appropriate, consistent pricing of the externalities of flying is a good guiding principle. But, before we set out some recommendations for moving in that direction, it is important to look briefly at the status quo of aviation carbon pricing and taxation.

On the tax side, aviation's tax treatment is unusual. VAT does not apply to (most) flights, by international convention, but instead Air Passenger Duty (APD) is applied to journeys departing from UK airports. And no fuel duties are applied to aviation fuel, again by international convention. Could these approaches be revisited to achieve climate goals in a fair and efficient manner?

We could look to end the practice of not charging VAT on flying. But this might best be done in conjunction with other nations, and it can be argued that APD stands in – very approximately – for VAT. More fundamentally, a VAT extension would not be targeted at global warming impacts specifically: different ticket prices would rise based on a large number of factors including the airline's pricing strategy, to what extent the ticket was pre-booked, whether passengers pre-purchase baggage add-ons, and so on. This means that some would pay more than others, and for reasons not linked to the impacts of their flight.

There is the possibility of amending APD. Using bands to set APD rates mean that the duty is far from proportionate to actual climate impacts (passengers flying from Liverpool to Athens pay the same rates as those flying to Dublin, despite Athens being 12 times further away). But introducing further bands would make the system rather inelegant and complicated for consumers and airlines, and it seems preferable to use actual carbon pricing (as we will come onto) while leaving APD with the role of a VAT stand-in. A 'frequent flyer levy' has often been suggested, but may not be administratively straightforward and again – more fundamentally – would not focus efficiently on the harms in question.

Applying some form of Fuel Duty is superficially attractive but this would not help with the pricing inequities that currently exist between different routes (see below) and indeed – given that it may only be legally feasible within Europe – may exacerbate the problem.[100]

Instead, the priority should be carbon-pricing reforms to focus on the key harm of flying, incentivise all forms of emission reductions, and remove unfair biases between different flights.

100 T&E, Jet Fuel Duty: How much revenue could have been raised for the UK Government if fuel duty was applied to jet fuel in 2023?, September 2024.

Current policy falls short of a consistent carbon price

The UK Emissions Trading Scheme (UK ETS) covers flights within the UK – and Gibraltar – and departures to the EEA and Switzerland – working side-by-side with the EU ETS. The carbon price in the UK scheme varies but is currently around £40 per tonne. Flights to and from most of the rest of the world are now covered by a separate – if sometimes overlapping – international system called CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation). This is still in its infancy, with a pilot phase having been completed, a first phase running from 2024 to 2026 and a second phase scheduled for 2027 to 2035. Two differences between CORSIA and the UK/EU ETS stand out:[101] first, it only requires offsets for marginal emissions above a generous baseline – 85 per cent of 2019 emissions; and second, the current carbon price is considerably lower (currently below £20).[102]

The gap between these systems means that a flight from the UK to destinations within European will generally face a far higher effective carbon price than longer-distance journeys. Essentially, different travellers and different routes are facing arbitrarily different tax treatment. This is shown in Figure 24, which also notes that non-CO2 impacts are currently un-priced in all systems, and that the Crown Dependencies and British Overseas Territories (excluding Gibraltar) currently come under neither the UK ETS nor CORSIA – as we discuss below.

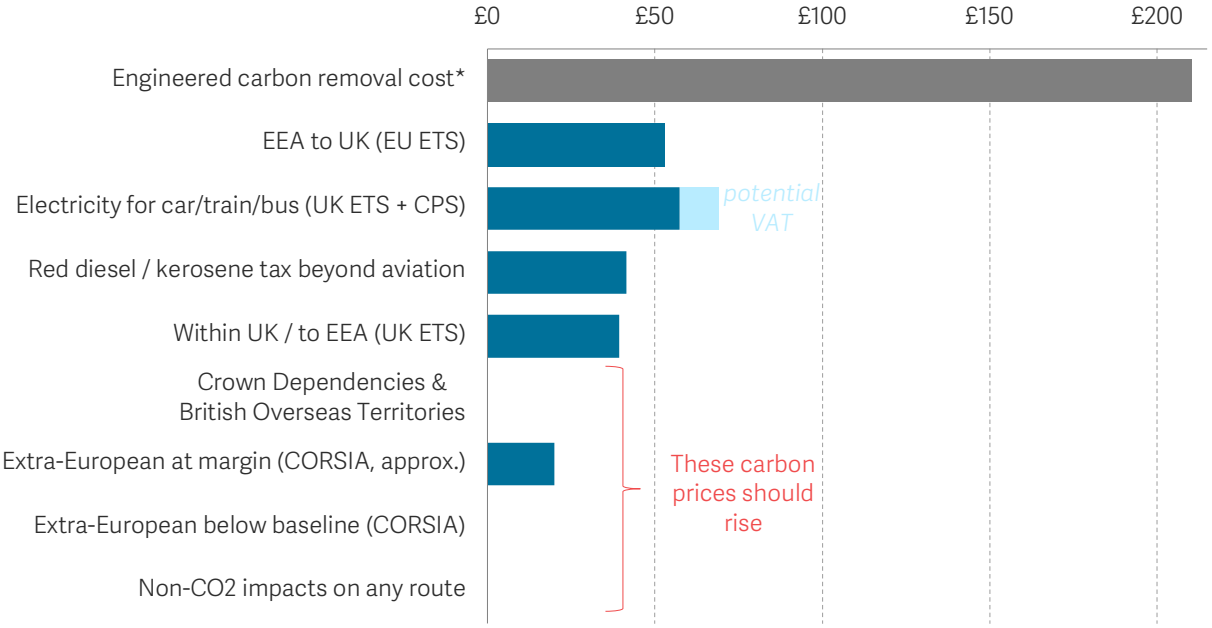
Insofar as gas is used to generate electricity for EVs, buses and trains, it is also notable that such surface transport will pay a carbon price through the UK ETS – and with an additional Carbon Price Support on top (plus VAT on these costs in the case of non-home EV charging). We therefore have a perverse system in which a local commute by EV, bus or train may face a carbon price of over £50 per tonne, a flight to Spain would pay £40 per tonne, and a flight to New York or Bermuda could pay nothing.

101 A third is that CORSIA has a higher registration threshold, so an operator can emit up to 10,000 tonnes of CO2 per year without taking part – compared to 1,000 in the UK/EU ETS. However, we do not explore this particular question of scope – nor the treatment of military flights – in this report.

102 The UK and EU ETS have had free allowance allocations for aviation, but these are being phased-out.

FIGURE 24: **Existing aviation carbon prices are very inconsistent**

Approximate carbon prices in 2024



NOTES: *Carbon removal cost based on Google's $280 contract. ETS and CORSIA market prices as of 21 September 2024. BOT excludes flights to Gibraltar, which are part of the UK/EU ETS. Electricity cost includes the Carbon Price Support, and would include VAT in the case of cars charged away from home. Fuel Duty rates excluding temporary 5p discount. CORSIA pricing applies only beyond a baseline of 85 per cent of 2019 emissions.
SOURCE: RF analysis.

Policy changes are needed to consistently and adequately price aviation's impacts

To deliver more consistent aviation carbon pricing, to ensure that Government and industry climate targets are met and to be fairer across flyers, policy change is needed. Three areas stand out, and these are not merely options for the long-term: the international policymaking environment implies that there can, and should, be decisions to make over the next few years.

Non-CO2 impacts should be priced

One important and potentially very near-term step would be to make progress with non-CO2 impacts. As mentioned above, these are very significant in scale, and it is estimated that the cost of slashing them is low, with perhaps only 2 per cent of flights accounting for 80 per cent of contrail impacts,[103] and an equivalent abatement cost of $5-25 or even less – e.g. by changing altitude at times.[104] Small changes to flights could potentially halve

103 R Teoh et al., Global aviation contrail climate effects from 2019 to 2021, Atmospheric Chemistry and Physics, May 2024.
104 Project Contrails, Google Research; A Frias et al., Feasibility of contrail avoidance in a commercial flight planning system: an operational analysis, Environmental Research: Infrastructure and Sustainability, March 2024.

contrail formation,[105] and this has been described as "the lowest hanging fruit of the aviation climate challenge and perhaps across the economy as a whole".[106]

In response, the EU is introducing monitoring and reporting requirements for these impacts from January 2025 (including for flights to the UK).[107] While the UK has recognised the problem of non-CO2 impacts,[108] it currently has no comparable plan. This should be rectified as soon as possible. Given that major airlines will be complying with the EU's requirements in any case, it should not be particularly onerous to mirror these for flights departing from the UK.

Going further, by the end of 2027, the European Commission is obliged to take stock and ("where appropriate and after having first carried out an impact assessment") set out proposals to expand the EU ETS to include non-CO2 aviation effects.[109] Again, the UK should move in step with these world-leading developments. It is true that the scientific estimation and practical monitoring of non-CO2 effects will no doubt develop further over time, but – given the available low-hanging fruit – pressing ahead with some form of pricing appears to be much preferable to open-ended inaction.

The ETS's aviation scope should be expanded to include the Crown Dependencies and British Overseas Territories

As noted earlier, the Crown Dependencies – Guernsey, Jersey and the Isle of Man – and British Overseas Territories (excluding Gibraltar) – such as the Cayman Islands and Bermuda – currently fall through a gap between carbon pricing systems. They are not included in CORSIA because they are considered to be domestic flights in that context. But they are also not included in the UK (and EU) ETS, despite the fact that their emissions are counted for the purpose of the UK's 'Nationally Determined Contribution' for 2030, which will require overall emissions to have fallen by at least 68 per cent compared to 1990. An obvious step, then, is for the UK ETS's aviation scope to be expanded to include flights between the UK and the Crown Dependencies and British Overseas Territories.

This would mean an alignment of treatment within Europe – so a flight from England to the Isle of Man would fall under the same system as a flight to Scotland, Ireland or Gibraltar. In other cases, this expansion might further highlight the differences between the ETS and CORSIA – with flights from the UK to the Cayman Islands facing stronger

105 Project Contrails, Google Research.
106 W Todts, Plane to see, Transport & Environment, May 2024.
107 There is a contested question of whether or not extra-European flights will be included.
108 DfT, Jet Zero strategy: delivering net zero aviation by 2050, July 2022.
109 EU, Directive (EU) 2023/958 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC as regards aviation's contribution to the Union's economy-wide emission reduction target and the appropriate implementation of a global market-based measure, accessed September 2024.

carbon pricing than flights from the UK to Jamaica, for example. ETS expansion should therefore not stop here, but it is a baby step that the UK can take without waiting for any broader international action.

Flights outside of Europe should be priced in the same way as those inside

More significantly, but less straightforwardly, the Government should also be more ambitious on carbon pricing for all international flights, beyond the existing UK and EU ETS arrangement. Flights to Turkey should not face a far lower carbon price per tonne than flights to Greece; flights to Canada should not face a far lower carbon price than flights to Spain, and so on.

Further progress might be possible through the global CORSIA framework, which is set to be reviewed every three years, including in 2025. However, past experience suggests this is unlikely to match the carbon pricing of the UK or EU ETS any time soon. It is not clear (yet) whether CORSIA will be strong enough to deliver the industry's net zero goals, or indeed help the UK hit its carbon budgets – which now include departing international flights (with some legislative change still needed to formalise this) – particularly given that CORSIA's offsets are likely to be in other countries and thus not contribute towards the UK's climate targets.[110]

The Government should therefore provide certainty that extra-European international departures will sooner or later face the same carbon price as within-Europe flights –and indeed broadly the same price as that facing electric cars, buses and trains.

Fortunately, there is the potential for this to be a bilateral rather than unilateral change. The EU will be reviewing its position on this topic before July 2026 and potentially expanding its ETS to extra-European flights from 2027 (with deductions available to avoid any double charging due to CORSIA).[111] International aviation policy is a complicated and contested issue, with some stakeholders favouring only co-ordinated global action such as CORSIA. But it is not reasonable to argue that the UK and EU cannot act here without global agreement, given that the goal is clearly one of equal treatment of different flights.

These are chunky policy changes but are needed to make sure flyers pay their way and the UK's climate goals are met

These are concrete steps that can be taken towards consistent aviation carbon pricing across different flights and different sources of warming. This approach would be fair across flyers and help achieve the necessary change as cost-effectively as possible.

110 By convention, aviation policies and accounting often only apply to departing flights so as to avoid double charging or double counting.

111 EU, Directive (EU) 2023/958 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC as regards aviation's contribution to the Union's economy-wide emission reduction target and the appropriate implementation of a global market-based measure, accessed September 2024.

Given the country's and the industry's net zero goal, the relevant carbon price should increasingly reflect the cost of greenhouse gas removals – and the UK ETS Authority has indicated that it would like to bring these within the ETS.[112] In this way, the Government can take the sector at its word – that net emissions in 2050 will be zero – and ensure that the costs will be fairly paid by the relevant polluters rather than all UK households.

Unlike with the electrification of cars, it seems very likely that the path to net zero will push up the cost of flying. But the scale of potential price change (and the impact of this on future demand) is hard to assess, given the huge range of factors – including the ease of contrail limitation, the cost of alternative fuels or other ways to reduce effective emissions, and the highly-uncertain cost of future carbon capture and storage.[113] With clear price incentives from government, we should of course hope that relatively inexpensive ways of reaching 'jet zero' can be found. But, if not, then prices will need to rise accordingly, rather than backsliding on climate targets or asking the taxpayer or other sectors to pay instead.

112 DESNZ, Integrating greenhouse gas removals in the UK Emissions Trading Scheme, May 2024.
113 To give one real-world indication of the potential cost of the latter, Google has ordered some future carbon removals at an effective cost of $280 per tonne: Google, Our first-of-its-kind direct air capture deal forges a path to lower costs, September 2024.

Section 6

Conclusion

The dominance of transport emissions in the UK's total carbon footprint means that policy makers can no longer accept the recent sluggish pace in decarbonisation. Decarbonising travel must be a key policy priority for the coming years, starting this Parliament. Travel is a core aspect of modern life, so changes here will affect almost everyone in the country. Policy must take into account how people travel, though, meaning that decarbonising transport is not a straightforward task.

Policy here must recognise that most travel is by car and that is not going to change. Things are complicated by the prevalence of spending on cars within household budgets – buying a car is one the largest expenses families face. Policies to incentivise the rapid take up of EVs have been in place for some time and these have helped to drive a step change in ownership with more than 1 million EVs on UK roads. But high costs to the public purse and the need to focus on supply, particularly the supply of smaller and more affordable cars, mean that a long-term subsidy is not the right approach at this point. At the same time, arbitrary and unfair tax breaks have outlived universal subsidies. These should be removed, but done so in a way that is reflective of uncertainty surrounding whether the sale of EVs is sufficient to meet short-term mandate targets. Announcing their expiry a few years ahead of time will help to bring forward demand to the near term. We must also remain firm on targets under the mandate, avoiding the temptation to ease them, for it is these that will drive the sale of cheaper vehicles that will, in time, present themselves as affordable options in the used car market.

But a fair approach to decarbonising transport also requires that low-cost charging is available to all owners of EVs. But this is not currently the case. Lower-income drivers will be much more reliant on the public-charging network than their richer counterparts, and as such it is good that not only is infrastructure improving, the parts of the system they will be most reliant on is surging and is doing so in the right places. As such, instead of provision we need to focus on the large – and growing – price disparity between charging cars at home and at chargers in the public realm. Competition is key here, and there are worrying signs that local monopolies are developing. If these issues are not ironed out as the network grows, ministers will be required to intervene on prices.

Many Brits, however, do not or cannot drive, so risk missing out on the considerable financial upside from decarbonising transport. The cost of driving is set to plummet in the future, while the cost of public transport will likely increase. These developments risk reducing public transport use and increase the problem of congestion on our roads. We currently subsidise public transport for a number of worthy reasons, but these do not account for distributional outcomes. This may well need to change in the future, and policy makers could look to expanding the concessionary fare system – perhaps linking to welfare eligibility, or even to car ownership – to ensure that the savings from clean transport are not enjoyed by drivers alone.

Finally, while flying represents a small share of emissions today, the decarbonisation of the rest of the economy means it will become a key source of emissions in the future. Not everyone flies though, so it is important that the externalities of flying are not socialised. There are many approaches to properly taxing flying, but one based on emissions (including non-CO2 impacts) has the most merit. Here the UK has the opportunity to be bold, pushing further than sluggish progress on the international stage, and ensuring flyers are responsible for the cost of emissions from flying both now and in the future.

Annex 1

Data citations

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For more information on this report, contact:

Jonathan Marshall
Principal Economist
Jonathan.Marshall@resolutionfoundation.org

Resolution Foundation

2 Queen Anne's Gate
London SW1H 9AA

Charity Number: 1114839

@resfoundation
resolutionfoundation.org/publications