



Fair Transition Unit

A SMOOTH RIDE

**ELECTRIC BUSES AND THE ROUTE
TO A FAIRER TRANSPORT SYSTEM**

**Stephen Frost,
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and Lesley Rankin**

June 2023

ABOUT IPPR'S FAIR TRANSITION UNIT

IPPR's Fair Transition Unit (FTU) was established in June 2022 as a new landmark initiative to carry forward the work of IPPR's cross-party Environmental Justice Commission and award-winning work on environmental breakdown.

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The Environmental Justice Commission drew on views and recommendations from citizens from across the country in a way that has genuinely shaped policy thinking and had tangible policy and media impact. Building on this legacy, the FTU puts the public at the heart of its work through extensive public deliberation.

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SUMMARY

Buses play a crucial role in the lives of people in England. From the daily commute and trip to school or university, to shopping or a visit to see family and friends; buses connect many of us with the things we need and care about. A good local bus service can be the difference between isolation and the ability to live a good quality of life.

Despite years of declining ridership, the social significance of buses remains high, and the public see them as a vital part of an effective, clean, and fair transport system. The public are clear that we must tackle the failures that contributed to the bus's decline while supporting a rapid shift in how buses are powered.

In this report, we show what it would mean to truly 'level up' the bus network and bring all of England's metropolitan areas up to the same per head level of provision as London. Action to address regional inequality in access to local public transport must go hand in hand with a faster decarbonisation of bus fleets across our urban areas – improving air quality and visibly demonstrating on streets across the country the government's commitment to addressing the climate crisis.

Buses have a crucial role to play in the UK's path to net zero. The UK government's existing transport decarbonisation plan fails to deliver the rapid and deep emissions reductions needed to keep 1.5 degrees of global warming in reach and does not grasp the opportunities that would come from prioritising widespread behaviour change. High quality local public transport – integrated with improved walking and cycling routes, community transport, and shared mobility schemes – is crucial in tackling the climate crisis and will support many more people to live a good life without feeling they need to use a car.

The decisions and investment made by the next UK government will either support a rapid renaissance for local buses or see more bus services lost across England. The latter would have serious negative consequences for both people's lives and the UK's ability to reach net zero. The UK's political parties must go into the next election able to present the country with their vision for a 'levelled up' and world-leading local public transport system – and make clear how they will deliver it by 2030 if we're to keep our climate goals in reach.

KEY FINDINGS

- 'Levelling up' public transport will deliver a wide range of economic, social, and environmental benefits. Our modelling shows that a scale up in bus services in metropolitan areas in England to match the per head level of provision in London would result in:
 - a total increase of 2.7 billion bus journeys a year and require 5,800 extra buses across mayoral combined authorities by 2030
 - an equivalent of over 900,000 cars taken off the road by 2030
 - a total reduction of 12 per cent in car miles just from increasing bus services in mayoral combined authorities compared to the Department for Transport's (DfT's) core transport projections for 2030
 - emissions reductions from cars and buses of 18 per cent between now and 2030, or 9.4MtCO₂e, compared to DfT's core transport projections.

- The distance travelled by bus has been declining for over 70 years and more than 4,000 services have been lost in England in the last decade. The impact of this has been felt most keenly outside of London and the South East.
- Local leaders and operators have the ambition to decarbonise bus fleets at pace – the main barrier to a faster transition is the extent of government leadership on this issue, particularly willingness to provide the appropriate funding to local transport authorities to meet this challenge and allow for the most efficient rollout.
- The future of zero emissions buses is electric, with hydrogen buses only having a small role to play within the UK’s bus fleet. Current government progress to decarbonise bus fleets is too slow, as of May 2023 in England only 87 zero emission buses were in use outside of London, and at the current pace we will not have a zero emission fleet until 2060.
- Bus service improvement plans and enhanced partnerships have been an important step in delivering a more coordinated local bus service but franchising is the best approach to delivering a bus network that works for everyone in metropolitan areas.

KEY RECOMMENDATIONS

- As a matter of urgency, the UK government must **set out a more ambitious transport decarbonisation plan** which emphasises rapid reductions in transport demand and encourages greater shifts to public transport and active travel. Central to this plan should be the vision to **deliver a world-leading local public transport system at the heart of a fairer, cleaner transport system**.
- UK government should **set the phase-out of new diesel bus sales to 2030** and **make clear that the default choice of technology for buses is electric**, not hydrogen. Operators should ensure that, from today, no new ICE bus is bought for use in urban areas.
- **Every mayoral combined authority in England should set targets to have both a larger and a net zero bus fleet by 2030** and **pursue a franchising model for local bus networks**.
- The UK government should back the ambition of local leaders by **extending the funding of zero emission bus regional areas (ZEBRAs) by £2.5 billion between 2023–30**. Funding should not be allocated through a competition-based model but through single pot funding.
- **All local authorities within mayoral combined authorities should set out plans to reallocate road space to buses and active travel**. These plans should be explicit about reducing the number of journeys made by cars and increasing mode share for public transport, walking, wheeling, and cycling.

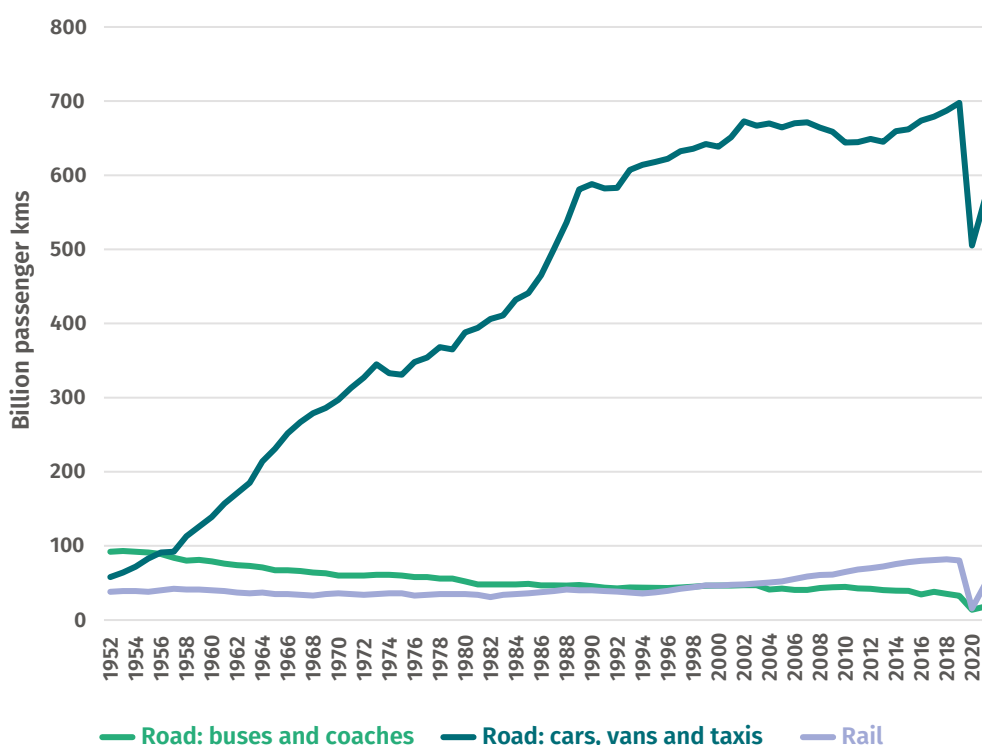
1. THE ROLE OF BUSES IN PEOPLE'S LIVES AND THE UK'S PATH TO NET ZERO

THE NEED TO REVIVE THE BUS NETWORK

People across the UK depend on local bus services. Despite the slow recovery of bus patronage since the height of the pandemic, more than two billion journeys were taken by bus in the year ending March 2022 (DfT 2023a). Young people use the bus more than any other age group, women make more bus journeys than men, people with a disability are more likely to travel by bus than those without, and those on the lowest incomes use it more than those on higher incomes – at least in part as they are the least likely to own a car (Vine and White 2020 and UTG 2023). Across IPPR's work we have argued that buses are vital to social inclusion (IPPR 2021).

FIGURE 1.1: PASSENGER MILES BY BUSES AND COACHES WERE OVERTAKEN BY CARS IN 1955 AND BY RAIL IN 2002

Passenger kilometres (billions) travelled by select transport mode, annual from 1952 to 2021



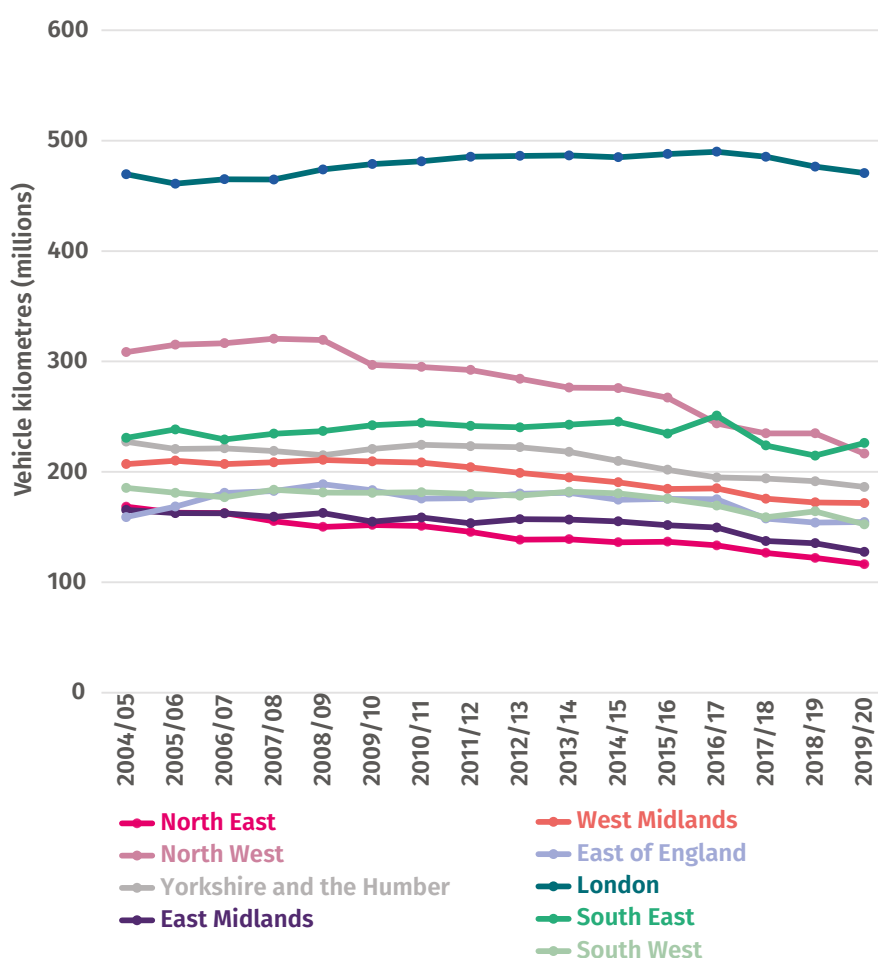
Source: Author's analysis of DfT 2023b

Despite the importance of buses to many, it is not since 1955 that buses and coaches have been responsible for more passenger miles travelled in the UK than cars, vans, and taxis (figure 1.1). Although London and the South East have

maintained a relatively stable level of bus service throughout the 2000s, every other English region has seen a decline in the number of miles travelled by buses between 2004/05 and 2019/20 (figure 1.2). The North East and North West have seen the most significant decline in this time period, with the miles travelled by buses dropping by almost 30 per cent in each region. After 70 years of declining patronage, the impact of Covid-19 has been dramatic and contributed to the loss of over a quarter (27 per cent, representing over 4,800 services) of bus services in England between 2012 and 2021 (CBT 2022a).

FIGURE 1.2: THE DISTANCE TRAVELLED BY BUSES IN ENGLAND HAS DECLINED MOST STEEPLY IN THE NORTH EAST AND NORTH WEST

Vehicle kilometres travelled by local buses, annual from 2004/05 to 2019/20



Source: Author’s analysis of BUS02b (DfT 2023c)

BUS DRIVERS’ VIEWS ON THE SOCIAL VALUE OF BUSES¹

Bus drivers told us that buses are crucial for people’s mobility: “It’s the difference between getting out and about and staying in the house, it’s as simple as that. The bus network is woven into whole fabric of Glasgow”, and “people are relying on the bus to take them to where they need to be – family, friends, work, doctor’s appointment.”

¹ The IPPR team spoke to six bus drivers in one-to-one, one-hour, semi-structured interviews in January 2023, held over Zoom. Throughout this report we feature their views on the role and future of local buses.

One bus driver spoke about the role they play in communities with limited access to cars or other forms of public transport:

“[Buses are] very important to the local community, not everyone drives or lives near a train station. If we’re not there they’re walking it or having to get a taxi. A lot of areas where there’s not a lot of money, people haven’t got money for a car.”

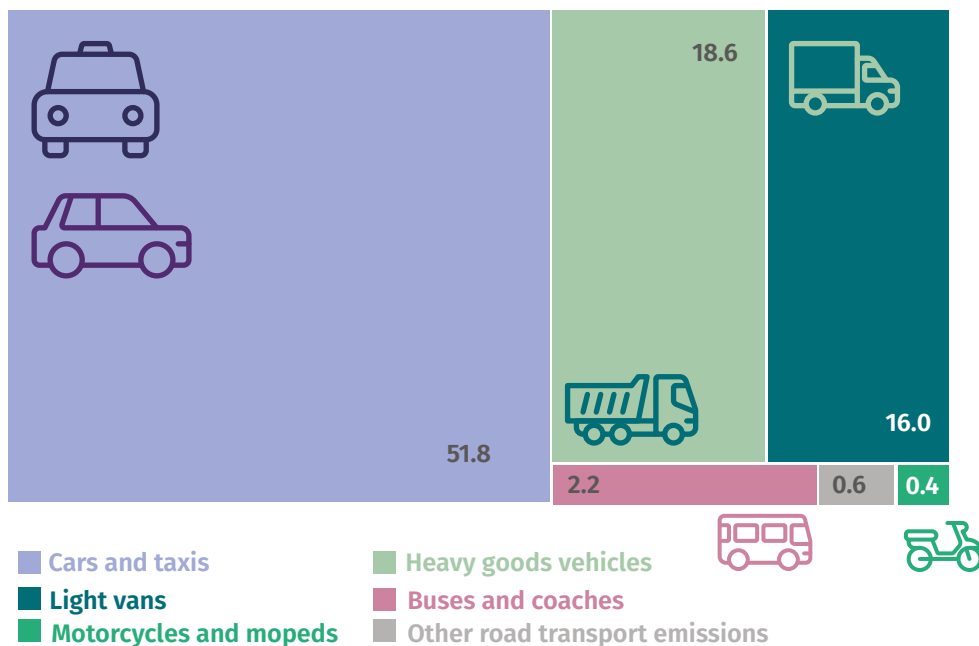
Getting people out of their cars and on to buses is one of the central transport policy challenges for the UK. There are signs that both the Conservative and Labour parties understand this. The national bus strategy details the Conservative government’s ambition to grow bus patronage and mode share from pre-pandemic levels (DfT 2021a) and they have set a levelling up mission to ensure that “by 2030, local public transport connectivity across the country will be significantly closer to the standards of London” (DLUHC 2022). Meanwhile, Labour’s emerging policy platform for the next election manifesto includes commitments to address regional imbalances as part of a just transition and to reform the ‘broken’ bus system (Belger et al 2023).

BUSES WILL PLAY A DECISIVE ROLE IN ACHIEVING NET ZERO

Rapid decarbonisation of transport is essential in reaching net zero by 2050. Since 2016, transport has been the UK’s largest emitting sector for greenhouse gases and in 2020 road transport accounted for 91 per cent of domestic transport emissions (DfT 2022a). The biggest contributor to surface transport emissions are cars and taxis: 52 per cent in 2020 (and 61 per cent in 2019) (see figure 1.3). On average across English regions, one-third (33 per cent) of the emissions within the scope of local authorities to influence were from transport (see figure 1.4).

FIGURE 1.3: CARS AND TAXIS ACCOUNT FOR OVER HALF OF ALL EMISSIONS FROM ROAD TRANSPORT IN THE UK

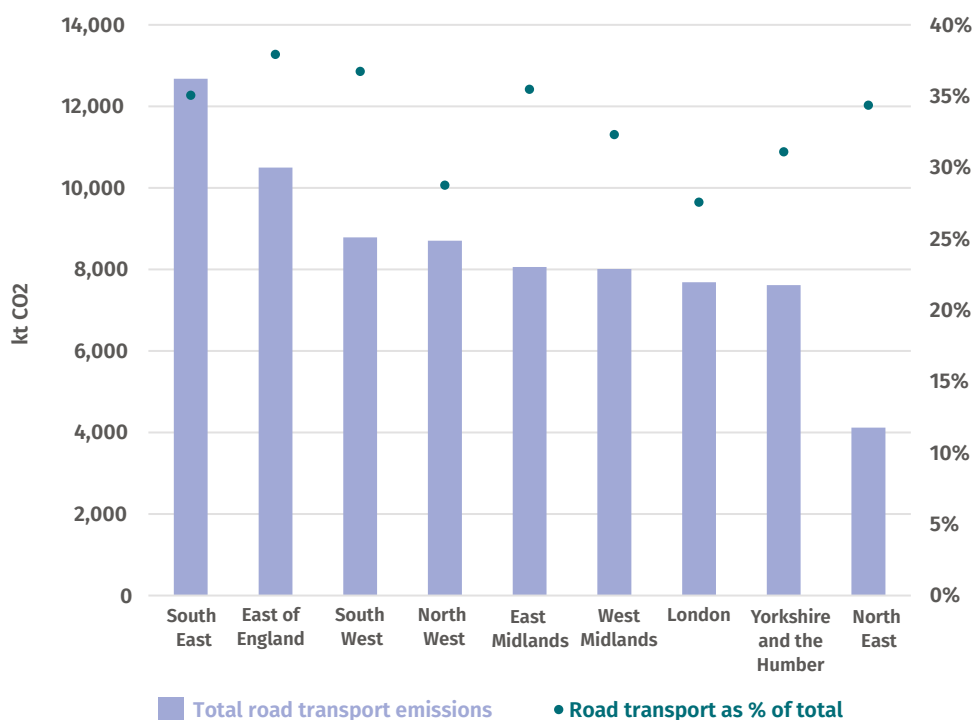
Tonnes (millions) of carbon dioxide equivalent emissions from road transport in 2020



Source: Authors’ analysis of DfT 2022a

FIGURE 1.4: ONE-THIRD OF THE EMISSIONS WITHIN THE SCOPE OF LOCAL AUTHORITIES TO INFLUENCE ARE FROM ROAD TRANSPORT

Carbon dioxide emissions defined as being within the scope of local authorities to control that are from road transport and the percentage of total emissions within their control it represents across English regions (2019)



Source: Authors' analysis of DfT 2022a

Electrification of private cars will be key in reducing emissions from transport but to stay on track to reach net zero the UK must reduce the distance travelled by cars by at least 20 per cent by 2030 (Allen et al 2023). The UK's existing transport decarbonisation plan fails to acknowledge the scale of behaviour change required in the 2020s and does not provide a clear vision on how decarbonisation efforts can be aligned with creating a fairer transport system (Frost et al 2022). As detailed in our previous research, achieving this requires an overhaul of how transport decision making works and a ramping up of investment in providing cleaner transport options.

Alongside promoting active travel, community transport and shared mobility the UK must create the foundations of a world-leading and affordable local public transport system by 2030 (Frost et al 2021; IPPR 2021). Electrifying buses is important, but they are already the most space and carbon efficient form of road transport and the core role of buses in the race to net zero will come from mode shift to them from private cars (Walker et al 2020).

Evaluating government progress to date

The government has made some progress towards its target of 4,000 zero emission buses by 2025 (CCC 2022). Government funding (see table 1.1) will see approximately 1,500 green buses delivered across England in the next few years, with an additional 600 in devolved administrations and 300 in London.²

² This includes 1,278 zero emission buses to be delivered under the ZEBRA scheme, 100 that have already been funded (DfT 2022b) and 130 that have been ordered due to the government's All Electric Bus Town competition (WMCA 2022a).

In Northern Ireland in particular, substantial progress has been made on decarbonising the bus fleet with just under £100 million being invested into the publicly owned bus and rail services company Translink for the procurement of 140 electric buses (DfI 2022).

TABLE 1.1: MAJOR FUNDING FOR BUS DECARBONISATION FROM NATIONAL GOVERNMENT AND DEVOLVED ADMINISTRATIONS

Government funding for bus decarbonisation by amount and purpose

Policy	Funding amount	Purpose
Bus Service Improvement Plan (BSIP) funding	£1.08 billion (from £3 billion originally promised)	To improve local bus provision by increasing frequency, affordability, and reliability of services. While funding was not for purchase of ZEBs, BSIPs had to set out plans for their inclusion.
Transforming Cities Fund (TCF)	£2.45 billion	Transport fund given to England's largest city regions to invest in public and sustainable transport infrastructure including bus service improvements.
City Region Sustainable Transport Settlements (CRSTS)	£5.7 billion over five years	Investment for eight mayoral combined authorities to improve their local transport networks.
Zero Emission Bus Regional Areas scheme (ZEBRA)	£270 million across two rounds and additional funding of £25 million to four councils	Grant funding for up to 75 per cent of the additional cost of a ZEB above the cost of a diesel bus.
All Electric Bus City Fund	£50 million for one city	Funding for up to 300 electric buses in Coventry to make it the first all-electric bus city.
Scottish Zero Emission Bus Scheme (ScotZEB)	£62 million for 276 electric buses in phase 1 and £58 million in phase 2	Capital grants to bus operators (replacing the previous SULEB scheme) for zero emission buses with 137 to be assembled at the Alexander Dennis manufacturing plant in Falkirk. Phase 2 will open in Spring 2023.
Bus Service Operators Grant	£188 million in 2021–22 to bus operators to recover fuel costs	A grant to operators and local councils to recover a proportion of fuel costs, including £24 million in 2021–22 to non-zero emission buses among operators.

Sources: Transport Scotland 2023; CBT 2022b; DfT 2023d; DfT 2022c; DfT 2022d; DfT 2022e; DfT 2022f; DfT 2021b

However, to ensure the target is met, between now and 2025, the pace of deployment will need to ramp up substantially. Despite government estimates of over 3,400 zero emission buses having been ordered or funded (DfT 2023e), as of May 2023 in England only 87 zero emission buses were in use outside of London (PA 2023). Government targets and the pace of delivery will also need to ramp up beyond 2025. With approximately 38,000 buses operating in the UK and approximately 1,000 zero emission buses replacing them each year, we will not have a zero emission fleet until 2060.

“we will not have a zero emission fleet until 2060”

BUS DRIVERS' VIEWS ON THE NEED FOR CLIMATE ACTION

“It’s causing havoc, someone somewhere just has to say enough’s enough. Know what I mean?”

All the bus drivers we interviewed were agreed on the need for fast and wide-ranging climate action: “the planet’s going wrong, we need to fix it.” There were significant concerns for children, grandchildren, and future generations: “if we want this planet to be here in hundreds of years, we need to do something now”.

Drivers were proud of driving ‘green’ buses and being part of the solution, mentioning the ‘personal satisfaction’ in their job of reducing the impact on the environment, as well as getting people from ‘a to b’: “I think it’s the future personally.” The drivers noted the improvements to public health offered by electric and hydrogen buses, mentioning reduced inhalation of fumes for drivers and people in the city centre: “from a health point of view, it’s 100 per cent better”.

Drivers were frustrated that the shift to zero emission vehicles isn’t happening faster, given the urgency of the climate crisis: “it’s about changing mindsets to see we’re on the cusp of a catastrophic situation, if we’re not already in one”.

“from a health point of view, it’s 100 per cent better”

IMPROVING PUBLIC TRANSPORT IS POPULAR AND SEEN AS CRUCIAL TO A FAIR TRANSITION FOR TRANSPORT

There is widespread public support for rapid and transformative action to improve local public transport.

Through IPPR’s public deliberative events in England, Wales, and Scotland we have heard how improving public transport is seen as integral for fair transition to net zero, levelling up and improving quality of

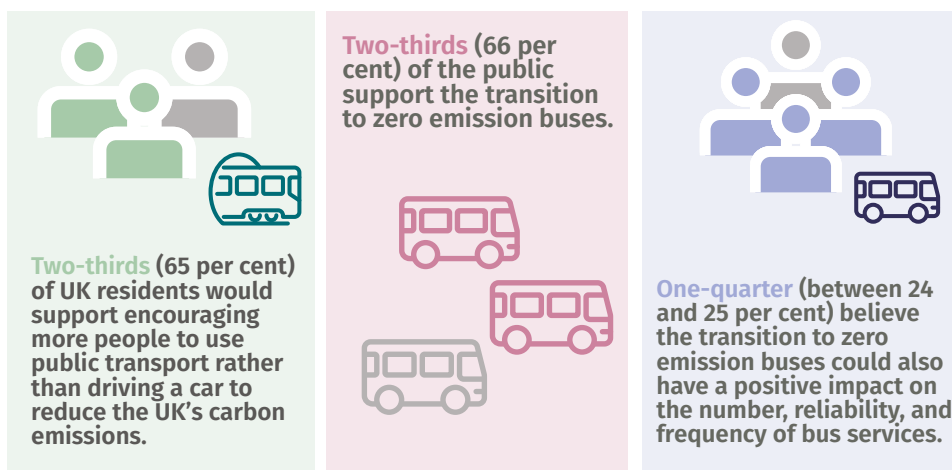
life in communities across the UK (IPPR 2021; Frost et al 2021; IPPR and the Cambridgeshire Fens Climate Panel 2021; Webb et al 2022; Mort et al 2022). In Glasgow, urban residents living on low incomes told us: “If you can get a good public transport system you can have winners. If you don’t, we’re losers” (Massey-Chase et al 2022).

Other large scale deliberative process, including Climate Assembly UK and Scotland’s Climate Assembly), all say the same thing – that the public demand action to make public transport more accessible, reliable, and affordable as part of achieving net zero and that public support for other action to change travel behaviours, such as those that restrict car use, is contingent on this (Frost et al 2021).

The level of public support for encouraging mode shift to buses, and the transition to zero emission buses, is backed up through recent opinion polls. Two-thirds (65 per cent) of UK residents would support encouraging more people to use public transport rather than driving a car to reduce the UK’s carbon emissions (Easdown 2022). Buses are seen as integral to delivery of ‘15-minute neighbourhoods’,³ with nine in 10 Britons (90 per cent) saying that a bus stop should be within a 15-minute walk or cycle every home in their neighbourhood (YouGov 2023). Two-thirds (66

³ Although the concept goes by several names, for example 15-minute cities or 20-minute neighbourhoods, the core goal of these remains the same – creating places where most of people’s daily needs can be met via short walking, wheeling, cycling or public transport journeys from home.

per cent) of the public support the transition to zero emission buses (Stagecoach 2022), and most people do not currently consider travelling by bus to be ‘green’ unless it is by zero emission bus (26 per cent compared to 81 per cent) (Go Ahead 2022). One-quarter (between 24 and 25 per cent) believe the transition to zero emission buses could also have a positive impact on the number, reliability, and frequency of bus services (Stagecoach 2022).



BUS DRIVER VIEWS ON THE CHANGES NEEDED TO INCREASE THE USE OF PUBLIC TRANSPORT

“I don’t know if one single change could make a difference to people’s mentality, how they feel about public transport and going on buses is so entrenched, there’s multiple changes that need to be done.”

Drivers said services need to be frequent, direct, quick, and get people to where they need to go, and that routes had been cut to save money: “if your service is reliable and turns up, people will continue to use it”. To get people out of their cars and onto buses, “the bus service has to be brilliant, bulletproof.” Buses should be prioritised on roads, with bus lanes into the city, “where we can skip the traffic”. One driver said there should be “people sitting in their car going – ‘that would be quicker on the bus’”.

There was support for a permanent cap on ticket fares for local trips, although one driver was concerned at how sustainable this was: “everything comes with a cost, who’s paying for it?”. Drivers also thought public campaigns could increase bus use: “it sounds like everything can be fixed with money, but you need to change people’s attitudes too.”

Edinburgh and London were mentioned as examples of municipal bus fleets or franchises. Drivers said the models worked better, both in terms of serving passengers – having routes going to areas that needed them, not only where the profit is; and in terms of finances – “everything gets invested back in” rather than being “answerable to shareholders”.

“there should be people sitting in their car going – ‘that would be quicker on the bus’”

2. LOCAL LEADERSHIP'S ROLE IN DECARBONISING PUBLIC TRANSPORT AND THE CHALLENGES FACING LOCAL NETWORKS

While there has been modest progress towards bus decarbonisation at a national level, the delivery of bus decarbonisation at a local level has been more piecemeal. This is despite many local transport authorities (LTAs) having more ambitious transport decarbonisation plans than central government. In this chapter, we review the motivations for bus decarbonisation among local authorities and discuss some of the major challenges to local bus decarbonisation.

Examples of action at a local level

While many LTAs have plans and ambitions to scale up local public transport and bus networks, delivery against these targets is more varied (see appendix A for full details of our assessment of 21 LTA regions).

National policies, such as the requirement to set out BSIPs and ZEBRA funding, have helped drive the decarbonisation of buses forward in some areas. This is particularly true for places like Coventry, Oxfordshire, and Glasgow (using ScotZEB funding). In addition, franchised or publicly owned networks including London, Nottingham, Blackpool, Newport, and Belfast have also made significant progress.

By contrast, several populous mayoral combined authorities have missed out on ZEBRA funding, including Liverpool City Region, Tees Valley, North East and West of England. In Scotland, despite having a publicly run, well-respected bus service in Edinburgh, Lothian Buses has only procured four electric buses at the time of writing⁴, although it has ambitions for zero emission buses to make up the majority of its purchases from 2024. Outside of Cardiff and Newport, there are very few other electric buses in operation and Wales does not have its own funding scheme for zero emission buses (Grice 2022).

MOTIVATIONS FOR LOCAL ACTION

The role in net zero plans and tackling air pollution

Many local authorities have declared a climate emergency and are developing local transport plans that overlap with overarching climate and air quality strategies. Although the proportion of greenhouse gas emissions that buses are responsible for may be relatively small, the shift away from diesel buses will support aims to deliver cleaner air – particularly in urban areas. Nitrogen oxide (NOx) emissions from buses are disproportionately high for the number of miles they travel (Lord 2021), and in cities like Glasgow, for example, the

⁴ Some stakeholders we spoke to said that this was because they had actually been victims of their own success by being a leading investor in Euro VI buses when this represented the cleanest option on the market.

highest concentrations of NO₂ occurred in the city centre where vehicle emissions are dominated by buses (SEPA 2021).

Several major cities in the UK already have, or will soon introduce, clean air zones that charge heavy vehicles including buses (and sometimes cars) below Euro VI emissions standards (Matthews 2022). Some cities like London are also planning to tighten these emissions standards by introducing zero emission zones in the coming years (MoL 2018), with a pilot scheme already underway in Oxford's city centre (OCC 2022).

Some combined authority areas have also incorporated bus decarbonisation as part of their wider green industrial strategies. For example, Liverpool City Region and Tees Valley both view zero emission buses as an end-user for locally produced hydrogen, as part of broader strategies to decarbonise high-carbon industries in these areas (LCR 2022; TVCA 2023).

Developing integrated transport networks

LTAs in combined authorities and city regions are also driving fleet decarbonisation as part of broader transport strategies to develop improved public transport networks across their area (CCC 2022). For example, Greater Manchester is working towards an integrated 'Bee Network' with consistent and affordable fares and branding across all forms of public transport including zero emission buses (GMCA 2021).

Social objectives

Some LTAs have also used bus decarbonisation funding as an opportunity to tackle social inequality. Many local authorities have seen the opportunity for new zero emission buses to increase public transport access in lower income areas and bring down air pollution at the same time. For example, West Yorkshire Combined Authority is using indices of multiple deprivation as a key metric when working with bus operators to determine where new, zero emission bus routes should be introduced.

The 'greenness' of buses can potentially improve patronage

In some areas, it is hoped that the 'greenness' of zero emission buses will bring a boost to patronage as part of the recovery from the pandemic. Anecdotal evidence suggests that zero emission buses are more comfortable for passengers and a smoother ride for bus drivers. Estimates from Stagecoach even suggest that one million extra passengers could be gained from a full transition to zero emission buses (Stagecoach 2022).

CHALLENGES DELIVERING AT A LOCAL LEVEL

There are many challenges facing local delivery that help to explain this patchwork progress across different local authorities. To understand them in more detail, we spoke with a wide range of industry and local stakeholders and the key insights are summarised as follows.

- 1. The need for continued funding.** Electric and hydrogen buses remain more expensive than diesel buses. These costs may decrease in future due to factors such as decreasing manufacturing costs, faster manufacturing timelines (from two years down to 18 months), longer ranges for electric buses and more extensive grid and network upgrades to accommodate bus depots. However, uncertainties remain around electricity prices, demand for and cost of raw materials and uncertainty around lifecycle costs (since the oldest electric buses in London have not yet reached the point where their batteries need replacing meaning there is a lack of real-world data around total cost of ownership) (Hayes and Griffen 2022; CPT 2022).

2. **Short-term and competitive funding models.** The funding sought by LTAs for their BSIPs cumulatively came to £10 billion with government only allocating £1 billion to less than half the LTAs who applied (CBT 2022b). Competitive funding has meant many councils missed out both on BSIP and ZEBRA funding. As the Transport Select Committee inquiry says: “local areas were asked to be ambitious, but the department has not matched this level of ambition in the funding it has made available. Instead local areas were pitted against each other for an often miserly share of an inadequate pot” (HoC 2023). This has a series of negative impacts including concentrating funding towards those with the most experience, slowing down manufacturing pipelines due to uncertainty around short-term funding rounds, and the stifling of knowledge sharing between councils. As one stakeholder noted, “everyone goes quiet when a funding round is announced”.
3. **Having enough staff with the right skills.** For local authorities, technical expertise is needed to support delivery of transport plans and make applications for funding. For industry, there is a need for apprenticeships that offer appropriate course content rather than current syllabuses which focus on diesel buses. More apprenticeships overall, greater communication about job opportunities, and feeding back the attractiveness of driving green buses could all play a role in driving recruitment, increasing retention and decreasing reliance on contractors.
4. **Bottlenecks caused by grid connections.** Deploying bus depots for electric buses require approval for grid connections from distributed network operators and may require network upgrades if the depot is not located near a substation. Both processes can slow down delivery timelines, and in particular for grid connections because of a first come, first served model which means bus operators must wait in a queue behind projects that may be much smaller and less strategically important.
5. **The need to do more with current powers.** While many bus routes across the UK are commercially operated, local transport authorities still have substantial powers relating to allocation of road space for cars and buses, road planning and parking, and the ability to introduce clean air zones (Barras 2021). Some stakeholders we spoke to suggested that local authorities could do more with existing powers and introduce stricter clean air zones since the majority of CAZs in the UK only target heavy vehicles and only charge vehicles that fall below the Euro VI diesel standard.
6. **Unique challenges for small bus operators.** The vast majority of smaller operators have had no access to or involvement in bids for ZEBRA funding (CPT 2022) and operate in more rural or inter-urban routes where local authorities have smaller teams with less experience making funding bids. This risks these operators being put out of business by stricter clean air zones that could target diesel vehicles.
7. **Uncertainty and opportunity around end-of-life assets.** There is a greater need to understand the uses of batteries in buses at the end of their lifecycle. Examples of opportunities for re-use could include refurbishment in stationary energy storage and shared learnings with other heavy goods vehicles, with which buses share many parts. Indeed, areas in the UK like the West Midlands could be ideal locations for these kinds of opportunities, given commitments already made by recycling companies like Veolia (Nguyen-Tien et al 2022).
8. **Addressing contradictions from national government.** The government has acknowledged the need to limit traffic growth but is still planning a £27 billion investment in upgrading and expanding road infrastructure in anticipation of increased car volumes (CCC 2022). As we discuss in chapter 5, a more joined-up

“everyone goes quiet when a funding round is announced”

national transport strategy that prioritises public transport will be essential to addressing these contradictions and enabling both more and cleaner buses.

- 9. Governance of bus networks.** The vast majority of bus networks in the UK are privately owned and LTAs have limited power over local bus services. There are many benefits to exploring a shift to franchising, whereby local transport authorities specify all routes and technology requirements and bus operators competitively bid to run services. These benefits include more frequent, cheaper services, simplified ticketing for consumers under a unified brand that could include other forms of public transport, cross-subsidising of less profitable routes with more profitable ones, greater investment in the network, greater collaboration with and certainty for bus manufacturers, the potential for collaboration between different franchises and less reliance on central government funding (UTG 2022; UTG 2015).

3.

THE TECHNOLOGY CHOICES FOR LOCAL PUBLIC TRANSPORT

In addition to the practical and financial challenges mentioned above, it is critical that local leaders make the right technology choices to deliver cost-effective transport decarbonisation. This is particularly important for electric buses and hydrogen buses which both require substantial investment into infrastructure, meaning it will be difficult and expensive to pivot once a decision is made.

In this chapter we set out why in most cases electric buses should be the preferred technology option. We also discuss where hydrogen may have a role to play in specific niches – for example long-distance coach journeys. However, we highlight how electric buses perform better across a range of criteria, including availability, technological maturity, overall cost, and emission reductions achievable.

BUS DRIVER VIEWS ON ZERO EMISSION BUSES

“Anything we can do to speed up the process to get hydrogen and electric into depots and out on the road is surely the best thing we can do for public and drivers.”

The bus drivers could not have been more emphatic about the differences between diesel and zero emission buses, describing it as “night and day”. Drivers commented on the smooth, comfortable, quiet drive, of battery powered vehicles benefitting both drivers and passengers.

Without the roar of diesel engines there are better interactions with customers as the driver can hear what they’re saying. Passengers like the smoother, quieter ride, and other benefits of new vehicles like charging points, more space, and more comfortable seats. Sometimes diesel buses lurch when moving off from a stop, posing a risk to (particularly elderly) passengers, but “with electric, it just glides”.

Anecdotally, some drivers also thought new passengers had been attracted by the new buses, and that some passengers were taking the bus rather than the car for environmental reasons. Drivers also acknowledged some passengers won’t know the difference, or aren’t interested: “couldn’t care less, as long as they’re getting where they’re going.”

Drivers discussed the experience of residents and pedestrians, saying night-time and early morning driving, particularly at the starts and ends of routes, was quieter and less polluting for residents.

The behind-the-scenes changes at bus depots has been big part of drivers’ experience of the change to electric and hydrogen. The air quality is much better now, where previously: “when you went into the depot you couldn’t see in front of you, it was like walking into a big cloud”.

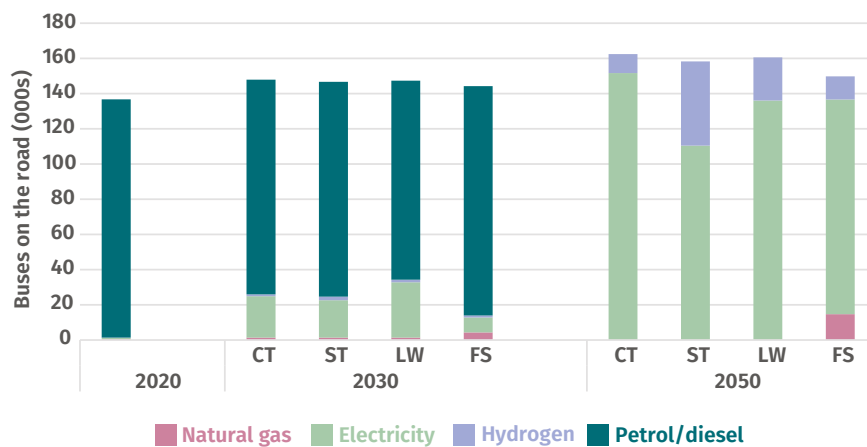
Drivers were optimistic about a transition to an entirely zero emission fleet: “the quicker the better”.

THE NEED FOR GREATER CERTAINTY OVER FUTURE TECHNOLOGY PATHWAYS

The government's position on supporting the rollout of zero emissions buses has been to remain technology neutral. This has led to conflicting analyses of future technology pathways (see figures 3.1 and 3.2). While the notion of not picking winners is understandable in principle, in practice it creates uncertainty, particularly for manufacturers, at a time when bus decarbonisation needs to be accelerating. Electric and hydrogen buses should not be considered equally viable options for most parts of the country. Below we set out the reasons why we believe electric buses should be the default technology choice for national government and local authorities.

FIGURE 3.1: MODELLING BY NATIONAL GRID ESO SUGGESTS THAT THE VAST MAJORITY OF BUSES WILL BE ELECTRIC WITH ONLY A SMALL ROLE FOR HYDROGEN⁵

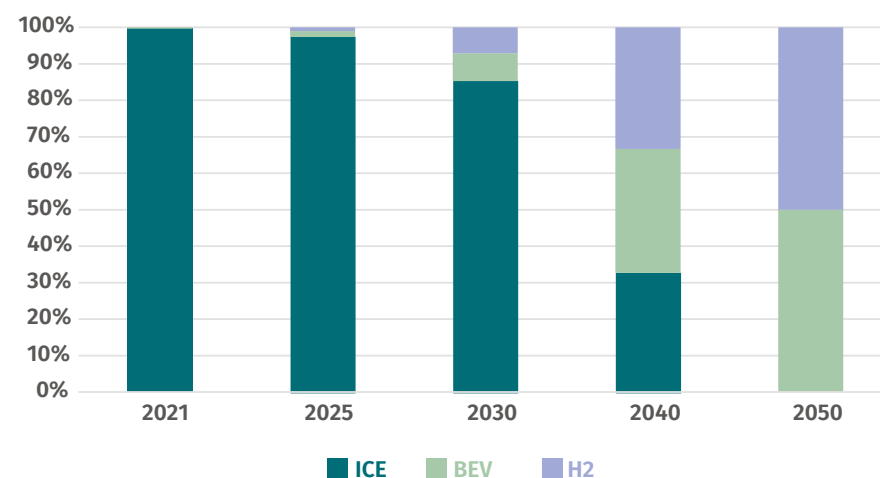
Projections for the number of buses on the road by fuel type, and by year and technology across a range of scenarios



Source: National Grid ESO 2022 [adapted by IPPR]

FIGURE 3.2: BY CONTRAST, MODELLING BY INNOVATE UK SUGGESTS AS MANY AS HALF OF ALL BUSES COULD BE HYDROGEN BY 2050

Projections for the proportion of buses and coaches on UK roads by fuel type



Source: Innovate UK 2021 [adapted by IPPR]

⁵ National Grid ESO model four plausible scenarios for future energy demand: consumer transformation (CT), system transformation (ST), leading the way (LW) and falling short (FS).

THE CASE FOR ELECTRIC BUSES TO BE THE DEFAULT TECHNOLOGY CHOICE

Availability

Due to their technological maturity, it is much easier for bus operators and local authorities to source electric buses from manufacturers than hydrogen buses. At the time of writing there are 87 models of electric buses in Europe compared to only eight for hydrogen and only four electric coach models compared to just one for hydrogen (Mulholland 2022).

In addition, part of the economic case for hydrogen buses and coaches requires sufficient demand for hydrogen as a fuel for other sectors of the economy to justify the substantial investment into hydrogen production methods, pipelines, and storage. However, many authors including IPPR have previously concluded, while hydrogen will be an important fuel for some industrial processes, it should only play a very minor role in other sectors like heating (Collins 2023; Webb et al 2021). Limiting demand for hydrogen overall will therefore impact the business case for its use in transport as there will be fewer opportunities for co-investment into, or use of existing, hydrogen infrastructure (Webb et al 2023). Consequently, for the few scenarios where hydrogen buses or coaches may be deployed, developing a strategy that sets out multiple use cases for the infrastructure will be key.

Some stakeholders we spoke to did not rule out the possibility of deploying hydrogen buses in future for more rural or inter-urban routes due to their superior range and travel speed. In the West Midlands for example, National Express are investing in green hydrogen buses in the hope of scaling up domestically produced green hydrogen infrastructure for their longer-range coach network (WMCA 2022b).

However, many stakeholders also noted that electric buses may have already developed longer-range batteries by the time hydrogen buses and hydrogen infrastructure become more commercially viable. Indeed, while some bus operators noted that the average range for an electric bus was around 130–150 miles, newer models from manufacturers like Alexander Dennis have claimed ranges of up to 260 miles (Alexander Dennis 2022). As many bus operators confirmed, if these kinds of ranges proved accurate, these newer buses “would be a game-changer”.

Emissions

The pathway for decarbonising electricity is already well-established and emissions are steadily declining in the power sector. By contrast, there are serious concerns about the low-carbon credentials of hydrogen production (Webb et al 2023). Blue hydrogen involves ‘cracking’ methane into hydrogen in a process that emits carbon dioxide that is then, in theory, captured by carbon capture and storage technology. However, this method is not yet low-carbon due to methane leakages and low capture rates, and still relies on natural gas as the source of methane (Howarth and Jacobson 2021). In the absence of much stricter ‘deep blue’ hydrogen regulation that addresses both of these issues, hydrogen buses could only be considered low carbon if they used ‘green hydrogen’, produced via electrolysis.

Yet green hydrogen is currently expensive to produce due to high electricity demand and very little is produced at scale in the UK. While costs are expected to fall, it may take a long time until green hydrogen reaches parity with the technologies it may replace (Rosenow 2022).

As we reference in chapter 2, the lack of domestic production means hydrogen for current bus projects is either imported (incurring substantial shipping transport emissions) or comes from ‘grey hydrogen’ – produced as a result of

carbon-intensive industrial processes without any capture technology affixed (UTG 2022).

Cost

Industry and local stakeholders told us throughout the research that electric buses were generally a cheaper option than hydrogen buses. This is also supported by studies looking into future costs which suggest electric buses will be a cheaper option with similar or lower capex costs and significantly lower fuel costs than hydrogen buses. In both cases, this is due to uncertainty around the supply of hydrogen and hydrogen refuelling infrastructure (Element Energy 2020; Kim et al 2021; Arup 2022).

In fact, hydrogen fuel costs may be under-estimated in some of these studies. For example, in research from Element Energy (2020), there is an assumption that the vast majority of hydrogen will be blue hydrogen. However, as we discuss above, to be considered truly low-carbon, hydrogen buses will have to be supplied with green hydrogen via electrolysis, which is currently much more expensive (Aurora Energy Research 2022; Arup 2022; Kurmelovs 2021).

Yet even if the cost of electrolysis infrastructure falls below the costs of blue hydrogen as some studies suggest (Longden et al 2021), fuel costs for hydrogen buses are likely to remain higher than for electric buses. This is because there is an efficiency loss to using electricity to produce hydrogen rather than directly for charging an electric vehicle. The result is that, in cars, it is estimated that electric vehicles consume 1.2 kWh of energy per km, compared to 1.8 kWh/km for hydrogen fuel cell vehicles (Logan et al 2020).

PRACTICAL CHALLENGES FOR ZERO EMISSION COACHES

This report focusses on the transition to zero emission buses, however we have also been mindful of the interlinked goal of achieving a zero emission coach fleet. The business case for zero emission coaches is often more challenging than buses for several reasons:

- coaches may not benefit from economies of scale or regular patronage as they are more bespoke services that are less regular and routes that can change
- they tend to have longer journey times than urban bus routes which can sometimes raise range issues for electric-based coaches (CPT 2021)
- coach operators are often smaller, family run businesses and do not have the capital to invest in their own charging infrastructure or zero emission coaches
- many coach services often do not have their own depots and rely on public parking space, or may rent industrial space for their fleets meaning they do not have development rights to create a depot even if they wanted to
- charging infrastructure upgrades tend to prioritise private vehicles and often do not account for coaches' requirements.

TECHNOLOGY CHALLENGES FOR ZERO EMISSION COACHES

From a technological standpoint, some stakeholders have suggested that hydrogen may be the most appropriate choice for coaches over batteries due to a number of challenges which buses do not face. These include the following.

- **Luggage and seating space.** Batteries installed in coaches currently reduce luggage capacity by around one-third and may also eat into seating space. It is hoped that designs for hydrogen coaches would be able to avoid this by having fuel cell tanks on the roof (although as we discuss below, such a design may face regulatory hurdles).
- **Longer journeys.** The coach market in the UK is currently split into several different areas – school runs, social tours, holidays in the UK, European holidays, and inter-urban city routes. Though battery mileage is improving and could be used in coaches to cover some of these markets, the latter two options are much longer journeys that may be better suited to hydrogen coaches which could theoretically run for between 500–600 miles.
- **Fewer stoppages.** Coach journeys over four and a half hours by law require that drivers have a break for at least 45 minutes. Coach companies often comply with this law by swapping drivers at stoppage points to speed up overall journey times. With hydrogen coaches, in theory, current practices could continue whereas electric coaches may also need the stoppage to recharge.

However, there are a few challenges to scaling up hydrogen coaches. While some coach operators are considering designs that could incorporate a hydrogen fuel tank on the roof to free up luggage space below, some stakeholders warned that this design would be unlikely to meet ‘rollover regulations’ – regulations that ensure coaches have a low enough centre of gravity to avoid tipping over (ITF 2020). While some stakeholders pointed to China as an example of successful hydrogen coach rollout, these vehicles are not required to comply with these same rollover regulations. In addition, the same uncertainties around hydrogen infrastructure for buses also applies for coaches. To overcome this obstacle, some stakeholders have called for an infrastructure plan that sets out multi-purpose use cases for green hydrogen refuelling stations.

4. THE BENEFITS OF LEVELLING UP ZERO EMISSION BUSES

While further progress both at a local and national level is needed to deliver existing bus decarbonisation targets, there is an opportunity to go further than this pathway and reshape the role public transport plays in the future of transport decarbonisation. In this chapter, we model and describe the benefits of a pathway for a future public transport system that substantially scales up bus services across metropolitan areas in England to match service provision in London. For this modelling, we assume all new buses are electric based on the advantages we set out in chapter 3.

In London, both the absolute number of buses and the number of journeys per person are much higher than anywhere else in the country (table 4.1). In other words, there are more buses available, and they are used more frequently in the capital than anywhere else in the country.

TABLE 4.1: THE NUMBER OF BUSES AND USE OF BUSES PER PERSON IS HIGHER IN LONDON THAN ANY OTHER METROPOLITAN REGION IN ENGLAND

Number of buses and number of bus trips per person by region

Region	Number of buses ⁶	Bus trips per person (2018/2019) ⁷
London	9,142	245
Greater Manchester	1,500	67
Merseyside	1,200	71
North East & North of Tyne	1,200	71
South Yorkshire	1,352	64
West Yorkshire	1,247	61
West Midlands	2,000	90
Tees Valley	350	44
West of England	695	71
Cambridgeshire & Peterborough	370	34

Source: IPPR analysis of local BSIPs and DfT 2023c; ONS 2022

Our model does not seek to explain the reasons behind this current disparity, though urban density in London,⁸ historic regional imbalances amounting to **a £51 billion investment gap in transport infrastructure between London and the North**, a franchise model being deployed in London and the longstanding

6 Where available, numbers are drawn from 2018/19; otherwise bus numbers are taken from estimates in BSIPs.

7 We take this year as it represents the last year of data unaffected by the pandemic.

8 Importantly, while we acknowledge that it is currently harder for lower density populations (ie regions and cities outside of London) to be catered for by public transport (Rodrigues and Breach 2021), our model is interested in what it would take to have a similar level of demand across these regions and therefore adjusts for density by assuming a higher number of miles per journey outside of London. To achieve this level of demand will require both changes to public transport as well as changes in the urban realm, with denser neighbourhoods designed around easy access to improved public transport services.

expertise of TfL all play a role (Johns and Giovannini 2021). However, from a fairness perspective, an ambitious increase in the size of electric bus fleets would also make a major contribution to levelling up regions in England and address historic disparities.

The economic benefits of investing in local public transport are well established. Within this model we do not assess the economic benefits of the scale up in services proposed, but previous studies have suggested a return on investment of at least £4 for every £1 spent including through improved access to labour markets and health benefits from increased physical activity (KPMG 2020 and DfT 2016).

While we do not model the demographics of passengers taking these journeys, as IPPR analysis has previously established, increasing both public transport access and keeping fares low is most likely to benefit low-income households. Increasing service provision would therefore also play a key role in tackling transport poverty and the cost of living crisis (Massey-Chase et al 2022).

Overall, we find that a scale up in bus services in metropolitan areas in England to match the per head level of provision in London would have the following major benefits:

- total increase of 2.7 billion bus journeys a year across mayoral combined authorities by 2030
- an equivalent of over 900,000 cars taken off the road by 2030
- a total reduction of 12 per cent in car miles just from increasing bus services in mayoral combined authorities alone compared to DfT's core transport projections for 2030
- emissions reductions from cars and buses of 18 per cent between now and 2030, or 9.4MtCO₂e, compared to DfT's core transport projections
- substantial contribution to delivering local transport plans that aim to increase public transport patronage and decrease car journeys
- a total capital investment cost for buses and depot infrastructure of £9 billion (including London) including a total government subsidy of £2.5 billion between 2023–30.

COMPARISONS TO EXISTING WORK

Our model is a useful way to encourage political imagination and is primarily intended as an illustrative exercise. Other organisations have undertaken comparable exercises that look at different ways of increasing bus provision with the same kinds of benefits. For example, analysis by WPI Economics has found that increasing bus patronage by 80 per cent between 2019 to 2050 could yield cumulative emissions reductions of 15.8MtCO₂ (Oakley et al 2022). Going further, analysis conducted for the TUC found that increasing levels of provision across the whole of England and Wales (excluding London) would result in a 120 per cent increase in bus and tram passenger kilometres (TUC 2023).

The two examples above offer useful comparison to our modelling but there are some important differences. First, we focus on mayoral combined authorities rather than the whole of England and Wales as with TUC modelling or Great Britain as per the WPI Economics study.

There is also an important difference in the methodology for calculating future bus demand between our modelling and the examples given above. The models above specify an estimated level of car reduction to meet net zero targets in future and then estimate how much of that reduction could be met by an increase in bus services (and other forms of public transport).

By contrast, our model takes fairness across regions as a starting point. This means we *start* by specifying the increase in bus service provision in mayoral combined authorities and from there calculate the social benefits and progress towards net zero targets.

The result is far more ambitious than the models mentioned above across a range of metrics that we set out below. For example, with bus services in mayoral combined authorities matching London, our model suggests an 82 per cent increase in bus passenger miles in these regions alone by the much earlier date of 2030, compared to an 80 per cent increase by 2050 across Great Britain as estimated by WPI Economics.⁹

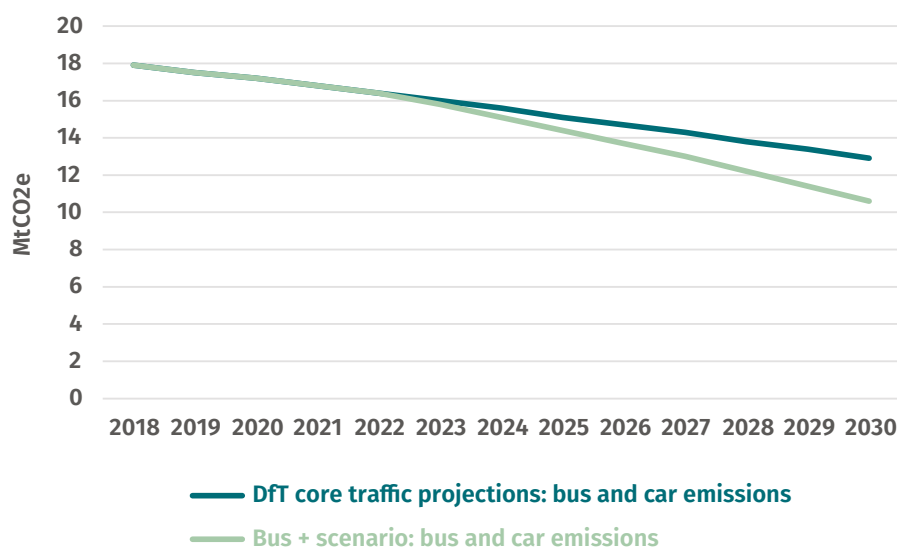
RESULTS IN DETAIL

A substantial reduction in car miles and emissions

Our results in figures 4.1 and 4.2 show a substantial reduction in emissions and car vehicle miles compared to the Department for Transport’s future traffic projections.¹⁰ Our modelling suggests a total reduction in car miles of 12 per cent by 2030 from increases bus services alone across all mayoral combined authorities. Finally, while this analysis does not quantify reductions in other pollutants, the reduction in car miles would see a substantial reduction in air pollution from traffic.

FIGURE 4.1: A MORE AMBITIOUS ROLLOUT OF ELECTRIC BUSES WOULD SEE SUBSTANTIAL EMISSIONS REDUCTIONS COMPARED TO DFT’S TRAFFIC PROJECTIONS FOR 2030

Comparison of emissions reductions scenarios for cars and buses between DfT and IPPR modelling



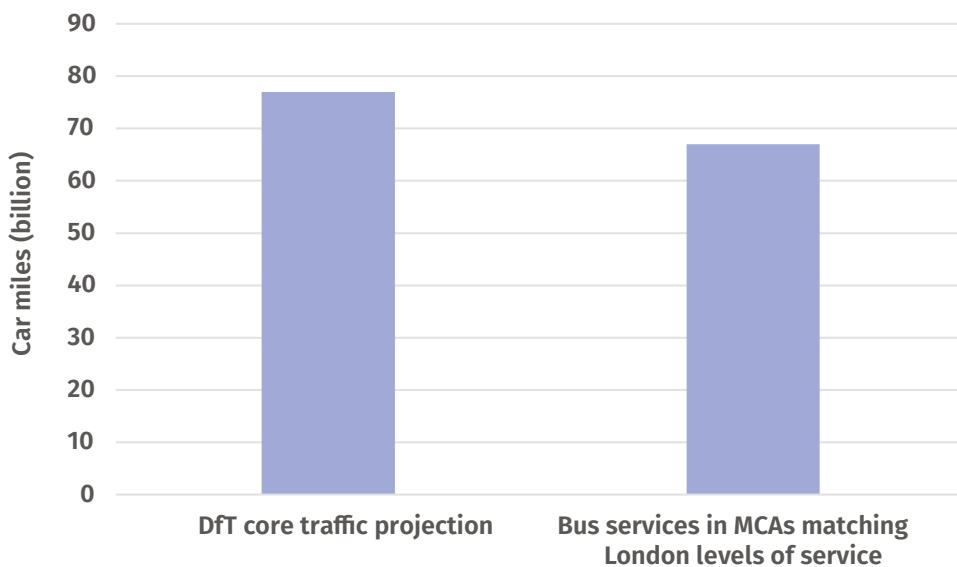
Source: IPPR analysis of local BSIPs and DfT 2023c; ONS 2022; DfT 2022g; DfT 2022h; Oakley et al 2022

⁹ Part of the reason for this stark difference is due to some mayoral combined authorities having less dense populations meaning an equivalent level of service to London would require more passenger miles per journey. As the WPI Economics report notes, bus patronage particularly in urban areas has the potential to increase substantially after investment (Oakley et al 2022). This helps to validate our initial assumptions that a big increase in bus services to match London levels of service will result in increases in bus patronage.

¹⁰ These projections are the best estimate for how many cars and buses would be on the road in the absence of our proposed intervention and so we use these figures as our baseline.

FIGURE 4.2: INCREASING BUS SERVICES IN MAYORAL COMBINED AUTHORITIES TO MATCH LONDON LEVELS OF SERVICE WOULD HAVE A SUBSTANTIAL IMPACT ON REDUCING CAR MILES

Comparison of car miles in 2030 between DfT and IPPR modelling



Source: IPPR analysis of local BSIPs and DfT 2023c; ONS 2022; DfT 2022g; DfT 2022h; Oakley et al 2022

Helping regions to deliver local transport plans

The reduction in car miles and increase in bus journeys could also make a substantial contribution to regional transport strategies. Many mayoral combined authorities' transport plans express an ambition to reduce car miles and increase bus journeys.

Levelling up bus provision to match London levels of service would make a substantial contribution to these ambitions. For example, Greater Manchester's transport strategy sets a target to shift 50 per cent of all journeys to public transport by 2040. Our model suggests levelling up bus services would deliver a 15 per cent reduction in car miles in Greater Manchester by 2030 even before considering the role of other forms of public transport. In West Yorkshire, the transport strategy sets a target to increase bus journeys by 25 per cent by 2027. Matching London levels of service would see bus trips nearly quadruple by 2030. The West of England's transport strategy sets a target to double (ie 100 per cent increase) bus trips by 2036. Our model would result in a nearly 250 per cent increase by 2030.

The summary of benefits of levelling up bus services at a regional level is shown in table 4.2.¹¹

¹¹ Estimates of bus numbers are largely based on BSIPs but accurate fleet numbers are not commercially available, meaning some fleet numbers may be under or overestimates. For example, BSIP figures like those in South Yorkshire often describe total routes operating in the city rather than routes that serve *only* the city region.

TABLE 4.2: A GREATER ROLLOUT OF ZERO EMISSION BUSES WOULD MAKE A BIG CONTRIBUTION TO MAYORAL COMBINED AUTHORITY TARGETS TO CUT EMISSIONS AND CAR MILES AND INCREASE BUS TRIPS

Increase in buses and bus trips and decrease in car miles and emissions by mayoral combined authority

Region	Increase in buses	As percentage	Increase in bus trips (million)	As percentage	Reduction in car miles compared to 2030 baseline	Reduction in emissions (MtCO ₂ e)
Greater Manchester	1,393	93%	506	268%	-15%	1.14
Merseyside	259	22%	249	244%	-21%	0.71
North East & North of Tyne	834	70%	346	243%	-20%	1.17
South Yorkshire	85	6%	254	279%	-16%	0.74
West Yorkshire	1,132	91%	428	298%	-16%	1.17
West Midlands	987	49%	455	173%	-10%	1.03
Tees Valley	340	97%	136	454%	-19%	0.34
West of England	266	38%	164	246%	-12%	0.37
Cambridgeshire & Peterborough	503	136%	181	616%	-14%	0.47

Source: IPPR analysis of local BSIPs and DfT 2023c; ONS 2022; DfT 2022g; DfT 2022h; Oakley et al 2022

Investment costs and subsidies are manageable for government

While scaling up services to the levels we set out would clearly require a substantial increase in investment, our model suggests that subsidies from government would be both manageable and decline over time.

Our model suggests that overall investment costs will need to increase to £9 billion between now and 2030 on top of private and public funding that has already been committed or invested in bus decarbonisation. The model also asks specifically how much public investment would be needed if the government continued with its ZEBRA scheme, which offers up to 75 per cent of the cost difference between zero emission buses and diesel buses and up to 75 per cent of the cost of infrastructure upgrades required (HoC 2023).

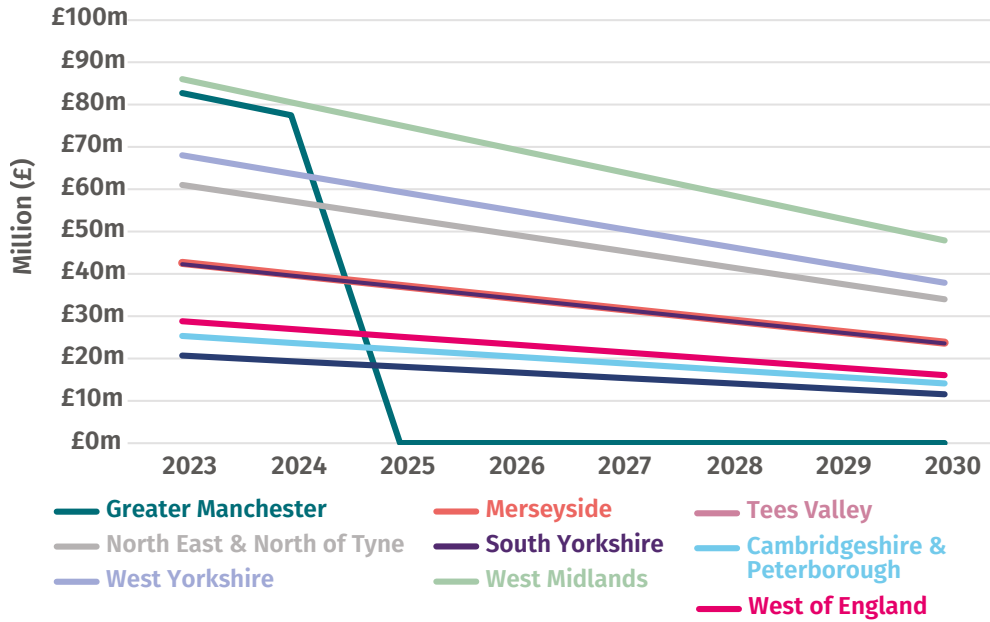
If this scheme continued, as figure 4.3 shows, total government subsidy between 2023–30 would be approximately £2.5 billion.¹² Importantly, this subsidy would decrease from £457 million in 2023 to £209 million in 2030, in line with studies estimating future cost reductions for electric buses (Element Energy 2020).

This modelling does not evaluate the operating costs of scaling up bus services, nor does the model explicitly discuss how much bus fares should be in future or comment on any subsidies for fare prices that may be needed to reach this level of demand. While this question requires further study, our model does make the evidence-based assumption (Tennøy 2022) that both the increased frequency and access to bus routes and the ‘greenness’ of all new buses, will increase bus patronage even without fare subsidies.

¹² We assume that once Greater Manchester’s franchise model is up and running they will no longer receive funding through the ZEBRA scheme and will instead require contracted services to run electric buses as is currently the case in London

FIGURE 4.3: GOVERNMENT SUBSIDIES FOR ELECTRIC BUSES DECREASE OVER TIME AS THE SUPPLY CHAIN MATURES AND UPFRONT CAPEX COSTS DECREASE

Government subsidy for electric bus and infrastructure capex over time by mayoral combined authority



Source: IPPR analysis of local BSIPs and DfT 2023c; ONS 2022; DfT 2022g; DfT 2022h; Oakley et al 2022; Element Energy 2020; TUC 2023

5. CONCLUSION AND RECOMMENDATIONS

England's bus network remains vital for many but is a shadow of its former self: its benefits are unfairly shared across the country and existing funding is barely enough to maintain current levels of service. It doesn't have to be this way. As the national bus strategy says: buses are the quickest, easiest, and cheapest way to make radical improvements to local public transport (DfT 2021a).

Restoring our bus network to its former glory and 'levelling up' public transport would be transformative for people's lives, communities, and local economies. It is also fundamental to reaching net zero in a way that is fair and perceived to be so by the public.

At the heart of this report, and IPPR's previous research, is the need for the UK government to **publish a new transport decarbonisation plan which recognises the need for, and opportunities presented by, reducing transport demand** and complies with the advice of the IPCC on achieving rapid and deep emissions reductions in the 2020s to keep 1.5C of warming in reach. This can only be delivered fairly alongside a new strategy to deliver far greater mode shift to public transport and active travel.

A NEW VISION FOR BUSES IN 2030

The UK government, and all parties going into the next general election, must set out how they intend to **deliver a world-leading local public transport system by 2030** and the role it will play at the heart of a wider transition in making how we travel fairer, cleaner, and healthier.



The 'levelled up' bus network of 2030 must:

- have increased the levels of service in all metropolitan areas to closer to those seen in London
- be faster and more reliable, with buses given priority through designated lanes and car-free areas
- have led to far greater bus patronage and mode share, including having brought the number of per person trips by buses in all major metropolitan areas much closer to London levels
- have affordable and simpler fares that are well integrated with other forms of local public transport, community transport and shared mobility schemes (including ebike sharing and car clubs)
- be connected with high quality walking and cycling infrastructure
- have made significant progress in the shift from diesel and have largely been electrified within major metropolitan areas.

The key criteria for success will be ensuring more people are able to live a good life, wherever they live, without needing to own a car.

Below we outline the policy programme that should underpin the delivery of a 'levelled up' and cleaner bus network across the UK's metropolitan areas.

GOING FURTHER AND FASTER ON OVERARCHING TARGETS

A more ambitious transport decarbonisation plan must provide a clear direction of travel by setting out more ambitious targets at both a national and local levels.

At a national level, we recommend that the government should set the **phase-out date for the sale of new ICE bus sales as 2030**, and keep open the option of bringing this forward. The CCC has already noted that announcing a phase out date for non-zero emission buses by or before 2032, could help to stimulate an acceleration in the delivery of zero emission buses. In practice however, many local councils, including all the mayoral combined authorities we analysed in this report, are already prioritising the purchase of zero emission buses and almost all have a target date for the decarbonisation of their fleet. **From today, operators should be purchasing only zero emission buses for routes in urban areas** and, if required, the government should be ready to regulate to enforce this.

For more rural areas, we recognise that electric buses may not yet be proven to offer the range needed, bus operators are likely to be smaller and less able to purchase electric buses and councils will have less capacity to apply for government funding. **In the run-up to 2030, operators in rural areas should purchase zero emission buses wherever possible and buy plug-in hybrids for the remaining routes.**

While existing local decarbonisation targets are welcome, we would also recommend greater ambition for those LTAs that have the means to do so. Consequently, in tandem with a ramp up in funding mentioned below, we **recommend that every mayoral combined authority in England should set targets to have both a larger and a net zero bus fleet by 2030**. As part of this target, **we recommend that the default choice of technology for buses should be electric over hydrogen**. While we recognise that a small number of areas may have easy access to cheap and, in time, low-carbon hydrogen, as we discuss in chapter 3, electric buses are currently much more widely available, lower carbon and are likely to have greater prospects for cost reduction.

Finally, there are significant economic and social advantages to delivering bus decarbonisation through franchising. As such, following Greater Manchester's lead, **we recommend that every mayoral combined authority should pursue the development of a franchising model for local bus networks** as soon as feasible. In the longer term, we recommend that the government should work with LTAs to facilitate discussion over the feasibility of pooling resources and delivering franchising over broader areas that include smaller or more rural LTAs to ensure they are not left behind.

MORE FUNDING, MORE FAIRLY ALLOCATED

While positive initial progress has been made on decarbonising buses, as we discuss in chapter 2, continued funding is essential to the rollout of zero emission buses while electric buses and hydrogen buses remain more expensive than diesel. However, as we discuss in chapter 4, there is a significant case for scaling up bus services even beyond current targets on the grounds of levelling up, improving air quality and making a more substantial contribution to tackling transport emissions.

With this in mind, **we recommend that the government commit to extending the funding of its existing ZEBRA scheme by £2.5 billion between 2023–30**. This would mean £457 million committed for the remainder of 2023, falling to £209 million by 2030. At an average across these years of £300 million per year, this funding

would represent only a small increase from the £270 million the government committed to bus decarbonisation in 2021 to 2022 (DfT 2022e). Furthermore, if more mayoral combined authorities followed Greater Manchester's lead and pursued a franchising model, this would likely further reduce the cost of subsidies to government.

While the ZEBRA scheme is an important initiative that should drive bus decarbonisation, the way this funding is distributed must be changed. As the Campaign for Better Transport has previously argued (CBT 2022b), funding for local transport authorities must move **away from a competition-based model, towards long-term allocation of funding through a single pot of funding** that is granted when specific milestones and objectives are reached. Alongside this model, government should internally seek to accelerate the process for approving and providing funding as well as **ensuring that every local authority has funding to hire in-house expertise to deliver on bus service improvement plans** and their integration within wider transport planning more generally.

In addition to an uplifted ZEBRA funding scheme, **government should allocate funding for SME bus and coach operators, particularly in rural areas**. This pot of funding would require LTAs convening smaller bus operators in their area and putting forward proposals for bus decarbonisation jointly. This would ensure smaller operators do not get left behind or get unduly penalised by parallel plans by local authorities to stimulate modal shift, accelerate decarbonisation and tackle air pollution through measures such as congestion zones.

While this paper does not explore broader economic benefits to scaling up bus services, it will nevertheless be essential to ensure that greater electric bus investment sees corresponding benefits to the UK supply chain. We recommend that government should follow their own example from the Clean Heat Market Mechanism (that will require boiler manufacturers to make a proportion of sales from heat pumps) and **set bus manufacturers a minimum percentage requirement for manufacturing electric buses** as a proportion of their total business. Correspondingly, government should **require recipients of ZEBRA funding to source a minimum percentage of their electric buses from UK manufacturers**. This would also require **ZEBRA funding to follow Scotland's example and have a cost cap** (where subsidies would be offered up to 75 per cent of the cost difference between zero emission buses and diesel, or up to the cost cap, whichever was cheaper). This would help to prevent the temptation for manufacturers to charge a premium in the knowledge that operators were required to source a percentage of their fleet domestically.

Finally, a rapid scale up in bus services in mayoral combined authorities will also require a corresponding scale up in both local capacity and broader route planning to facilitate service improvement, such as the creation of bus corridors. While this report does not estimate these broader costs, at the very least we recommend **that government should scale up its investment in BSIPs from £1 billion to the £3 billion it originally committed to** as part of its national bus strategy (DfT 2021a). The next UK government should commit a transformative level of funding to LTAs to deliver the full scope of their BSIPs, this should be in the region of £10 billion.

The new investment detailed above could be funded through fairer and more responsible allocation of existing transport funding. Capital funding for an improved bus network (roughly 60 per cent based on previous studies (KPMG 2020)), should be reallocated from the £27 billion committed to the roads investment strategy – a strategy that is incompatible with both climate and nature goals. Fuel duty cuts disproportionately benefit the wealthiest and it is estimated they will cost £27 billion in lost revenue over five years (Salutin 2023).

These cuts should be reviewed with the resulting increase in revenues from fuel duty ringfenced to fund improvements to public transport, alongside improved walking and cycling infrastructure.

PROVIDING THE CONDITIONS TO ENABLE SUCCESS

Beyond increasing funding, there are a range of enabling measures that are needed to move further and faster on bus decarbonisation. This will require action taken both at a national and local level and careful coordination between the two.

At a local level, a significant scale up in bus numbers will also require careful road planning to accommodate for increased service provision alongside improving speed and reliability. Consequently, we recommend that **all local authorities within mayoral combined authorities set out plans to reallocate road space to buses:** aiming to creating a cohesive network of bus-priority routes that support the shift to car-free high streets and city centres. **Reallocation of road space to buses should be integrated with action to provide more space for walking, wheeling, cycling and nature** in-line with a coordinate response to climate adaptation and in support of a nature recovery.

To accompany these plans, **we recommend that local authorities should explore introducing zero emission zones that include all private vehicles into major city centres, town centres and high streets and in areas of high air pollution.** As suggested by TfL (2019), zero emissions zones will be most effective and fair if implemented alongside physical transformations to an area that prioritise walking, cycling and public transport over motorised vehicle. In air pollution hotspots they may work best if tightly-defined, for example covering school streets, and limited to certain times of day (ibid). Such zones should never be introduced without an accompanying scale up in bus services and would require a corresponding increase in national government support for scrappage schemes that support people to move to cleaner modes of transport.¹³ This would help to ensure that a shift to zero emission public transport would lead to an increase in accessibility and avoiding both the perception and actual risk of limiting people's ability to travel into city centres or within their local area.

In addition to accommodating vehicles on the road, it will also be crucial to create enough space for both buses and coaches to charge, while fitting in within other community transport needs. To this end, **we recommend that local authorities set out plans to incorporate shared charging infrastructure** that would include use cases for bus depots allowing public charging as well as new public charging infrastructure allocating space and charging points for coaches. This planning could also extend to promoting community ownership of assets, as is currently being crowdfunded in Merton and Malvern Hills (Crowdfunder 2023; Teme Wheels 2023).

At a national level, **we welcome plans from National Grid ESO to reform grid connections** from a first come first served to a first *ready* first served model which should enable those with planning consent already in place to be prioritised. This should result in bus depots getting grid connections significantly more quickly and **we recommend that bus infrastructure should also be considered a strategic infrastructure priority** when receiving these connections.

Finally, although there is uncertainty around how batteries will be used at the end of their life, there is also significant potential for a range of applications. Consequently, we **recommend that government should consider requiring battery manufacturers to take an equity stake in bus recycling plants** to encourage battery designs to be more easily recyclable.

13 Scrapage schemes should be designed to promote the shift to cycling, shared mobility and public transport, but still support those who need access to a private car to purchase EVs.

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APPENDIX A.

METHODOLOGY FOR MODELLING

Our key objective for the modelling conducted for this report is to assess the benefits of scaling up bus services in mayoral combined authorities across England by 2030 on a per person basis to match the level of service provided in London. As we mention in the main body of the report, our model takes fairness across regions as a starting point. This means we *start* by specifying the increase in bus service provision in mayoral combined authorities and a target date of 2030 and from there calculate the social benefits and progress towards net zero targets. The key benefits we look at are:

- emissions savings (primarily CO₂ but potentially an option to do NO_x too) of modal shift to this new level of bus service
- reduction in car passenger miles and/or equivalent number of cars taken off the road by modal shift to buses
- we also wanted to show estimates of investment costs for achieving this degree of modal shift.

CALCULATING A SCALE UP IN SERVICES

1. To estimate number of buses, we calculate the number of buses per person in London, and estimate what the bus fleet would be elsewhere if the same ratio of buses to people applied in mayoral combined authorities in England. We compare this to the current size of the fleet in each area to estimate additional buses by the target date of 2030.
2. To estimate additional bus miles, using the method above we estimate the passenger journeys by mayoral combined authority by 2030 from matching a London level of service. We then multiply the number of vehicle miles per bus journey to reach a new bus vehicle miles figure for 2030. We assume this remains consistent between 2018/19 and 2030 and treat this as a reasonable proxy for area density, where shorter miles per bus journey represents greater density and vice versa. We note that a scale up in urban development could lead to bus miles per journey decreasing in future as populations cluster more closely around city centres.
3. To estimate reduction in car miles, we assume between DfT traffic projections and our own modelling there is no overall change in total vehicle miles but that an increase in bus miles leads to a corresponding decrease in car vehicle miles. We recognise this 1:1 assumption may be a slight overestimate as not every reduced car journey will guarantee a person taking the bus but we make this assumption for simplicity and to illustrate the best case scenario. We then apply occupancy rates for both buses and cars and how they change between 2019–30 to provide estimates of bus and car passenger miles in the baseline traffic projections and bus passenger miles in our own scenario. We then subtract the increase in bus passenger miles in our modelled scenario from the passenger miles in the baseline to estimate a new car passenger miles figure for 2030. Finally we divide the passenger miles figure by an occupancy rate for cars in 2030 to estimate car vehicle miles reduced by mayoral combined authority.

4. We then estimated the equivalent number of cars taken off the road in 2030 by dividing the passenger miles reduction for each mayoral combined authority by the occupancy rate to and then an average car miles per year figure of 10,000.

ESTIMATING CO2 SAVINGS

1. We used DfT road traffic projections core scenario to estimate an average CO2 per mile figure for both cars and buses (NB buses in the data are represented as 'public service vehicles' or 'PSVs' – we recognise a very small proportion of PSVs will also include mini-buses that are not included in our analysis) in 2015 and 2030. We then assumed a linear reduction in emissions per miles between the two periods and focussed on between 2018 and 2030 to match our scale up in bus services. Using the core scenario for vehicle miles for both cars and buses, we applied the respective emissions per mile figure for each region in each relevant year. We then assumed a linear growth in occupancy rates (see above) between 2018 and 2030 and divided the emissions figures for both bus and car vehicle miles by the relevant occupancy rate for each region in each relevant year to establish a baseline for passenger emissions per mile.
2. We then estimated emissions reductions in the year 2030 in our modelled scenario based on the percentage reduction in passenger miles between baseline and our scenario and applying the CO2 per mile figure for cars in the core scenario for traffic projections. We also divided the result by the occupancy rate of 1.7 for cars in 2030 to give passenger emissions per mile figure for each region
3. As part of this modelling, we assumed no additional progress on scaling up bus services would actually begin until 2023, after which we assumed linear progress towards the emissions reductions figure for each mayoral combined authority between 2023 and 2030. We also assumed that all buses would be decarbonised by 2030 and there would be linear progress towards this between 2023 and 2030. For simplicity, we assume no change in infrastructure costs as infrastructure investment does not typically fall over time.

INVESTMENT COST

1. We estimated current CAPEX costs for electric buses from estimated industry spending based on analysis of local authority BSIPs and ZEBRA funding announcements, as well as estimating both the subsidy per bus the government is paying and the estimated cost of a diesel bus.
2. We use an estimate for CAPEX for an electric bus in 2030 from an Element Energy study to establish a cost reduction curve between 2023 and 2030 and assume linear reduction.
3. We assume the figure in the Element Energy study focusses only on the CAPEX for the bus itself and we assume this is also the case for the costs we found for electric buses today. To estimate infrastructure costs, we conducted a literature review that included review of costs suggested in BSIP and ZEBRA bids where available.
4. Using research from the paper looking into progress towards BSIP targets for each mayoral combined authority, we subtracted the number of EBs that have already been deployed or received funding from the number of buses needed by 2030 in each mayoral combined authority under our modelled scenario.
5. We then assume linear deployment of buses between 2023 and 2030 and apply the reducing CAPEX cost each year to estimate a total for each region and overall.
6. We then calculate potential public financing cost by assuming a hypothetical scenario where the government continues with its ZEBRA funding of up to 75 per cent of the difference between an electric bus and diesel buses and 75 per

cent of the cost of infrastructure between 2023 and 2030. We assume here that no subsidy funding goes to London (which, other than support for Covid-19, is self-financing in normal times) and none to Greater Manchester from 2025 onwards as their new bus franchise begins to come into action in late 2023 but still receives some initial public support as patronage continues to recover from the pandemic.

APPENDIX B.

ASSESSING LOCAL ACTION TO DECARBONISE BUS FLEETS

Region	BSIP funding?	ZEBRA funding?	Other funding	Target for ZEBs in BSIP	ZEB % to be achieved	Ownership model
Liverpool City Region Combined Authority	Yes – £12.3 million	No – Bid for £10.2 million with £12.5 million from LCRCA for 40 double deck hydrogen buses	£172.5 million from Transforming Cities Fund (TCF) £710 million from City Region Sustainable Transport Settlements (CRSTS)	Decarbonise 1,200 bus fleet by 2040	~1.6% (20 being funded by CA)	Privately operated, some buses owned by LCRCA
Greater Manchester Combined Authority	Yes – £94.8 million	Yes – £36.9 million with £12.5 million from GMCA and £37.2 million from bus operator for 170 electric buses	£312.5 million from TCF £1.07 billion from CRSTS	All buses electrified by 2032	~9%	Moving to a franchising model in 2023
West Yorkshire Combined Authority	Yes – £70 million	Yes – £23 million with £34 million from bus operators for 47 double deck and 64 single deck electric buses	£318.8 million from TCF £830 million from CRSTS	ZEB fleet by 2036	~9%	Privately operated, considering franchising model
West Midlands Combined Authority	Yes – £87.9 million	Yes – £30.4 million 100 double deck hydrogen buses and 24 articulated hydrogen buses with undisclosed third party contributions	£321.5 million from TCF £1.05 billion from CRSTS	ZEB fleet by 2030	~6%	Privately operated, considering franchising model
Tees Valley Combined Authority	No	No – bid of £60 million for converting 150 buses to hydrogen	£75 million from TCF £310 million from CRSTS	150 buses converted to hydrogen	0% (and not ZEB)	Privately operated
West of England Combined Authority	Yes – £105.5 million combined with North Somerset	No bid	£103 million from TCF £540 million from CRSTS	ZEB or ULEB fleet by 2035 at latest (ideally 2030), hopes for 250 electric buses by 2027 in Bristol (BBC 2022)	0%	Privately operated
South Yorkshire Combined Authority	No	Yes – £8.4 million with undisclosed amount from operators for 27 single deck electric buses	£170.5 million from TCF (Sheffield City Region) £570 million from CRSTS	ZEB fleet by 2040 at the latest	~2%	Privately operated
Cambridgeshire and Peterborough Combined Authority	No	Yes - £4.3 million with £16.5 million from CA and bus operator for 30 double deck electric buses	£95 million from TCF	ZEB fleet by 2030	~8%	Privately operated
North East Combined Authority	Yes – £163.5 million combined bid with North of Tyne CA	No – Bid of £18.7 million with total cost of proposal £41.1 million for 73 electric buses	£208.5 million from TCF	ZEB fleet by 2035	0%	Privately operated
Norfolk County Council	Yes – £49.6 million	Yes – 15 single deck electric buses	£38.3 million (for Norwich)	90 of buses to be Euro V, Euro VI or zero emission by 2027	n/a	Privately operated

Nottingham	Yes – £11.4 million	Yes – £15.2 million with £18.8 million from Nottingham City Transport for 78 single deck electric buses	£8.3 million from TCF (with Derby)	ZEB fleet by 2030	~25%	Municipally owned and operated
Coventry	No	No	£50 million from All-Electric Bus Town competition with £60 million from bus operator for 130 electric buses	300 EBs by 2025	~43%	Privately operated
Leicestershire	No	Yes - £19 million with £25.6 million from operators and £2.2 million from city council for 68 single deck and 22 double deck electric buses	£40.3 million from TCF	Short-term target of all buses Euro VI by 2025	~30%	Privately operated
Blackpool	Yes – part of a joint submission for £34.2 million	Yes - £19.6 million with loan from council and sale of Euro VI stock for 57 double deck and 58 single deck buses	No	Introducing an ULEZ in town centre by 2027	~58%	Municipally owned and operated
York	Yes – £17.4 million	Yes – £8.5 million with £10.5 million from bus operator for 44 single deck electric buses (adding to 33 existing EBs)	No	ZEB fleet in city by 2025, Euro VI in inter-urban rural services by 2025		Privately operated
Oxfordshire	Yes – £12.7 million	Yes – £32.8 million with £43.7 million from bus operators for 159 electric buses	No	Introduction of a Zero Emission Zone by 2035	n/a	Privately operated
Cardiff	n/a	n/a	£8 million, including £5.7 million from DfT for 36 electric buses (Thomas 2022)	ZEBs by 2035 across Wales (Deakin 2022c)	~15%	Municipally owned
Newport	n/a	n/a	£2.8 million from DfT with £15 million invested by Newport Transport for 16 electric buses adding to 16 already in place (Searle 2021)	Expectation for whole fleet of approximately 100 buses to be electric by end of the year (Grice 2022)	~33%	Municipally owned
Belfast	n/a	n/a	£74 million from NI Department for 80 electric buses and 23 hydrogen buses	Metro services in Belfast to be ZEBs by 2030	~40%	Publicly owned and operated by Translink
Glasgow	n/a	n/a	£18.6 million from ScotZEB for First Group in Aberdeen and Glasgow	Low emission zone to be introduced in 2024	~40% of First Scotland's fleet	Privately operated
Edinburgh	n/a	n/a	£1.7 million from SP Energy Network's Green Economy Fund for four double deck electric buses	Aim for majority of buses purchased from 2024 to be zero emission	n/a	Municipally owned and operated
London	n/a	n/a	Investment from TfL for 950 zero emission buses on the road or on order	ZEB fleet by 2034 (SMMT 2022)	~10%	Franchise model

Source: IPPR analysis of BSIPs and: BBC News 2022; Grice 2022; Deakin 2022a; Deakin 2022b; Deakin 2022c; CBW 2021; Jenkins 2022; Arnold 2022; DfT 2022i; Intelligent Transport 2022; DfT 2021c; Corr 2022; DfT 2022d

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