

# Funding the Gap

Replacing the  
Vehicle Fuel Tax  
*with What?*





# Contents

|    |   |
|----|---|
| 04 | Foreword  |
| 05 | The global vehicle fuel tax issue               |
| 12 | Motoring taxes are important sources of revenue |
| 16 | Policy levers to enable a new model             |
| 23 | People and place                                |
| 26 | Example Personas                                |
| 32 | Potential impact of various policy levers       |
| 34 | A viable way forward                            |
| 35 | Contributors                                    |
| 36 | Key contacts                                    |

## Connect with WSP experts

We would be delighted to share more of our insights with you; please do get in touch with our team via [NewMobility@wsp.com](mailto:NewMobility@wsp.com) or contact the team members noted at the end of the whitepaper.

# Foreword



The movement of people and goods by road has been at the heart of society throughout human history. As roads became an integral part of social mobility and economic growth, the need to build and maintain them has placed significant demands on local and national governments. Countries around the world take different approaches to how they allocate funds to the building and maintenance of roads, which are paid for through general taxation as well as specific fuel and vehicle taxes, road-usage charging and other fees. Globally, the revenue from fuel tax on fossil-fuel-powered vehicles is in decline, driven by improvements in fuel efficiency, inflationary pressures and the imperative to decarbonize transportation.

As societies have developed, the interrelationship between an increasing need and desire for mobility and the sources of revenue to fund road infrastructure projects have been stable and well understood. The situation has become complicated with the continuing shift to low- and zero-emission vehicles in a changing mobility environment—reshaped by electric vehicles and other forms of new mobility (automated, connected and shared), micromobility (e-scooters, for example), encouragement for active travel and public transportation use, as well as an evolving understanding of place. As a result, fuel tax revenue is in decline, the costs associated with road infrastructure are increasing, and the way in which people need and want to travel is constantly changing.

Traditional solutions, such as simply applying a higher level of fuel tax, will no longer work; systems thinking that places people at the heart of the analysis and solution is required to effectively address these dimensions of change.

The impact of any change will be felt differently by people depending upon how they use and access transportation. Place becomes an important consideration; as an example, those living and working in rural communities will be impacted by changes in the vehicle fuel tax very differently from those who live in dense urban cities.

This understanding has led us to consider the policy levers that impact fuel tax revenues and how they could be applied to establish a fair and equitable solution—both for people and for governments, who are wrestling with the need to reduce greenhouse gas emissions while enabling society to prosper and flourish. Our thinking is based on a systems-led approach with people and place at the centre of efforts, considering varying social and economic circumstances. Our analysis provides examples of solutions that can be applied—both policy and technology—and the impact of each on diverse groups of people and stakeholders. The intention is to provide the basis, through case studies and personas, for the development of fuel tax replacement models that can break barriers and forge public acceptance of replacement taxation policy to support a greener and more sustainable world.

**Eric Peissel**

*Global Director, Transport and Infrastructure*

# The global vehicle fuel tax issue

## *Rethinking how to finance road transport infrastructure with the continuing shift to electric vehicles in a changing mobility landscape*

The latest report from the Intergovernmental Panel on Climate Change (IPCC), published in 2023, identifies that a 1.5 °C global rise in temperature is now almost certain, putting the world on a dangerous path to ecological tipping points.<sup>1</sup> Without significant climate action (Sustainable Development Goal 13), beyond what has been committed to within international climate treaties and nationally determined contributions, society will be facing ecological collapse, large-scale environmental damage and subsequent social hardship. Clearly, it is paramount that climate change and the concurrent need to decarbonize becomes the driving force for policy development around the world.

Transportation and mobility are critical to all societies—acting as the backbone and enabler for physical human and cultural connection and almost all global trade. But that comes at a cost—transportation is the second highest industry contributor to climate change globally (electricity and heating being the first).<sup>2</sup> The efforts from within the sector to decarbonize are essential to enable the sustainable growth of healthy and prosperous societies. One significant step is the move from fossil-fuel-powered vehicles to electric vehicles (EVs).

Road transportation generates significant tax income for governments globally, but the adoption of EVs as part of the solution to the climate emergency results in a significant drop in road-transport-related tax revenues. This whitepaper creates a narrative for potential solutions—appropriate for people and the places where they live, work, play and visit—to address declining vehicle fuel tax revenues.

Throughout the analysis, fuel tax describes a combination of transport-related taxes levied on vehicles: taxes on fuel, sales tax on vehicles and some form of annual charge per vehicle.

In the United Kingdom (UK), the term “fuel tax” typically reflects a combination of fuel duty (an excise duty applied to each litre of petrol and diesel at the pump) and a sales tax (VAT) added per litre. A vehicle sales tax and an annual tax for public road use (tax disc) are additional taxes.

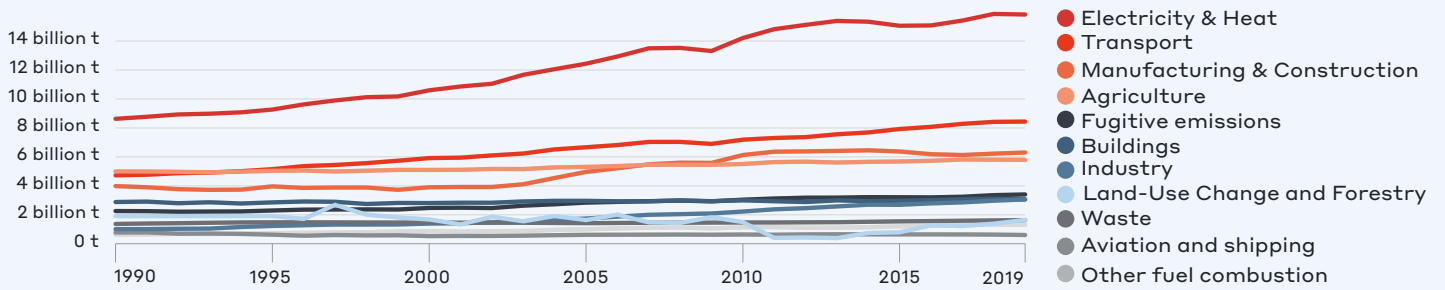
1 "Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," IPCC, March 2023.

2 Hannah Ritchie, Max Roser and Pablo Rosado, "CO<sub>2</sub> and greenhouse gas emissions," Our World in Data, accessed April, 2023.

## Road transportation and CO<sub>2</sub> emissions

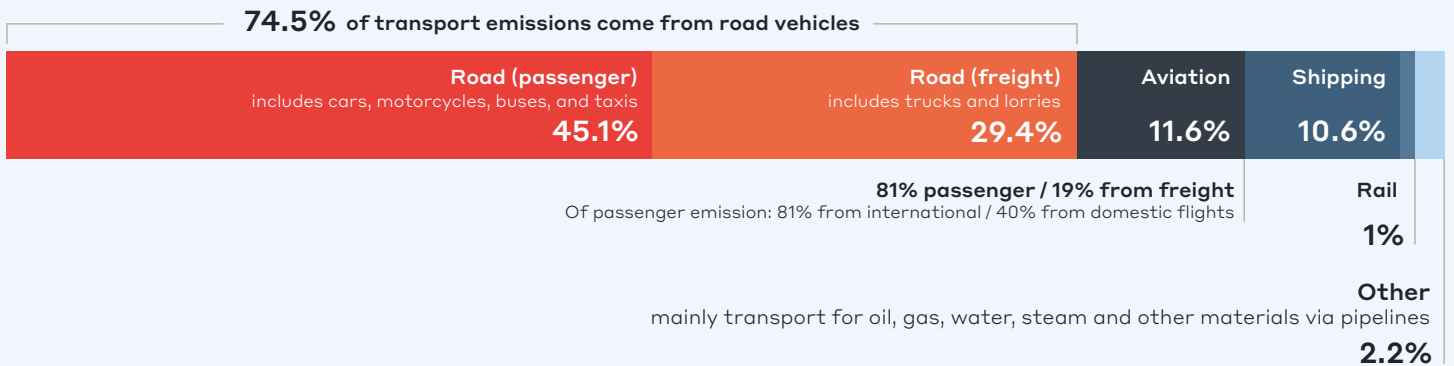
Transportation is responsible for 10-15 percent of global CO<sub>2</sub> emissions (and 24 percent of global energy-related CO<sub>2</sub> emissions) – Figure 1. This is largely due to the tailpipe emissions that result from burning fossil fuels in internal combustion engines (ICE) and the number of privately owned ICE vehicles around the world. The US Energy Information Association estimated (October 2021) that in 2020 the number of light duty vehicles (cars, vans) worldwide was 1.31 billion, forecasting a peak of 1.6 billion in 2038.<sup>3</sup>

Within the transportation sector, road transportation (both passenger and freight) remains the most significant polluter, accounting for 45 percent and 29 percent of global transport emissions respectively – Figure 2.



**FIGURE 1** Annual global greenhouse gas emissions (GHG) by sector, up to 2019

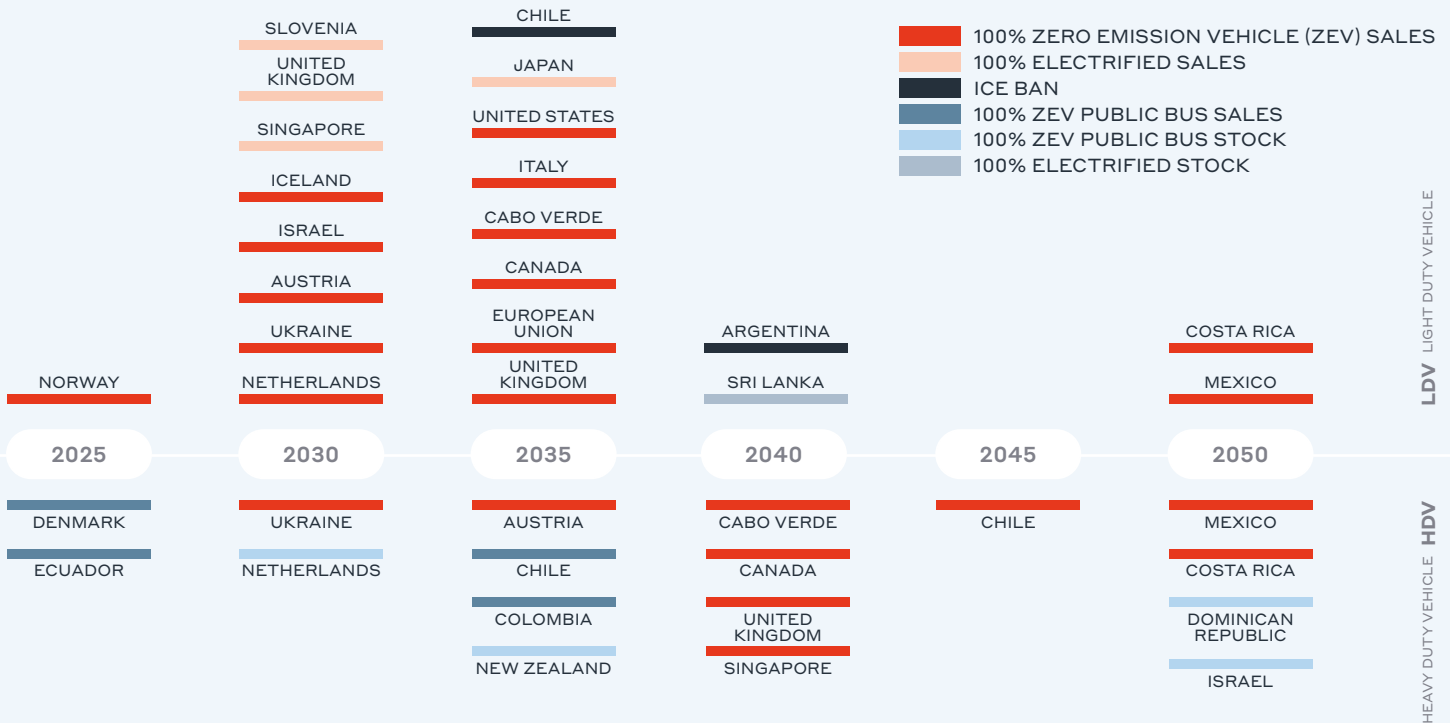
Adapted from: Hannah Ritchie, Max Roser and Pablo Rosado, "CO<sub>2</sub> and greenhouse gas emissions", Our World in Data, accessed April, 2023.



**FIGURE 2** Global distribution of emissions from transport in 2018, by mode.

Adapted from: Hannah Ritchie, "Cars, planes, trains: where do CO<sub>2</sub> emissions from transport come from?" Our World in Data, October 06, 2020.

<sup>3</sup> "EIA projects global conventional vehicle fleet will peak in 2038," *Today in Energy*, U.S. Energy Information Administration, October 26, 2021.



**FIGURE 3** Global zero-emission vehicle mandates and ICE bans, policy developments

Adapted from: [Global EV Outlook 2023: Policy developments](#), International Energy Agency, accessed June, 2023.

### Road transportation fuels growth

Road transportation, as a means of moving people and goods, has become the backbone of economic and societal growth around the globe. From informal tracks that link settlements and enable trade, to the sophisticated highway and freeway networks that transport hundreds of thousands of people and tonnes of goods in buses, cars, vans and trucks.

Transport activity is expected to more than double by 2050.<sup>4</sup> It is vital that this rapid expansion of the transportation sector is founded upon zero-emission modes, to reverse the trend of increasing GHG emissions from this sector. Many governments around the world have sought to gain control over transportation emissions by placing limits on the sale of polluting vehicles and mandating zero-emission modes of transportation (Figure 3). These policies are having a positive impact on the sale of EVs and other alternatively fuelled vehicles, and it is crucial this trend continues.

Incentives have seen the greatest success in China, Norway, The Netherlands and in the US state of California. In Norway, it is now cheaper to own and run an EV than an ICE vehicle. This has been achieved by a combination of measures, including exempting EVs from the high sales taxes and registration fees that ICE cars face, and relatively high fuel prices—a feat not yet achieved in many countries. The Netherlands' heavy investment in EV charging networks has bolstered the country's EV market share, and California's high fiscal incentives and strong zero-emission vehicle (ZEV) mandate ensure the state leads most countries in EV sales.<sup>5</sup> The EU, in 2023, voted to approve a law that bans the sale of petrol and diesel vehicles from 2035.<sup>6</sup> The UK government has mandated the same, but by 2030, with a similar ban for hybrid vehicles by 2035 and heavy goods vehicles (HGVs) by 2040.<sup>7</sup>

<sup>4</sup> [ITF Transport Outlook 2021](#), The International Transport Forum, Organisation for Economic Co-operation and Development (OECD), 17 May, 2021.

<sup>5</sup> Nic Lutsey, "Transition to a global zero-emission vehicle fleet: a collaborative agenda for governments," [The International Council of Clean Transportation](#), September 2015.

<sup>6</sup> "Revision of CO<sub>2</sub> emission performance standards for cars and vans, as part of the European Green Deal," [A European Green Deal](#), European Parliament, accessed April, 2023.

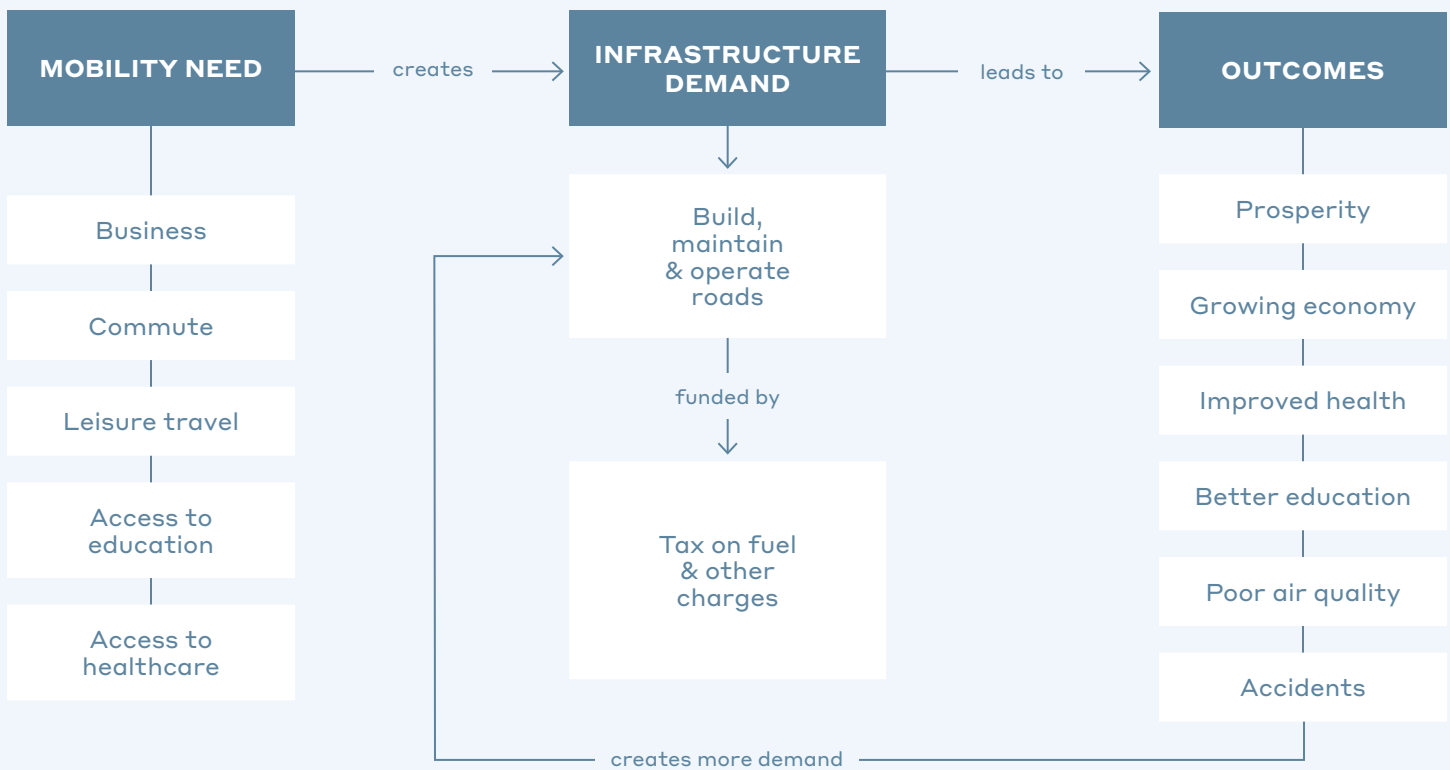
<sup>7</sup> "Transitioning to zero emission cars and vans: 2035 delivery plan", UK Government, accessed April, 2023.

Roads are likely to remain an essential component of transportation and continue to enable mobility within a net zero economy. Many road network operators are developing their own net zero strategies and plans setting out how they will enable and facilitate the move toward net zero economies. These plans tend to prioritize improving existing roads rather than delivering extensive new roads or carriageway widening—due to the significant investment of embodied carbon in the development of the road network in the first place. In the UK, the National Highways plan for net zero, published in 2022, presents three pillars where carbon use and emissions will be reduced: corporate activity, maintenance and construction, and road users.<sup>8</sup> The National Highways plan considers net zero road user emissions to be achievable on its roads by 2050, which, in turn, will support nature and communities in proximity to the strategic road network.

### Paying for roads

Road networks have, to date, developed via a linear path. In that historic model, a route becomes established through need, then formalized by building a road, which needs to be maintained; as demand increases, further capacity is created (Figure 4).

The building, maintaining and operating of roads is funded, in general, by government from general taxation. Those who own and use vehicles on the roads contribute in a variety of ways (Figure 5); however, this simple, traditional, relationship is changing fundamentally. The need to decarbonize road transportation means that global revenues from motoring taxes are in decline. Motoring taxes are considered more fully in the next chapter—A complex problem.



**FIGURE 4** Traditional linear relationship between road use and funding



**FIGURE 5** Motoring taxes come from a variety of sources

<sup>8</sup> "Net zero highways Our 2030 / 2040 / 2050 plan," National Highways, accessed April, 2023.



## Emergence of a more complex system

As the mobility landscape undergoes fundamental change, the relationship between funding roads and road use is no longer clearly understood. Disruptive factors such as active travel and EVs have combined to add complexity to the previously accepted system (Figure 6), creating additional demands while reducing the available funding (from fuel taxes).

Many governments are encouraging more active travel, especially in urban centers—to promote healthier living and wellbeing, improve air quality, improve road safety and reduce reliance on motorized

transport—to make places more liveable. The advent and uptake of net zero mobility options, including e-scooters and e-bikes, for deliveries as well as personal use, is changing the modal split on streets.

A corresponding paradigm shift is needed, one that envisions shaping mobility landscapes to support ongoing changes in people's behaviour, activities and needs.

Given the multiple interfaces, causal links and dependencies that comprise a complex system, a change to one element can have far-reaching consequences around and within the system itself. Figure 6 illustrates some of the complexity that has been introduced to the system.

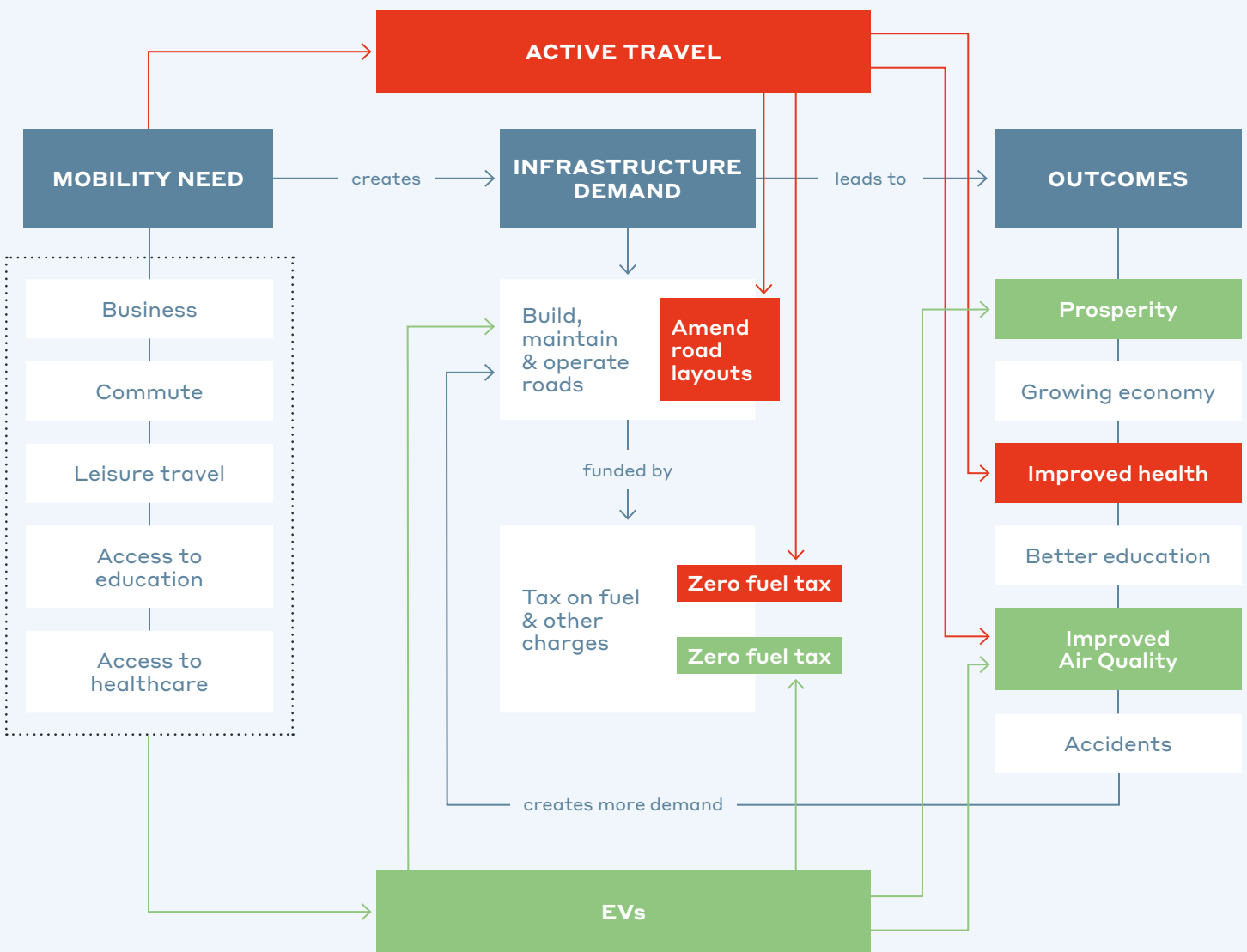


FIGURE 6

Moving from linear to dimensional: balancing tax and mobility has become more complex; active travel and EVs have added complexity to the traditional system. Compare to the traditional relationship, Figure 4.

## The impact of EVs on fuel tax

Globally, the numbers of battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) have increased dramatically over recent years (Figure 7), reducing government income from fuel taxes.

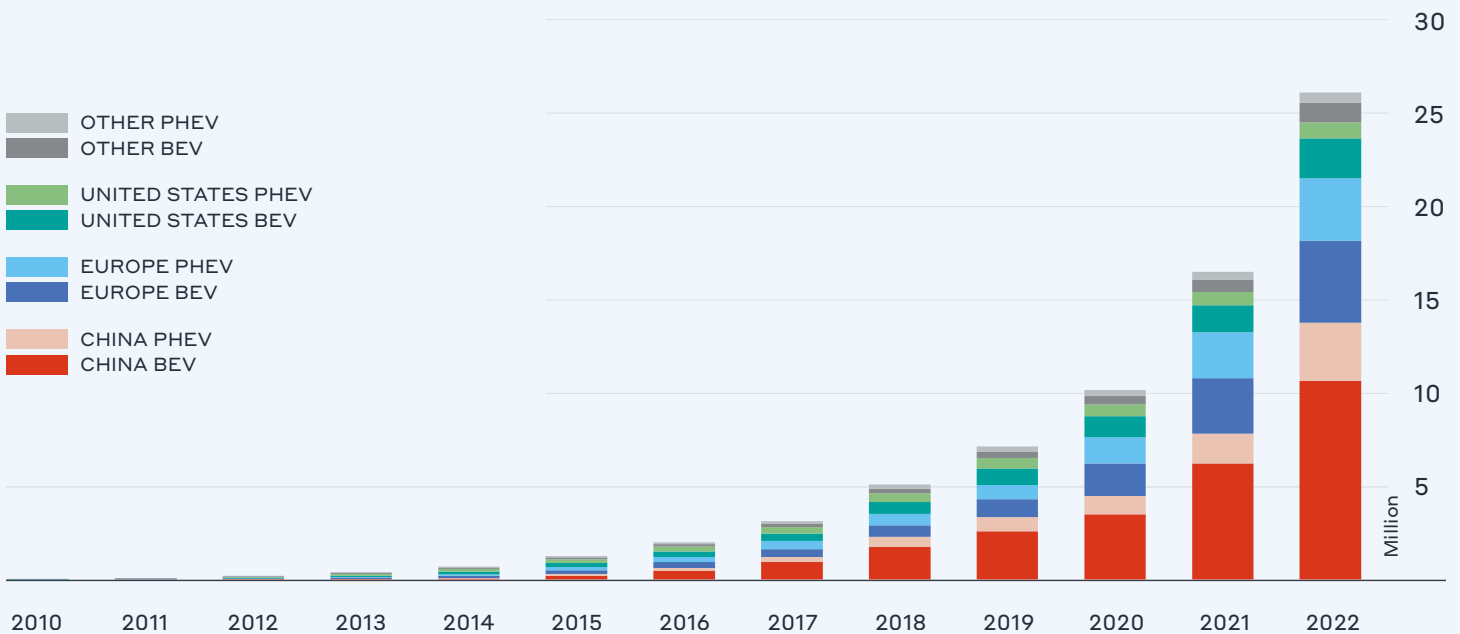
In the UK, fuel duty (levied on purchases of petrol, diesel and variety of other fuels) and vehicle excise duty raise circa £35 billion (~ CAD 61 billion) a year, approximately 20 percent of that revenue is used to maintain and develop roads.<sup>9</sup> Neither fuel duty nor vehicle excise duty are currently levied on EVs; therefore, the policy to ban the sale of new petrol- and diesel-powered cars by 2030 (with HGVs) to follow by 2040) would reduce potential tax revenues from motor vehicles to near zero over the next 20 years, if the current tax regime remains unaltered.

A partial solution would be to align taxes on vehicle sales and annual charges for EVs with the equivalent ICE vehicles, creating a like-for-like replacement. Norway is now gradually changing the established zero-tax on EVs given the increasing share of EVs in the vehicle fleet; the tax on EVs today is approaching the same level as that of ICE vehicles as the government can no longer afford to provide this level of tax break.

However, this sales tax on EVs does not deal with the loss of tax on petrol and diesel and cannot easily be substituted by a tax on electricity used to charge an EV.

Separating the sale of electricity between domestic use and EV charging is not feasible, although electricity purchased from public EV-charging points is subject to sales tax in most countries. In the United States, United Kingdom and Australia, off-peak tariffs are available and EV charging at those times is encouraged, but electricity used to charge EVs cannot be separated from electricity used to power domestic appliances during those periods. There is no simple like-for-like replacement.

Policies that enable decarbonization are reducing revenues from motoring taxes. The choices for administrations are either to accept that reduction and reduce public services or use other charges to plug the gap. The challenge is to replace those taxes in an equitable way that enables sustainable economic growth.



**FIGURE 7** Growth in electric vehicles

Adapted from: [Global EV Outlook 2023: Catching up with climate ambitions](#), International Energy Agency.

<sup>9</sup> "Road pricing," Fourth Report of Session 2021-22, House of Commons Transport Committee, UK Parliament, 04 February, 2022.



## Maintaining roads

While some governments legally separate income from motoring taxes for expenditure on road maintenance and construction (known as ‘ring-fencing’), there is no universal link between fuel taxes and the costs of building or maintaining roads. Irrespective of whether these funds are ring-fenced or hypothecated, an overall reduction in government tax income is likely to lead to reduced government expenditure. In combination with rising costs for building and maintaining roads due to inflation, pressure is building on highway authority budgets and maintenance backlogs.<sup>10</sup>

In the United States, the revenues from motoring taxes are allocated to the Highway Trust Fund, which funds Federal transportation projects. The fund records inflows from revenues collected through excise taxes on the sale of motor fuels, trucks and trailers, and truck tires; taxes on the use of certain kinds of vehicles; and interest credited to the fund.<sup>11</sup>

The rapid expansion of road freight transport also has significant implications for road maintenance.

As vehicle fleets are decarbonized, transitioning to BEV/PHEV, the average axle weight is expected to increase, which can largely be attributed to the addition of a battery pack. This is most significant for HGVs where significantly larger batteries are required for long-distance travel and movement of heavy loads. The additional weight would add strain to road infrastructure and increase maintenance requirements.<sup>12</sup> Coupled with falling motoring tax revenues and road maintenance budgets, the condition of major roads around the world could deteriorate, constraining development and making driving a more dangerous activity.

When considering vehicle weight, it clearly is not just hybrid and electric HGVs that will be heavier than their ICE counterparts. EVs can weigh an average of 200-300 kg more than a petrol car.<sup>13</sup> For this reason, in Norway the current (2023) taxes and fees stand at 25 percent VAT for the vehicle fee above 500,000 Norwegian Krone (NOK) (~ CAD 66,000), as well as a “vektavgift” [weight fee] of (~ CAD 16) per kg the car weighs over 500kg.<sup>14</sup>

10 [Dominic Browne, “ALARM Survey 2023: The maintenance backlog hits record £14bn,” \*Highways Magazine\*, accessed April, 2023.](#)

11 [Congressional Budget Office, \*Highway Trust Fund Accounts\*, accessed June, 2023.](#)

12 [John Low et al., “The hidden cost of road maintenance due to the increased weight of battery and hydrogen trucks and buses—a perspective,” \*Clean Technologies and Environmental Policy\*, 05 December 2022.](#)

13 [Gareth Herincx, “Electric vehicles: an automotive expert debunks common myths”, Admiral, accessed July, 2023.](#)

14 [“Skatter, avgifter og toll 2023: Proposisjon til Stortinget \(forslag til lovvedtak og stortingsvedtak”, Det Kongelige Finansdepartement, Finish Government, 30 September 2022.](#)

# Motoring taxes are important sources of revenue

The first form of tax on vehicle use was introduced in the UK in 1909, enacted by The Finance Act (1910)—taking the form of a duty levied on petrol which was included in the price paid by the motorist at the pump. Fuel duty was replaced in 1919 by taxation on vehicle sales and an annual tax paid by the vehicle owner to allow its use on public roads (known as the tax disc<sup>15</sup>), and then reintroduced in 1928. Alongside sales tax on petrol and diesel, this creates four separate forms of taxation on driving. Similar measures exist across the globe with road transport forming an integral part of the taxation system in many countries (as described later in this chapter).

Globally, tax revenue from road transport has become an integral part of government income. The scale of income varies significantly—just considering revenues from fuel tax (Figures 8 and 9), income varies between 1-5 percent of government tax income (where information is freely available); revenue from general sales taxes on fuel and vehicles is additional to these figures. If fuel tax revenues are not replaced, this drop in fiscal income will lead to

significant and noticeable reductions in government tax receipts. In the US, 2020 fuel tax income was USD 53 billion (~ CAD 71 billion), representing 1.5 percent of general revenue,<sup>16</sup> and in the UK, 2022/23 fuel duties are estimated to raise £26.2 billion (~ CAD 45 billion).<sup>17</sup>

In California, the sales of EVs show a positive correlation to total vehicle registrations. With this trend set to continue and as automobile manufacturers move deeper into the EV market segment, California will be negatively impacted by the large reductions in state fuel tax from across the US.<sup>18</sup>

The transition to low- and zero-emission mobility due to climate change policies<sup>19</sup> and the resulting significant fiscal challenges from a decreasing fuel tax create a potential conflict between encouraging and accelerating decarbonization policy and the need to protect fiscal interests. This could potentially limit or slow down progress toward reaching net zero.

15 A paper certificate attached to the windshield to demonstrate that the annual tax for the vehicle had been paid.

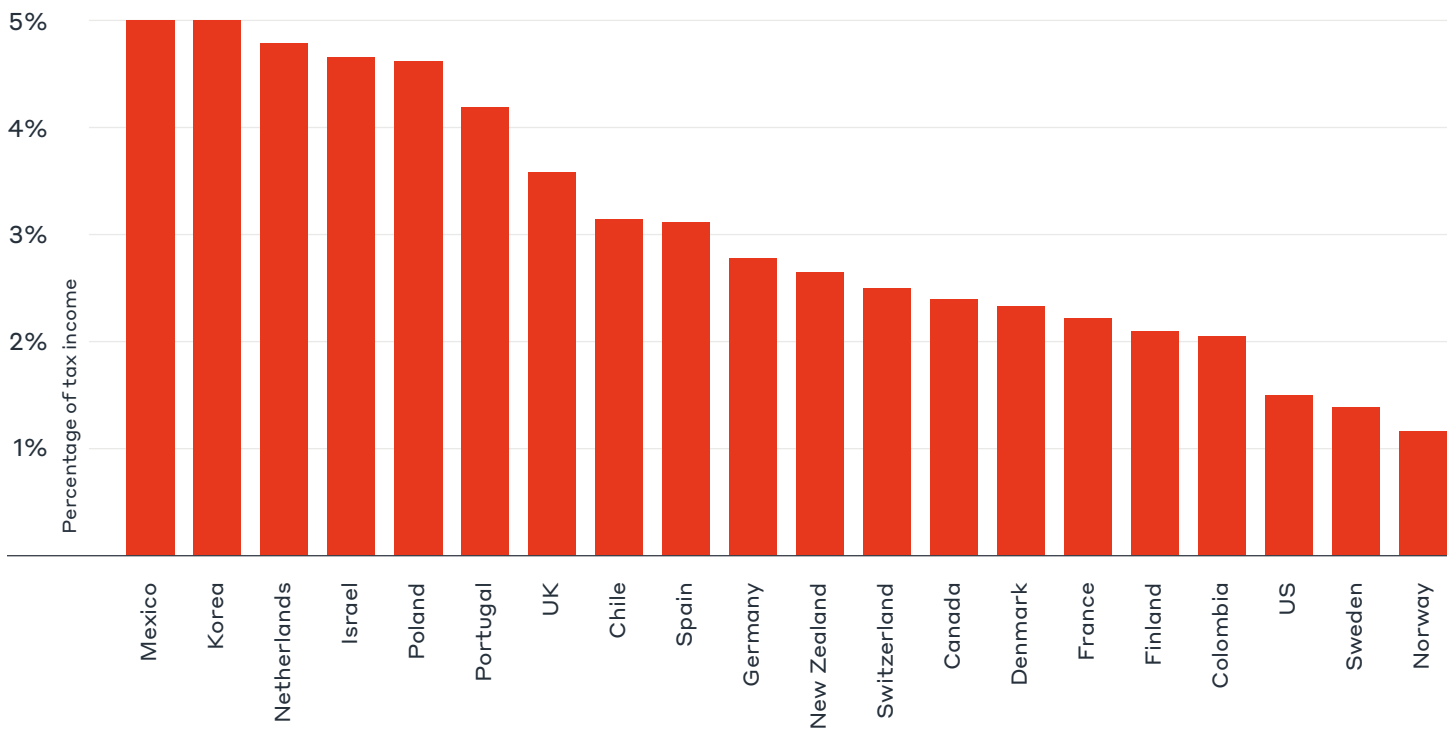
16 "State and Local Backgrounders: Motor Fuel Taxes," The Urban Institute, accessed June, 2023.

17 Anthony Seeley, "Taxation of road fuels," Research Briefing, House of Commons Library, UK Parliament, 24 June 2022.

18 Jennifer Ricciuti, "Impact of Lost Gas Tax Revenue Due to Sale of Electric Vehicles: Analysis and Recommendations for the 50 States", *Analytics Capstones*, 31 August 2020.

19 *Global EV Outlook 2023*, International Energy Agency, April 2023.





**FIGURE 8** Tax revenues from fuel tax as percentage of tax income, per country

Source: "Tax revenue", OECD Data, accessed 10 August 2023; "Net Energy Tax Revenues and Reform Potential" OECD Data, accessed 10 August 2023.

## A complex problem

The problem is a complex one with various sources of tax derived from motoring (also see Figure 5):

- 1 Tax on fuel (fuel duty and sales tax)** – Revenue from fuel tax is reducing across the world. As ICE vehicles become more efficient, they use less fuel per mile travelled, and EVs use no fossil fuels; therefore, users pay no tax at a fuel pump. Encouragements toward active travel also reduces vehicle miles travelled. In addition to fuel-specific taxes, many governments also apply general sales taxes further increasing fiscal dependency on fuel sales.
- 2 Vehicle sales tax** – Incentives to purchase EVs result in less sales tax either through subsidy, grant or zero-rate taxes. Reducing or removing incentives risks a slowdown in purchasing a more expensive (like for like) EV and could result in a reverse in the decline of ICE vehicle sales. This is a sunk cost that applies to the first purchaser of a vehicle.
- 3 Annual vehicle tax** – An emissions-based approach reduces tax revenues. In the UK, the annual payment (vehicle excise duty) was changed in 2001 to reflect CO<sub>2</sub> emissions such that engines with the highest emissions attracted the highest charge. BEVs and PHEVs have been exempt from the annual tax in the UK, although the system is set to change in 2025 to a standard rate irrespective of fuel source or vehicle value. As this payment does not vary with use, there is no incentive to reduce miles travelled in any year.

Other charges are levied on motorists including parking charges, congestion charges, tolls and “benefit in kind” tax for company car users (UK).

## Administrative levels of taxation

A further complexity is where taxes are levied. In Australia, legal challenges are happening in the state of Victoria over taxes and fees for EV road users and to what extent different levels of government can levy a charge. In the United States, taxes are levied separately at local, state and federal levels. Taxes on the sale of gasoline and diesel are levied at both the federal level (18.4 cents per gallon for gasoline) and the state level (ranging from 8.95 cents per gallon in Alaska to 62.9 cents per gallon in California).<sup>20</sup> Car sales tax levies vary between states—for example, 2 percent in Alabama to 7.3 percent in California and 8.3 percent in Nevada.

## Incentives

EVs are currently more expensive to buy than their ICE equivalents—creating a barrier for many private buyers and users, even when purchased via a leasing arrangement. To combat this issue and bolster EV adoption rates, governments around the world introduced incentives to purchase EVs over ICE vehicles. Incentives for EV adoption have taken many forms, among them enabling EVs to enter bus/taxi lanes, direct grants and tax rebates to scrappage schemes for older ICE vehicles.<sup>21</sup> Both the International Energy Agency<sup>22</sup> and International Council on Clean Transportation<sup>23</sup> have identified the extent to which these incentives vary, and some governments have begun limiting or removing these incentives where EV adoption rates are growing. While initiatives and schemes such as these encourage the take-up of EVs in favour of ICE-based vehicles, they also add to the growing decline in vehicle fuel tax and sales tax from road transportation.

20 “FAQs: How much tax do we pay on a gallon of gasoline and on a gallon of diesel fuel?,” U.S. Energy Information Administration, accessed June, 2023.

21 “Scrappage scheme,” Transport for London, accessed April, 2023.

22 *Global EV Outlook 2023*, International Energy Agency, accessed May, 2023.

23 Zhinan Chen et al., “Asia-pacific passenger vehicle taxation policies and their potential to drive low-emission vehicle purchases,” January, 2022.

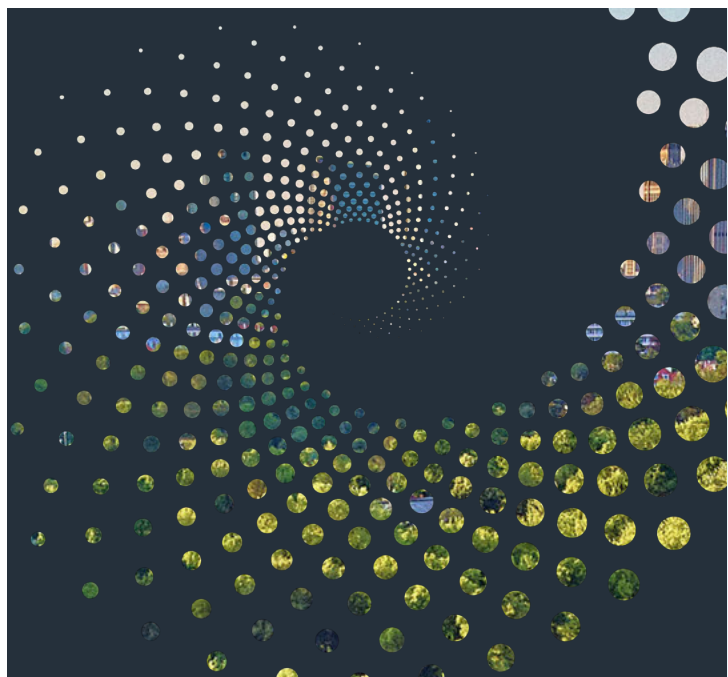
## Outcomes of change – fairness and equity

The Organisation for Economic Co-operation and Development (OECD) defines a tax as a “compulsory, unrequited payment to government.”<sup>24</sup> In return, taxpayers receive a level of public service, with the tax system as a whole designed to fund the services that a particular government considers appropriate and necessary for the society it serves. A general principle is that when taxpayers consider the system to be fair and reasonable, compliance (in paying tax) is relatively high.

The concept of tax equity is a measure of the fairness of the tax system based on an individual's ability to pay. There are two aspects of tax equity, horizontal equity and vertical equity. Horizontal equity—sometimes called “equal justice”—is concerned with equal treatment for those taxpayers in similar situations and with roughly equal ability to pay. Vertical equity is concerned with tax rates paid by individuals and families with different abilities to pay. Governments rely on a mix of taxes with different implications for horizontal and vertical equity. The system is complex and the net result in some instances is that the lowest-income families pay a greater share of their income toward taxes than the highest-income families—which is regarded as not being fair nor equitable.

As we have seen, fuel tax has become an integral part of government revenue at many administrative levels (e.g., federal, state and municipal)—and any change impacts the status quo. Changes to encourage the switch from ICE to EV tend to benefit higher-income households as they are most likely to be able to afford a new replacement vehicle. Household spending on mobility/transportation is a relatively greater burden on lower-income households.<sup>25</sup> As fuel tax reduce even further, their replacement will be scrutinized in detail to understand the distribution of cost and impact on different groups.

The UK's Transport Select Committee reported that potential replacements for fuel duty and vehicle excise duty would all introduce inequity for particular groups of people.<sup>26</sup> In addition, effective congestion management requires a demand- and usage-sensitive equitable system of motoring taxation. None of those potential policies would deliver an equitable system of motoring taxation predicated on usage and environmental impacts. Equity is explored in the chapter on people and place (p.23), considering the potential impacts of policy levers.



## New Mobility Next

WSP's whitepaper *New Mobility Next* reflects on the rapidly changing mobility ecosystem as influenced by technological and wider socio-economic change. The exploration encourages a focus on the needs of people, communities and places when planning, delivering and operating new solutions so that the benefits of decarbonization, digitalization, automation and associated business models are harnessed to maximum effect. All of this must be done while advancing equitable access and commercial sustainability. *New Mobility Next* pushes for a new paradigm, one where customer-centric and systems-led thinking are at the heart of a collaborative, cross-sectoral approach to an increasingly complex landscape.

[More here](#)

<sup>24</sup> Ruud De Mooij and Michael Keen, “Taxing Principles,” *Back to Basics Compilation*, IV. Economics in Action, International Monetary Fund, accessed June, 2023.

<sup>25</sup> Shruti Vaidyanathan, “Analysis: Gasoline Costs Consume Nearly 20% of Some Household Budgets,” *The American Council for an Energy-Efficient Economy*, 20 May, 2021.

<sup>26</sup> “Road Pricing,” *Fourth Report of Session 2021-22*, House of Commons Transport Committee, UK Parliament, 04 February, 2022.

# Policy levers to enable a new model

The choice for governments as they are challenged with declining revenues from vehicle fuel taxes is either to reduce public spending to match the decline or to raise revenue in other ways. There are two broad forms of policy lever available:

- 1 **Pay directly for use**
- 2 **Increased general taxation**

Taking a place-centric approach with people at the centre allows the policy levers to be applied with equity—as a local or national scale policy lever that works in one location may result in wholly different outcomes in another. Careful consideration through a system dynamics approach will help avoid unintended consequences of any change. Factors such as access to public transit/public transportation, shift working, existing road networks, and health and wellbeing create imbalances of need.

Policy levers also need to be designed to encourage the uptake of active travel modes and zero emission mobility, creating sustainable cities and places that are no longer reliant on private ICE vehicles. This is in conjunction with considering how new policies may create disproportionate impacts on various demographic groups, resulting in heightened inequalities between local areas and communities. The next chapter—People and Place—explores these issues in more depth.

## Pay directly for use

The tools and policy levers based on the premise that the user pays when they use the road include:

- **Tolls:** entry-based charging
- **Congestion zones:** area-based charging
- **Road usage charging (RUC):** distance-based charging
- **Annual charging and vignettes:** time-based charging

Not all levers are available to every authority, and the application of one lever in one place may have a completely different impact in another. The application of a toll to a road, bridge or tunnel is available to road network operators who own or manage such assets. Similarly, the application of a congestion zone is available only to authorities who have jurisdiction over an appropriate area and transport network.

Alternatives have also been proposed in some regions, such as a charge per mile travelled in an EV and changes to the given sales tax (presented later in this chapter).



## Tolls

Entry-based payment is the simplest form of charging road users and is based on access to a tolled facility such as a section of road, a bridge or a tunnel. Tolls are perhaps the oldest form of road user charge, dating back to turnpikes. They have frequently been adopted as a means of funding a new bridge, road or tunnel facility.

Tolling vehicles to use roads, bridges, tunnels and high-occupancy vehicle lanes can take place via toll booths, where vehicles must stop and the driver pays the toll with cash or a card, or via a wireless electronic toll collection system, or a mixture of the two. Toll booths can create a significant bottleneck to traffic flows during peak periods as they often require vehicles to join queues, stop and pay before continuing the journey. By utilizing on-road technologies such as Automated Number Plate Recognition (ANPR), Radio Frequency Identification (RFID) and Light Detection and Ranging (LiDAR), tolling can become an automatic activity that does not rely on physical barriers. Additionally, an automatic payment system can remove the psychological barrier to travelling on toll roads as the revenue collection is less intrusive making the user experience more seamless.

### CASE STUDY

## Central Texas Regional Mobility Authority

📍 UNITED STATES

WSP USA supported the Central Texas Regional Mobility Authority as their General Engineering Consultant for close to 7 years, and in 2019, unveiled the new Toll Road in Austin, Texas.

The improved toll road aims to alleviate heavy commuter congestion in South Austin and provide motorists with a faster, more reliable route to the city centre. WSP USA provided construction management and oversight services for the Mobility Authority. The project was designed and constructed with best management practices meant to protect the environmentally sensitive surrounding area. In addition to compliance and contract management, WSP USA provided technical support, utility and engineering coordination, and public involvement services.





## Congestion charging zones

Congestion charging, also known as cordon charging, levies a financial charge for entering a defined area as a means of reducing congestion in urban centres. Entry points to congestion charge zones are marked clearly—for example, with a white “C” in a red circle displayed on signposts and on road markings. Vehicles are identified using an ANPR camera system, which records entry to the zone. Failure to pay results in a fine. The revenue is collected either automatically through a pre-payment system or the road user arranges payment within a pre-defined time window.

Low-emission zones are a form of congestion charging where the most polluting vehicles are charged for accessing a defined area while “cleaner” vehicles are exempt from payment.

Congestion charging is a highly effective way to facilitate modal shifts away from privately owned ICEs, towards ZEVs and public transportation modes. Due to this, cities around the world are experimenting with congestion charging schemes to assist with other policy goals, such as environmental impact and public transportation improvement. London has both the Congestion Zone and the Ultra Low Emission Zone (ULEZ) in operation—vehicles that do not comply with the relevant Euro emission standard (therefore excluding EVs) are subject

to a fee to enter the zone. Both the Congestion Zone and the ULEZ have significantly reduced traffic levels and improved air quality for the benefit of human health, while raising funds for the city’s transport system.<sup>27</sup>

A Crit’Air sticker, based on the vehicle’s compliance with European emission standards, must be bought and displayed in order to drive through the Greater Paris and Central Paris permanent low-emission zones. Paris City Hall is also set to impose higher parking fees to SUV owners to reduce air pollution in the capital and support the transition to EVs (due to come into effect in January 2024).

### CASE STUDY

## Congestion Charge in Stockholm and Gothenburg

📍 SWEDEN

WSP was the lead consultant for the Swedish Transport Administration in the policy design for the congestion charge for both Stockholm and Gothenburg, as well as the evaluation of the policy effects in Stockholm. Congestion charging was implemented in both cities to reduce traffic flows, lessen transport-related emissions and improve travel times. Infrastructure investments and support for sustainable transport modes are made possible by congestion charging revenues. Sound congestion charging schemes must be practical, feasible and understandable for travellers, and should make clear where the raised revenue will be used. They must be based on solid scientific research and trusted transportation modelling, with quantified estimates of alternative policies.



27 “New report reveals the transformational impact of the expanded Ultra Low Emission Zone so far,” Mayor of London, London Assembly, accessed July, 2023.

## Road usage charging (RUC)

Under a RUC program, motorists are charged based on the number of miles they drive. RUC schemes can be used to nudge changes in behaviour and seek to reduce congestion and pollution—varying charges by time of day to manage demand or reducing (even to zero) the charge applied to vehicles with more than one occupant. High occupancy vehicle schemes encourage car-pooling, ride sharing and use of public transportation as travellers in those vehicles are exempt from the charge.

### Distance-based

A distance-based charging system relies on technology to record miles driven linked to the vehicle and the driver.

A well-established area-based scheme operates in Singapore—the Electronic Road Pricing (ERP) system introduced in 1998 to reduce congestion and keep roads free flowing. It is a technological upgrade from the earlier Area Licensing Scheme which levied a flat fee on vehicles entering the Central Business District.<sup>28</sup> Operating on roads prone to congestion, this system is based on tolling of arterial roads with ANPR and gantry sensors detecting the passage of vehicles with an attached in-vehicle unit.<sup>29</sup> The fee is dynamic and depends on the time of day, vehicle size and specific route. This usage-based taxation mechanism supplements the purchase-based Certificate of Entitlement, a monetary quota system that potential vehicle owners must enter to own a vehicle for up to a 10-year period.

Despite the technology being mature and available, there are currently no distance-based systems in operation that collect vehicle data through a satellite navigation system (e.g. GPS). The Finnish Government considered this approach when considering RUC implementation, but due to concerns around privacy and the likely negative public response, it was deemed too politically challenging to overcome and risked preventing the successful adoption of any form of RUC.<sup>30</sup> The specific mechanism of any RUC scheme must be determined based on the local circumstances, further explored in the chapter People and Place.

28 [“Electronic Road Pricing \(ERP\),” Ministry of Transport, Government of Singapore, accessed May, 2023.](#)

29 [“Off-Peak Car Scheme \(OPC\),” Land Transport Authority, Government of Singapore, accessed April, 2023.](#)

30 Tom James, “Te Ara Matatika | A Fair Charge for Better Cities,” The Helen Clark Foundation and WSP New Zealand, 05 May, 2022.

## CASE STUDIES

### Road User Charging America

#### UNITED STATES

WSP worked with RUC America to advance the research, development and demonstration of RUCs as a direct alternative to fuel tax revenue sources. The 10-year strategic plan drafted by WSP addresses the many challenges associated with RUC programs (such as building public acceptance and minimizing administrative costs) and provides ways to evaluate three scenarios for launching and maintaining RUC operations—“full replacement,” “hybrid deployment” and “fleet conversion”. It centres on providing executives with achievable policy enactment goals across four phases of development to create a successful RUC.

### Minnesota Distance Based Fee (DBF) Rate Setting

#### UNITED STATES

WSP served as the Minnesota Department of Transportation’s (MnDOT) technical consultant and managed the design and operation of its pilot in the Minneapolis-St. Paul metropolitan region. WSP further assisted the MnDOT in advancing its DBF program by conducting a policy gap analysis (to identify current best practice from live RUCs in Virginia, Oregon and Utah) and a whitepaper outlining a framework for basic rate setting and fleet segmentation methodologies suitable for the DBF project. The framework places equity and fairness as its primary foundation applying positive and deductive adjustments to base rate calculations to account for varying road user groups considering a range of objectives—income equity, geographic equity, accessibility and environmental outcomes. Using this method, the MnDOT can ensure the DBF is not only effective for revenue collection but also contributes to other state objectives.



## Annual charging and vignettes

### Time-based

Time-based charging is a form of road pricing that applies charges to vehicles, normally in addition to compulsory road tax, to use the road across a particular time period. It can take two main forms: flat fee, a vignette that allows unlimited use of the road network within the period it is valid, and graduated, where the fee differs depending on the time of day—e.g. when traffic levels are higher than usual through a particular area.

Vignette schemes are operated in Denmark, Luxembourg, The Netherlands and Sweden; in the EU, the schemes are governed by the Eurovignette Directive. While member states are not required to impose road tolls, where they do, they must follow the Directive.

Time-based charging is usually based on the average costs incurred per vehicle on a particular road network. This can be the environmental damage caused by vehicle emissions, or damage to the road infrastructure, principally related to vehicle weight. In Germany, HGVs are subject to a charge for using federal roads and link roads as they drive the most miles on average and have the greatest wear impact on the roads.

The fee is set to increase by the end of 2023 and is ring-fenced for road improvement/investment only on the “user pays” principle; revenue is equivalent to 25 percent of the national fuel tax revenue.<sup>31</sup>

The roll-out of a vignette charging system does not target congestion and air quality as much as other distance-based schemes, since a vignette restricted to motorways incentivises occasional users to drive on arterial roads/toll free parts of the network, not designed for heavy wear and traffic volumes.<sup>32</sup> Unlike a vehicle tax supplement, a vignette applies to all road users ensuring that foreign registered vehicles and short-term users contribute to the financing of road infrastructure.<sup>33</sup> In this way, time-based charges can be polarizing for road users, with short-term prices being relatively higher than longer-term annual prices making it cheaper for those who use the network more frequently and cause more wear and tear. The EU's recent directive will amend the fee calculations to become based on the distance driven rather than on a flat fee—to address this imbalance.<sup>34</sup>



31 Pölös Zsófia, “After fierce debates, Germany votes in favour of HGV road toll increase,” [trans.info](https://www.trans.info/), accessed April 2023.

32 and

33 Christoph Erdmenger et al., “Road pricing for cars in Germany?,” Umweltbundesamt, German Federal Environment Agency, April 2010.

34 “European Parliament approved reform of road haulage charging,” European Parliament, 17 February 2022.

## Alternative motoring taxes

### EV road duty

A form of replacement fuel tax is to create a charge for EV use—either via the cost of electricity or by a proxy surcharge on distance travelled, noting that segregating electricity used for EVs from domestic use poses significant challenges that have yet to be adequately solved.

In Victoria, Australia, the Zero and Low Emission Vehicle (ZLEV) RUC was introduced in July 2021 as a direct equivalent to the petrol and diesel Commonwealth fuel excise. This means that users of BEVs, PHEVs and hydrogen vehicles are subject to a financial charge per kilometre.<sup>35</sup> During the early stages of implementation there was significant public opposition, and plans for similar charges were ruled out or repealed by other states and territories. There are concerns that the ZLEV charge is premature and will slow uptake, discouraging user shift to ZLEVs. The ZLEV RUC is currently undergoing legal challenge in the High Court of Australia.<sup>36</sup> This situation illustrates the need for strong national level and coordinated policy decision-making to avoid polarization between regions and to ensure success of early-adopted RUC schemes.

The Resolution Foundation in the UK has recommended a “road duty” charge for EVs at a rate of 6 pence (+VAT) per mile,<sup>37</sup> suggesting that the data on use could be collected via GPS and charged monthly to the owner. The proposal relies on GPS data as a record of miles travelled. Due to varying data protection regulations, this solution could be difficult to implement and would require users to give explicit permission for the use of this personal data, something that more privacy-focused people may not willingly share.

### Vehicle ownership charge

An alternative to paying for vehicle use is an additional charge for ownership. In the United States, 32 states impose a special fee for EV registration that is typically in addition to the motor vehicle registration fee to counteract the lack of fuel tax payment. But contrary to intention for encouraging EV take up, this fee is often in excess of the standard state fuel tax, meaning drivers of efficient ICE vehicles are inordinately favoured. Some states have worked to address this by applying the registration fee to all vehicles. Virginia, Utah and Oregon have implemented voluntary RUCs which charge users per-mile travelled capped at the respective registration fee.

In the UK, Benefit-in-Kind (BIK) tax is a tax on employees who receive benefits or perks on top of their salary. This applies to employees that have a company car for private use or are purchasing a car through a Personal Contract Purchase salary sacrifice scheme. The amount of tax payable depends on the value (list price including extras and VAT, without the first-year registration fee and vehicle tax) and the CO<sub>2</sub> emissions. EV owners have historically been exempt from paying BIK tax on their vehicle to encourage uptake. The current BIK rate for an EV is 2 percent of the value. As EV sale prices decline and general EV market share increases, BIK tax revenues also decline—another aspect of tax revenue that is declining as a result of measures to decarbonize. To account for this, the BIK rate must continue to slowly increase, however the rate is fixed until 2025, then set to increase by 1 percent each year until 2028,<sup>38</sup> which was announced in the 2022 Autumn Statement. This transparency gives current and prospective EV owners clarity on the taxes they will have to pay, informing their decision-making—in favour of a low-emission vehicle.

35 “ZLEV road-user charge,” Vic Roads, Department for Transport and Planning, Victoria State Government (Australia), accessed April, 2023.

36 “Australian High Court test case set to determine the validity of Victoria’s electric vehicle tax,” Ashurst, February 23, 2023.

37 Gareth Roberts, “New report recommends ‘road duty’ for electric vehicles,” 2 June 2023.

38 “Road tax & company car tax on electric cars,” EDF Energy, accessed July, 2023.

## Increased general taxation

An alternative to any form of motoring tax where the user pays is a change to the general taxation regime. Such an approach would sever any implied link between motoring taxes and government spending on road transport. This increase in general taxation would also shift the tax burden so that those who do not drive or use the roads would effectively subsidize drivers.

Replacing the current motoring taxes within the context of general taxation in the UK, for example, the drop in government revenue is expected to be £13 billion (~ CAD 22 billion) by 2029/30, which is approximately equivalent to

- a 3.5 percentage increase in the basic rate of income tax (from 20 percent to 23.5 percent), or
- an increase in the main rate of VAT to almost 23 percent (from 20 percent), or
- a 50 percent rise in rates of fuel duties (noting that revenue from fuel duty will continue to decrease as ICE vehicles are replaced with EVs).<sup>39</sup>

<sup>39</sup> Anthony Seeley, "Taxation of road fuels," House of Commons Library, UK Parliament, 24 June, 2022.

## Adoption of any policy lever is not simple

Changes to road transport taxation policies should not undermine progress in modal shifts toward active travel and public transportation. The alternative needs to ensure that the perceived personal economic benefit from transitioning from ICE to EV is not lost as that would slow the uptake of EVs.

While standard policy levers and whole-journey tools exist to generate revenue to replace the "lost" taxes, it is clear that a simple and equitable solution does not exist. Adopting any of the levers or tools on their own may result in unintended consequences; while the levers and technologies exist to address the issue, the key to creating a sustainable solution is public understanding and acceptance. Without first understanding the potential and likely impacts of any change on people and places, it will not be possible to create a narrative that adequately explains both why the change is necessary and why it is the right solution for the particular location (national, regional or local level). Understanding the various causal links within the system is essential if any changes are to achieve the intended outcomes.



# People and Place

*How do we meet climate action goals and deal with the reduced revenue from fuel taxes in an equitable way?*



## People

Changes to motoring taxes can lead to strong emotional responses given these taxes have a direct and significant impact on daily activities and often form a major regular expense. This is clearly illustrated in France where changes to national fuel tax rates led to the Yellow Vest Protest movement (mouvement des gilets jaunes). However, opposition is not felt universally, and some populations are more receptive to motoring taxes than others. According to research by the Oliver Wyman Forum, people in Europe and the United States are less willing than people in China to accept limitations or additional costs on mobility.<sup>40</sup> However, within populations there can be a diversity in the levels of understanding, tolerance and the specific impacts of different approaches to taxation. Factors such as age, affluence and availability of alternatives to private car travel are important and influence perception of changes to any tax regime. The impacts are most keenly felt by those who have little choice but to own a car and particularly by those who can least afford car ownership.

Given the scale of the impact that motoring taxes have on individuals, it is important that amendments to these policies are cognizant of people's circumstances and general needs if they are to gain public support. One such angle for gaining support is education around the significant benefits for public health that total EV adoption could have, mainly due to improvements in local air quality. An analysis of the public health costs associated with ICE vehicle pollution conducted by the Electric Vehicle Council concluded the following: each EV that replaced an ICE vehicle in New South Wales, Australia, would save the local health service AUD 2,400 [~ 2,100 CAD].<sup>41</sup> The report notes this cost could be avoided entirely with a successful transition to EVs. Similarly, a study conducted by Garcia et al., for the University of Southern California showed that California's early adoption of ZEV has led to tangible benefits in air quality.<sup>42</sup> However, these benefits are currently limited to areas where ZEV adoption is greatest, which is within areas with high affluence and easiest access to education.

Taking a people-centric approach to policy development is vital; any proposals must consider the impacts on the diverse populations affected and include engagement with populations to inform decision-making. Social science insights indicate a democratic consultation process, which may include direct engagement methods such as citizen assemblies, can improve the likelihood of achieving consensus on controversial topics and increase the legitimacy of difficult policy decisions.<sup>43,44</sup> By engaging in a collaborative approach that involves citizens, consumers and stakeholders, the end solution to the fuel tax issue will be fairer, more widely accepted and therefore, more easily implemented.

40 ["China Willing to Pay Up to Make Traffic Flow," Oliver Wyman Forum, accessed April, 2023.](#)

41 ["Cleaner and Safer Roads for NSW," Electric Vehicle Council, June 2019.](#)

42 [Erika Garcia et al, "California's early transition to electric vehicles: Observed health and air quality co-benefits," \*Science of the Total Environment\*, Kerk School of Medicine University of Southern California, 02 February 2023.](#)

43 [Rebecca Sandover et al., "Contrasting Views of Citizens' Assemblies: Stakeholder Perceptions of Public Deliberation on Climate Change," \*Is There a New Climate Politics? Emergency, Engagement and Justice, Politics and Governance\*, 28 April 2021.](#)

44 [Ceilidh Welsh et al., "Why is it so hard to enact responsible change?," \*EMBO Reports\*, 09 March 2020.](#)



## Place

Place provides the context for where and how individuals travel. This provides a useful model for considering the potential impact of the change in fuel tax and any proposed alternative policy levers. There are significant variations of place that may influence the application and impact of new policies, such as settlement size, remoteness, coastal or inland, environmental protections and connectivity. However, for the benefit of this discussion a more aggregated approach to considering place has been taken.

WSP's experience in rural mobility, provides the basis for a methodology to classify regions into predominantly urban or rural, and to take into account geographical differences among them.

This methodology has been used in this paper to help formulate personas:

- Urban centre
- Suburban area
- Urban city/town centre
- Rural town
- Rural village and hamlets
- Remote rural locations

## Personas

Personas are a representation of consumers developed within the context of a study to enable the potential challenges and opportunities of individuals to be identified, and the impacts and benefits of a project or series of interventions to be assessed. Understanding what activities individuals will most likely engage in/with plays a central role in the development of personas. Do they need access to healthcare or education for example, or places of employment—these factors and more will vary according to the individual. Persona-based studies enable a human-centred design approach to be taken when considering systems, allowing users to be placed at the centre of decision-making and system design.

Ideally, personas are developed using extensive interviews and discussions with representative individuals and groups to ensure that they truly reflect the needs and pain points of people in that specific environment. For the purposes of this whitepaper, we have applied our experiences from other similar projects to develop a set of example personas and their potential responses to the various policy tools.

For this to remain manageable, we have restricted scenarios to six personas:

| Personas                         | Mileage     |                 |               |
|----------------------------------|-------------|-----------------|---------------|
|                                  | High        | Mid             | Low           |
| Remote rural locations           | Farmer Fred |                 |               |
| Rural village and isolated areas |             |                 | Retired Ruth  |
| Rural town                       |             | Manager Mel     |               |
| Urban city/town centre           |             | Recruiter Riley |               |
| Urban conurbation suburbs        | Nurse Neil  |                 |               |
| Urban conurbation centre         |             |                 | Finance Fiona |

The potential impact of various “user pays” charges on each of the personas is represented on the next page.

# Example Personas

## Farmer Fred



Fred is a sheep farmer in a remote rural location. His plot of land covers 5,000 hectares/12,000 acres. As a result of this distance and the spread of his livestock, Fred drives a lot in his line of work. He has his primary vehicle, a large 4x4, and an additional All Terrain Vehicle (ATV), which he uses on a day-to-day basis to access the remote parts of his land. He is knowledgeable about vehicles and repairs them himself when he can, so his vehicles can do many miles. For Fred, farming is a vocation and he gets little time off. He spends time in his community, but rarely goes further afield or to large cities.

**Location** Remote and rural

**Purchasing power** Very low



**Miles driven** Very high



## How charges will impact

### Tolls

Tolls are unlikely to have a major impact for Fred as he tends to stay in his local area.

### Congestion

Fred will not end up paying congestion fees. If he ends up in a city, he will have to pay a large sum as his vehicle is a more polluting type of vehicle.

### Distance-based

Fred would likely see a high bill if paying by mile, especially as his 4x4 has high emissions. A large fee for this would see Fred more likely to use his ATV or other modes that would not fall under the same schemes.

### Time-based

Fred is likely to not require paying time-based fees as he rarely drives outside of his immediate local area where time-based charges are unlikely to be applied.

## Retired Ruth



Ruth is a retiree living in a village in a rural area. Ruth is a nervous driver; her husband usually did the driving, but he passed away a number of years ago. The village Ruth lives in currently has a shop—and this is her lifeline. In addition to frequenting the shop to get essential goods, she uses the shop as a hub for socializing with other local people. Ruth occasionally drives to events and to see her children, mostly with a friend as she feels uncomfortable driving on her own. Ruth has a small two-door car which is cheap to run, but maintenance can be expensive. She would prefer not to drive, but the public transport in her area is infrequent. She is living on a small pension so has very little disposable income.

**Location** Rural isolated village

**Purchasing power** Very low



**Miles driven** Very low



## How charges will impact

### Tolls

Ruth occasionally uses motorways/freeways and a toll fee would have a large impact on her ability to go and see her family. The additional cost of using particular roads would make the journeys uneconomical for her.

### Congestion

Ruth would be unlikely to have to pay a congestion charge as she would be unlikely to drive into larger cities.

### Distance-based

While Ruth does not drive much, she would still be impacted by this payment. Any technological solution to recording miles or paying the charge would be difficult for her.

### Time-based

As Ruth's mileage is not consistent, an annual payment may result in a large bill at the end of the year which she may not be able to manage.

## Manager Mel



Mel lives in a rural town with her husband and four children. She is a shop manager in the town and works hours around her children's school and extracurricular activities as her husband is a tradesman and works long hours. Mel has a large people carrier so, there is room for the children, their equipment, and the dog. As the children have grown up, their activities and hobbies have taken the family farther and farther afield.

### Location

Rural town

### Purchasing power

Average



### Miles driven

Average



## How charges will impact

### Tolls

Mel and her family frequently drive up and down the motorways/freeways to one event or another and would likely have to pay a lot of money for the tolls.

### Congestion

Driving offers the family the most cost-effective solution as public transport is expensive and inconvenient for a family of 6 and their bags. As a result, congestion charges are likely to have an impact on the family if and when they visit areas with the fees.

### Distance-based

The family travels a lot of miles, though not as many as others due to mainly taking the longer journeys over weekends. However, driving is the only way for this family to get around, and they drive quite an old, inefficient vehicle. A tax on distance may well be less than the equivalent fuel tax.

### Time-based

Mel's family mainly travels at weekends, which could lower the cost of any time-based charges if off-peak/weekend travel is discounted. While money is not tight, the family could ill-afford to pay into an annual scheme or pay for an unexpectedly high cost, nor would it be financially viable considering they usually drive on weekends only.

## Recruiter Riley



Riley lives in a flat in the centre of a small city. They have been working in recruitment for the past few years since graduating. Riley commutes to an office in an out-of-town business park five days a week or goes to meet clients in person, and uses the train for longer journeys. Riley and their friends are big fans of climbing; as the only car owner among the friend group, Riley often drives their friends on weekend trips around the country to different events and locations.

**Location** Urban city centre

**Purchasing power** High



**Miles driven** Average



## How charges will impact

### Tolls

Tolls would be a large increase in expense for Riley. Their mileage around the country is often on main roads and charging for these would be an additional cost for them. However, as they usually drive with their friends, the cost could be shared.

### Congestion

As Riley drives into and out of a city centre, they'd be liable to pay for this frequently. Unless there was a discount for those who live within the city, this would be a large additional cost for them.

### Distance-based

Riley drives quite far with their friends, but has a small fuel-efficient car. Charging based on mileage would lead to a noticeable increase in the cost of driving.

### Time-based

As Riley drives for work five days a week and also travels long distances on weekends, they would face considerable time-based charges. Costs may be lower under an annual scheme, but this charge would unlikely be shared, increasing the cost of vehicle ownership for Riley.

## Nurse Neil



Neil works as a community nurse in a suburban town on the edge of the capital city. His role means he has to drive to see patients in the city and around his location. He drives an older estate car/station wagon on account of needing his car to take his children to school and various after-school activities. He often starts his working day at a hospital in the city to pick up the supplies and equipment he needs for the day. The amount he drives each day varies according to the patients he visits and how busy the roads are. He and his family occasionally go away to other parts of the country over weekends but often catch the train into the city for activities. They have been known to drive in in the evening as the trains to the suburbs are less frequent at that time.

**Location** Urban suburb

**Purchasing power** Low



**Miles driven** Very high



## How charges will impact

### Tolls

As Neil doesn't do much driving on motorways/freeways, he wouldn't be liable for many tolls as he uses non-arterial urban roads. However, as Neil uses his car with his family and his income is low, a fee for driving somewhere at the weekend would impact his and his family's decisions to make a journey.

### Congestion

Many of Neil's miles would be covered by a congestion charge; however, he is able to reclaim these costs from his employer. The process is far from straightforward, much like claiming mileage, and it would add a layer of admin. A charge would impact his decisions on social activities as it may increase the costs of trips into the city if they are not offset by cheaper/more frequent public transportation.

### Distance-based

Neil drives a long distance each year so would be liable for high charges. Neil already bills his work miles as some of his mileage would be paid by his employer. This scheme may be difficult to monitor, and it may be hard to verify all work-related miles.

### Time-based

A time-based scheme would cause problems for Neil as he drives a lot during the day and frequently during peak periods. The cost is reclaimable, but there would be an administration cost for this albeit less burdensome with an annual charge.

## Finance Fiona



Fiona works in a major financial hub for a global financial services firm. Typically, she commutes to her office during the week using public transport. However, she owns a high-end SUV which she uses occasionally on weekends to get out of the city or for small errands.

### Location

Urban centre

### Purchasing power

Very high



### Miles driven

Very low



## How charges will impact

### Tolls

Tolls would be ideal for Fiona as she uses her car infrequently and would only be paying for a small number of journeys on individual roads and tunnels on her route.

### Congestion

As Fiona lives in the centre of a city, she would be liable for a large amount to pay under a congestion charge. Despite not driving much, the fact that Fiona lives in the city means she would likely be paying more to drive, every time she did. While Fiona can afford this, she wouldn't feel it is fair.

### Distance-based

Fiona does not drive much, so any scheme that charges for distance is unlikely to impact her much.

### Time-based

Fiona tends not to drive her car at peak times so would be unlikely to pay much under a time-based scheme.

# Potential impact of various policy levers

The application of various policy levers to the personas demonstrates that the potential impact of any policy lever is different for each persona. Clearly, this is only a high-level assessment and a more detailed study would need to be undertaken with the details of how a particular scheme would operate in an area; alongside this would be a detailed development of each persona.

Any region, city, or country comprises a combination of place and personas which need to be considered and understood when designing any scheme. A clear understanding of the links within the system and the interfaces and dependencies involved is essential when creating a model of the system—using system dynamics will enable the potential impacts of any policy lever to be understood.

## Tolls

The personas demonstrate that tolling, as a solution to support revenue generation, is highly focused on location, only impacting road users who choose, or who have no viable alternative, to use the road, tunnel or bridge. Generally, tolls are applied to key arterial routes where the only obvious alternative to road users would be a safe, reliable, convenient and affordable public transit system, which is not always available. The burden of payment is therefore placed predominantly on residents and commuters with relatively negligible impact on visitors in comparison.

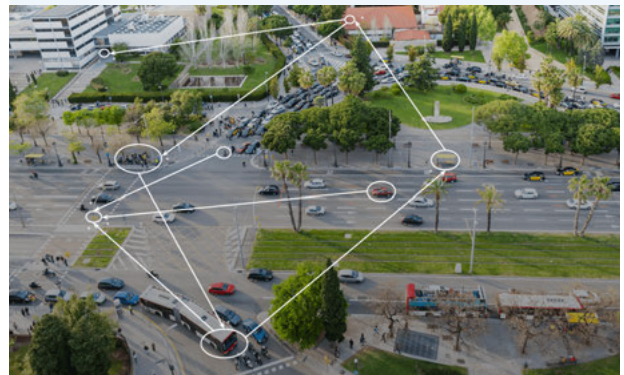
A rural/urban split is evident when considering tolls as an equitable solution. The higher populations in urban areas offer greater revenue collection opportunities leaving rural motorists with lower motoring costs than urban residents.

The financial and social impacts are only felt where driving occurs, but any tolling solution must take care not to sever potential social and economic links between areas. It is possible for tolls to lead to traffic displacement with road users making purposeful diversions onto less-used and less-maintained suburban or rural routes despite additional journey times.

## Applying System Dynamics

WSP's Scenario Planning Toolbox enables decision-makers to test how different assumptions can impact future transport in cities and places around the world. A pilot project with Southern California Association of Governments (SCAG) demonstrates how system dynamics brings improved understanding about the interrelationships between trends to advance decision-making.

[More here](#)





## Congestion charging zones

Similar to tolling, in that the personas demonstrate a strong geographical rural/urban split, congestion charging would introduce a charge that urban residents could not avoid by changing driving behaviour. While largely successful at raising revenue, congestion charging may introduce a class component to mobility reducing opportunities and the agency of less wealthy groups. Shift workers in lower paid roles require access to mobility often at hours when public transport is less available, requiring the use of a private car. The impact is felt considerably more than location-based tolling given that the charge can apply from the doorstep.

The equity of congestion charging as a revenue-based solution to declining fuel taxes is based on a secondary benefit in reducing traffic levels and local air pollution. If traffic levels are reduced considerably, this can in turn impact revenue collection requiring additional methods to keep consistent income. Therefore, any congestion charging scheme should not be solely relied upon for revenue collection but should target secondary aims over revenue.

## Distance-based

Distance-based road usage charging is effective in fairly distributing the costs of the road network to all users, ensuring that costs are paid proportionally to those who are responsible for them. This incentivises reductions in driving miles and therefore has direct positive benefits to the environment. Introduction of a distance-based charge has the potential to reduce traffic volumes and shift journeys to public transportation.

The personas indicate that people from rural communities are most likely to be adversely impacted by the distance-based charge. They have to make more frequent journeys, often of greater distance than those living in the centre of the town or city, as amenities may not be available locally. Under a distance-based charge, people may choose to reduce the number of journeys they make, increasing their reliance on, for example, their closest small village shop. Or they may choose to forego journeys altogether, especially in the case of trips undertaken for the purposes of shopping, leisure and holidays.<sup>45</sup>

If their car usage remained consistent, in the same way that road users from rural communities are likely to pay more under a distance-based charge, this would be in addition to already high fuel usage. This means paying a significant fee to reach any destination on top of existing running costs such as maintenance and parking. This increase in cost may lead to a rise in car sharing within rural communities to keep mobility costs down, a common practice in extreme rural areas such as in the northern Canadian provinces.

Technology introduces another step for road users, such as submitting mileage, and also raises concerns over data privacy, which may be a barrier to acceptance of the distance-based charge.

## Time-based

The personas indicate that a time-based vignette would suit those with frequent car use and high mileage because all drivers pay the same charge regardless of their total mileage.

Time-based charges may be discounted based on location or time of day; although this would make little difference to those that rely on the vehicle for commuting, it may encourage occasional drivers to continue to make their required journeys, rather than deterring them.

The graduated charges of any time-based scheme would need to be clearly signposted and easily accessible both online and in print to ensure that all users have clear visibility of the fees, to avoid being pressed unexpectedly with a large charge.

<sup>45</sup> Christoph Erdmenger et al., "Road pricing for cars in Germany?", Umweltbundesamt, German Federal Environment Agency, April 2010.

# A viable way forward

## Today

The previously understood simple balance of relating fuel use to tax revenues is no longer applicable within the complex mobility systems forming today, characterized by many interrelationships and dependencies.

Tax revenues from road transport are falling globally and will continue to fall as ICEs are replaced by EVs. Governments have a choice to either reduce public spending in response or raise revenue using different policy levers. The choice of lever will impact different groups of people in different ways, thus influencing equitable outcomes.

In some countries and regions, the number of miles travelled will continue to increase as economies develop—the mix of ICE-based vehicles and EVs will determine the impact on tax revenues from motoring, although it is likely that EV use will eventually become prevalent, diminishing motoring tax revenue all over the world. Encouraging active modes and net zero mobility will add to the demise of the fuel tax. Changes in place will reduce the need for short-distance road travel as amenities and services are provided closer to people's homes, thereby encouraging and facilitating active travel.

The scale and pace of the reduction in tax-take varies from country to country depending upon a wide range of political, social and demographic issues. Just as the context for the global issue varies around the world, solutions must be context appropriate; a one-size-fits-all approach is not appropriate. Before implementing any solution as a (partial or complete) replacement of fuel tax, it is necessary to design for all the diverse users of the given transport system considering the wide range of reasons they rely on that system.

Various policy levers are available to governments, either based on a user-pays model or through general taxation. Neither approach in isolation would create an acceptable or equitable option; however, combinations appropriate to people and places should be achievable.

The “do-nothing” approach would result in less funds available to government—forcing choices to be made about reducing public services, for example, or allowing road networks to deteriorate over time.

## Tomorrow

Taking a people- and place-based approach provides an understanding of the potential impacts of the policy levers. Applying systems-thinking, supported by a system dynamics process, enables the impacts of each lever to be understood for different personas. Combinations of levers can be evaluated, and their impact on each persona and the overall impact can be assessed.

The design of any solution to replace the fuel tax provides the opportunity to encourage changes in behaviours that lead to positive outcomes. The solution will need to address the dilemma posed by competing needs—encourage people to move away from relying on their vehicles for mobility and to collect revenue to fund accessible, clean, efficient and safe transportation services for all—which, in turn, supports sustainable economic growth in communities around the world. The various case studies highlighted in this paper show where elements of a plan or policy have been implemented across the world. Combining the case studies with the personas enables local and regional authorities to develop, evaluate and implement equitable solutions to declining tax revenues from road transport.





## Contributors

**Ian Patey**  
United Kingdom

**Olivia Cairns**  
United Kingdom

**James Knoll-Pollard**  
United Kingdom

**Peter Ramsey**  
United Kingdom

**Michael van der Sanden**  
United Kingdom

## Acknowledgements

**Scott Benjamin**  
Australia

**Eleanor Short**  
Australia

**Julia Obrovac**  
Norway

**Sean Campbell**  
United Kingdom

**Rehan Mian**  
United Kingdom

**Ben Patey**  
United Kingdom

**Giles Perkins**  
United Kingdom

**Trey Baker**  
United States

**Michael J. Warren**  
United States

# Key contacts



**Ian Patey**

[ian.patey@wsp.com](mailto:ian.patey@wsp.com)  
United Kingdom



**Benjamin McKeever**

[benjamin.mckeever@wsp.com](mailto:benjamin.mckeever@wsp.com)  
United States



**Mara Bullock**

[mara.bullock@wsp.com](mailto:mara.bullock@wsp.com)  
Canada



**Julia Obrovac**

[julia.obrovac@wsp.com](mailto:julia.obrovac@wsp.com)  
Nordics



**Marshall Muthen**

[marshall.muthen@wsp.com](mailto:marshall.muthen@wsp.com)  
South Africa



**Terry Smith**

[terry.smith@wsp.com](mailto:terry.smith@wsp.com)  
Middle East



**Alex Wan**

[alex.wan@wsp.com](mailto:alex.wan@wsp.com)  
Hong Kong



**Scott Benjamin**

[scott.benjamin@wsp.com](mailto:scott.benjamin@wsp.com)  
Australia



**Kristian Jensen**

[kristian.jensen@wsp.com](mailto:kristian.jensen@wsp.com)  
New Zealand



**Christine Verdier**

[globalt&i@wsp.com](mailto:globalt&i@wsp.com)  
France



**Olivier Beaud**

[olivier.beaud@wsp.com](mailto:olivier.beaud@wsp.com)  
Switzerland



© 2023 WSP Global Inc. All rights reserved.

The contents of this publication may not be reproduced by any means in whole or in part, without prior written consent from the publisher.



As one of the world's leading professional services firms, WSP exists to future-proof our cities and environment. We provide strategic advisory, engineering, and design services to clients in the transportation, infrastructure, environment, building, energy, water, and mining sectors. Our 67,000 trusted professionals are united by the common purpose of creating positive, long-lasting impacts on the communities we serve through a culture of innovation, integrity, and inclusion. Sustainability and science permeate our work. In 2022, WSP derived more than half of its \$11.9 B (CAD) revenues from services that support the UN Sustainable Development Goals. The Corporation's shares are listed on the Toronto Stock Exchange (TSX:WSP).



WSP Global Inc.  
1600 René-Lévesque Blvd. West  
11<sup>th</sup> floor, Montréal, Quebec  
H3H 1P9

[wsp.com](http://wsp.com)