

Written evidence submitted by Arup (EVP0105)

About Us

[Arup](#) is an independent firm of designers, planners, engineers, architects, consultants and technical specialists working across every aspect of today's built environment. Our aims and values underpin everything we do and we are passionate about supporting the transition to zero emission vehicles both in the UK and overseas, in an equitable and accessible way.

Our Experience

In the UK, we are working closely with clients including [Department for Transport, BEIS](#), [Welsh Government](#), [Highways England](#), Transport for Greater Manchester, Heathrow Airport, South Yorkshire Transport Executive and others to help define and support the strategy and role out of EV charging infrastructure and fleet transition in different settings on the UK road network. We undertook the analysis for DfT and BEIS that supported the £1 billion fund being established. We also work with clients in the UK to develop fit for purpose road pricing schemes, including Dartcharge and [Manchester Clean Air Plan](#).

Internationally we are working with governmental clients to introduce national road user charging schemes, including those in The Netherlands, Ireland, New Zealand and Australia. Our experts are both practitioners and thought leaders in this space, with recent publication examples including the [role of hydrogen](#), [why mobility pricing is now coming of age](#) and our [thoughts on next generation mobility pricing](#).

Please feel free to contact us for further information about anything contained in this response.

Key points of our response

Road pricing

- A convergence of factors (Covid-19 impacts, decline in fuel duty, achieving GHG targets), means there is a limited window of opportunity now to implement a national approach to road pricing that will ensure the UK is well positioned for the next generation of economic growth.
- We believe technology is no longer a barrier to creating a national road pricing strategy that allows for local flexibility. A new national pricing mechanism should have a common set of parameters, enabling interoperability and a simple user experience across the country, but allowing for some devolution of responsibility to local authorities to make adjustments which reflect their needs.
- A new national system cannot be implemented in isolation and must be part of a balanced approach which includes incentivising desired behaviours. The public should be clear on the benefits of the system and how revenue generated through road pricing is being hypothecated to achieve economic and climate objectives.

Accelerating the shift to zero emission vehicles

- We believe a successful transition to ZEVs in the UK is feasible by 2030, but overcoming the following challenges at pace will be key:
 - Charge point access & experience: Destination and on route charging (rather than at home) will be crucial to support uptake and there is massive opportunity to support and encourage better provision at transport hubs, retail

outlets and in city centres. Charging should be safe, convenient and affordable, with grants extended to the second hand EV market.

- Managing energy demand: Finding ways to better match clean energy generation with demand from EVs by strengthening the local power distribution system is key. We shouldn't be trying to replicate the current ICE re-fuelling experience as it doesn't allow for the smooth demand of energy across the day. Instead, providing provision for people to charge their vehicle when it is parked at a transport hub, retail or leisure venue will support better demand management as well as a more equitable, affordable and convenient experience for drivers.
- Encouraging bus fleet conversion: The deregulation of buses is hindering the move to net zero fleets as there is little financial incentive to convert to zero emission currently, or for transport and local authorities to mandate the use of these vehicles locally.

Part one: Accelerating the shift to zero emission vehicles

The feasibility, opportunities, and challenges presented by the acceleration of the ban of the sale of new petrol and diesel vehicles to 2030:

Transition by 2030 is feasible and will bring many welcome benefits, but there are a number of social, technical, financial and regulatory challenges that need to be overcome.

Charging Access and Equity

The access and running cost of EVs has to be equitable and not only be the preserve of those with access to off-street charging. The chargepoint network needs to be well distributed and reliable so that it supports the needs of all drivers and their journey types. Achieving the extent and coverage of the required chargepoint network and supporting the power network will be demanding in the timescales – useful benchmarks could be made to the pace achieved in the upgrade of the optical fibre telecoms network.

We estimate that on average 30% of car owners do not have access to off-street parking and so cannot charge using their domestic energy supply. Currently, there are limited opportunities for charging EVs on residential streets and so the majority of drivers will need to charge on route, at an EV 'forecourt', or at the destination.

The Urban Opportunity

Linked to the challenge of adequate off-street provision, there is potential to leverage the changing use of urban spaces and buildings linked to the pandemic as well as emerging mobility and behavioural trends (hybrid working locations, flexible hours, changing consumer habits etc) to develop more holistic, dynamic and user-centric EV infrastructure strategies in cities. Changes to future travel patterns will also impact the uptake and demand for EVs, with young people driving less than previous generations, and a general shift towards personalised mobility accounts that reflect the more flexible way people are living and working. For example, the potential for electric car clubs in urban locations caters to the trend of using cars for specific journeys, and should be supported by EV planning for future generations.

Energy Demand

As the fleet transitions, the UK will also need to strengthen the local power distribution

system. In the longer term, if the whole car fleet converted, around a third extra electrical energy will be required – which of course needs to be clean energy, and so there are energy generation questions to be explored. There is an opportunity to better match future energy generation and need to incorporate EV energy demands, and potentially even vice versa where EVs feed back into the grid (although this is technically challenging).

Smart Charging

The management of peak charging times, rather than delivering the overall energy quantum is likely to be the major challenge. The introduction of some form of ‘smart charging’ could smooth out grid demand. We need to ensure that vehicles can be charged at home, but also that drivers take the opportunity to charge at their destination - offices, transport hubs or retail parks, so that energy demand can be smoothed over the day.

Customer Refuelling Experience

There is a significant opportunity to improve the reliability and financial transparency of off-street charging, and help make it a positive user experience. This will likely require regulation to improve on the current market-driven approach, which will see the less prosperous areas of towns and cities poorly served.

Financing, Regulation and Planning

Wrapped around all of the above areas is the investment funding and financing, which needs to be well understood by all actors and clearly defined within a regulatory environment. All this is feasible but requires a clear high-quality national planning framework to enable local implementation.

The actions required by Government and private operators to encourage greater uptake of electric vehicles and the infrastructure required to support them:

Chargepoint Deployment

Stakeholder support may be required to provide affordable charging at a range of ‘destination’ locations. Major retail companies have the parking real estate to deploy large numbers of chargepoints and it is provision of charging at these locations which will encourage adoption. It is important that chargepoint providers are not unduly restricted by distribution network operator (DNO) connection charges, which can often deter from investment.

Regulatory Framework

Linked to the above, to enable the supporting power system upgrades it is important that OFGEM has a clear and transparent mechanism for incentivising DNOs to invest where appropriate.

Planning Frameworks

Each major town and city should have a clear plan that ensures adequate and affordable EV chargepoint coverage. The format and content of these plans should be comparable so that investment needs can be compared across regions and support meaningful discussions. The plans should use repeatable methods of calculating needs and use a recognised set of delivery mechanisms, whether private or public. The planning framework should be set centrally to support this.

Customer Incentives

A continuation of the grants available to bring the cost of EVs in line with that of ICE vehicles – it has shown to be a hugely effective policy to date. Grants could also be offered to help people purchase second hand EVs. Thought should be given to the market dynamics of the second hand car market as we approach the 2030 date to ensure the value of second hand ICE's is attractive to those offering part exchange trade-in deals for EV buyers.

Public Communication & Education

Better communication around the second hand EV car market and the viability of using a second-hand car is needed. There is a public perception that batteries have limited life and buying a second-hand car and battery might involve extra expense to change the battery at a later date.

Manufacturing & Supply Chains

The manufacturing sector will need support to transform approaches and practices across the whole supply chain, in line with a greener industrial strategy.

The particular challenges around decarbonising buses and how these should be addressed:

Lack of Incentives

There is currently little incentive for bus market operators to convert their fleets to BEVs: the buses are more expensive than their ICE equivalents, they may need to invest in a range of charging infrastructure both at the depot and on route, and there is no legislation to force the change. Perversely, some fleet operators make greater commercial gain from operating an inefficient fleet as their payment mechanism links to fuel usage. This contrasts to the approach taken in Europe, where at least a quarter of publicly procured buses will need to be zero emission by 2025.

In cities implementing clean air zones there is a commercial incentive for operators to move to low emission (rather than zero) buses as charges will apply. There is support to operators to enable the conversion of their fleets to comply with these emission standards. However, there is opportunity to help operators move directly to ZEVs rather than spending funds on cleaner ICE vehicles.

Deregulation

The deregulated bus market has led to a number of issues including the ability to accelerate the uptake of ZEV buses, as transport authorities have limited powers to mandate their adoption. Transport authorities have reported the issue of State Aid rules creating a major barrier to enabling the transition to ZEV buses in deregulated markets. Cities are looking at bringing control of bus services back into local government control which may address both long-standing issues with integration of the network (across popular and loss-making routes) as well as the adoption of ZEV buses which otherwise will be slow.

Innovation Lag

Some market innovation is emerging as energy suppliers are taking ownership of the batteries with other organisations responsible for the bus itself. This may de-risk the transition to ZEVs to some extent but it is questionable whether it will bring about a rapid move to ZEV

buses without other support.

The Government's ambition to phase out the sale of new diesel heavy goods vehicles, including the scope to use hydrogen as an alternative fuel:

Technology Maturity

The electrification of the HGV sector is less mature than that of the passenger vehicle market with considerable debate about the most appropriate technology options for moving to a ZEV future. There are currently few electric HGV models available and the charging technology is not yet well established to support for their large energy requirements. Electric Road Systems are also being proposed as alternatives – these are attractive from a transmission efficiency perspective, but will be expensive to operate and maintain.

Hydrogen Economy

The hydrogen economy is still in its infancy and is likely only to represent economic good value once scale is achieved. We initially need centralised investment to pump prime the system and provide certainty of demand or de-risk the programme which will provide investor confidence for production and distribution. When viewed in this way it is clear that we need to consider hydrogen's use by other energy consumers, such as domestic heating. We need to address this vector in a co-ordinated way, where demand needs are aggregated, rather than sector by sector. Then the case for hydrogen becomes attractive.

Hydrogen Distribution Network

The feasibility of using hydrogen for HGVs depends on a well-planned network of refilling stations located at existing truck stops. Hydrogen production does not necessarily have to occur at these locations as it can be delivered by road, rail and later by pipeline if hydrogen is used within the gas distribution system to supply domestic heating. It is by definition a national challenge – and hence a national approach is required to plan and enable the hydrogen distribution network.

Dual Fuel Transition

A possible transition technology exists in the form of dual fuel systems involving the conversion of diesel vehicles to run hydrogen combustion. This conversion represents a fraction of the cost of new fuel cell vehicles and could stimulate the market for the production of hydrogen in the long term. The uptake of this technology depends on OEMs adapting their warranties to allow for this conversion – an area which would benefit from government support in resolving.

Part two: Road pricing

The case for introducing some form of road pricing and the economic, fiscal, environmental and social impacts of doing so:

Just as the UK has made fundamental changes to its system of taxation during previous periods of great economic upheaval, we have an opportunity now to fundamentally rethink the way we afford to maintain our road network, invest in sustainable transport and deliver against our ambitions to achieve net-zero as part of a 'green and resilient' economic recovery.¹

We believe there is a clear case for an intelligent approach to national road pricing that will ensure the UK is resilient and well positioned for the next generation of economic growth.

Roads as the economic backbone of the UK

With over 300bn annual vehicle miles driven in 2019 across nearly 250,000 miles of road, it goes without saying the social and economic importance of the road network to the vitality and success of cities, towns, and regions across the country.² The road network remains the dominant mode of travel across the UK, accounting for 84% of all passenger miles in 2019. The road network also remains the dominant mode for transporting essential good across the country accounting for 79% of all domestic freight miles.³ However, the costs of maintaining the road network and the negative impacts of increased vehicle miles are equally well-evidenced.

Achieving GHG Targets

Transforming the operations of our road network will be essential to achieving net-zero across all GHG emissions by 2050. While there is an ongoing push to reduce vehicle emissions, ultra-low emission vehicles (ULEVs) currently represent only 0.5% of all licensed vehicles in the UK and the road network remains accountable for roughly one-fifth of all domestic GHG emissions.⁴ While the ban on the sale of new ICE vehicles will help accelerate the transition to a cleaner fleet of vehicles, it is clear that to address the climate emergency further measures to influence behaviour change and encourage the uptake of ULEVs will be required.

Funding Gaps and Covid-19 Impacts

Beyond climate change, the UK is enduring another once in a generation emergency. The Covid-19 pandemic has not only created significant economic hardship across the country it has also had a cataclysmic impact on our public transport networks across the UK. Our recent report, produced in partnership with London First, focused on the future of [Transport in London](#) and identified TfL as facing a long-term funding gap of £2bn per year. The drastic decline in passengers is common across all local transport networks in the UK as well as the national rail network.

The 2020 National Travel Attitudes Survey found that two-thirds of respondents say it is likely that they will avoid using public transport if it is crowded once travel restrictions have been removed risking the substantial strides over the past decade cities across the country have made to encourage users to make sustainable travel choices.⁵ If this progress is reversed cities are likely to experience greater congestion and poorer air quality.

Ensuring an Equitable Recovery from Covid-19

[Research from the IFS](#) has found that the impacts of Covid-19 have led to a decline in median household income of 8%, but households in the poorest fifth found their earnings reduced by nearly double this amount (15%). We also know that those individuals on the lower end of the income scale are also most likely to rely on public transport and are less likely to have the

¹ <https://www.gov.uk/government/news/pm-commits-350-million-to-fuel-green-recovery>

² TSGB 2020

³ TSGB 2020

⁴ <https://www.ons.gov.uk/economy/environmentalaccounts/articles/roadtransportandairemissions/2019-09-16>

⁵ <https://www.ciht.org.uk/news/public-attitudes-on-travel-and-transport-during-the-coronavirus-published-by-dft/>

flexibility to continue working from home in the medium-term future. It is essential we continue to invest in maintaining an affordable public transport network, for all individuals, but particularly those who are unable to drive and rely on public transport to continue contributing to the economy.

Dynamic Road Pricing Opportunities

From research we have carried out at a local level with the Centre for London on [Next Generation Road User Charging for London](#) we looked at a dynamic approach to road pricing that would charge a typical driver in London making a 10km journey £1.50, equivalent to the cost of a London bus ticket. We found if targeted towards the areas of greatest congestion, and the heaviest polluting vehicles, we could reduce overall demand by 10-15 percent while facilitating up to a 20% reduction in road based GHG emissions.

Which particular road pricing or pay-as-you-drive schemes would be most appropriate for the UK context and the practicalities of implementing such schemes:

We believe that technology **does not** pose a significant barrier to introducing a national road pricing scheme in the UK. From our experience around the world, in-vehicle devices, smart phones, on-board units and an increasing fleet of connected vehicles means that the opportunity to introduce an intelligent distance-based road pricing system is possible.

Identifying the most appropriate scheme for the UK context requires reflection on the principles of good taxation including a strong understanding of public attitudes. There is also a balance to achieve between compliance and road side infrastructure – for example, smart phone solutions offer reduced road side infrastructure, but arguably lower levels of compliance. The 2010 Mirrlees Review identified four principles of good taxation which we consider in relation to road pricing here:

Neutrality - any form of taxation should seek to treat people equally and fairly, and in the context of road pricing should be reflective of their impact, including both in terms of the distance they drive and the emissions they produce, but also the prevalence of sustainable alternatives and the level of congestion. Evidence shows that car ownership is high among the two lowest income quintiles in the UK and in low-income car-owning households, cars provide 83% of their travel.⁶ We know that less affluent households are more likely to shift behaviour with the introduction of a new road pricing mechanism as they spend a greater percentage of their overall income on travel. It will be very important to understand the impacts on these groups and ensure that revenue generated by the introduction of a new mechanism is invested back into sustainable transport modes which serve the needs of communities most impacted.

Simplicity - any proposed national road pricing must be simple enough for a user to understand and use, a quality central to developing public support. However, a simple approach to pricing from a user perspective does not mean it needs to, or should be, blunt and incapable of reflecting a user's impact. In our work with Centre for London we proposed using a simple base charge per kilometre driven (ie: 10p) against which a multiplier was applied reflecting, the type of vehicle, the emissions class of the vehicle, and the area and

⁶ https://www.racfoundation.org/wp-content/uploads/2017/11/acceptability_of_road_pricing-walker-2011.pdf

time of day it was making a journey. A user should be able to understand clearly and quickly what a journey will cost them and why, but that does not mean that cost cannot be reflective of their behaviour.

Stability - it will be incredibly important to travellers that they are able to simply understand and move between cities without having to manage a complex web of disconnected road pricing systems. As we have written about when discussing our work with [Transport Infrastructure Ireland \(TII\)](#), seamless interoperability is key to an effective national system. This is something that is already under threat as we see an increasing number of disconnected local tolling, emissions, and congestion-based charges being introduced. A nationally interoperable system means people will be able to travel across systems and local area boundaries, without requiring different technology, payment arrangements and system administration.

Flexibility - a stable, interoperable national road pricing system does not mean a mechanism that cannot be tailored to desired local pricing specifications to encourage particular behaviours and reflect local ambitions. Furthermore, any approach to implementing national road pricing should consider long term flexibility to adapt to changing political, technological, environmental, and economic challenges. A road pricing system implemented in this decade should be able to adapt to fit the challenges of future decades as well as being flexible enough to adapt and reflect changing social and political challenges.

Beyond creating a system that effectively reflects these principles of taxation it will be essential to consider the appropriate governance structures that enables privacy and consumer protections. We believe this points to a system that is nationally regulated, structured, and maintained similar to existing social security and healthcare systems but allows for flexibility in how a charging mechanism is applied within different regions of the country.

The level of public support for road pricing and how the views of the public need to be considered in the development of any road pricing scheme:

Our work on the Manchester Clean Air Plan and with The Centre for London has identified three crucial components that are essential to helping develop public support:

- **A clear purpose and scheme which reflects this purpose, communicated well** - The Congestion Charge in London and the Clean Air Zones across the country are very clear in their name the purpose of their scheme. Any national approach to road pricing needs to be similarly clear and explicit in the impacts it is trying to deliver.
- **A focus on changing behaviours and investment** - A national approach must be focused on changing behaviours and hypothecating revenues for specific investments, rather than supporting general government funding. This approach creates a clearer relationship between the 'carrot' and the 'stick'. It will be essential that the public understand what they are getting in return. When introducing the scheme an initial wave of these investments should already be identified so the public can directly connect the road pricing mechanism with real world improvements e.g. cleaner air, lower congestion.

- **A good user experience** - We are living in an increasingly subscription-based service world (Netflix, Amazon, Deliveroo) and we believe similar principles could be applied to a road pricing system. People expect services which are easy to use and intelligent and this should be no different for a new road pricing scheme.

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Endnotes