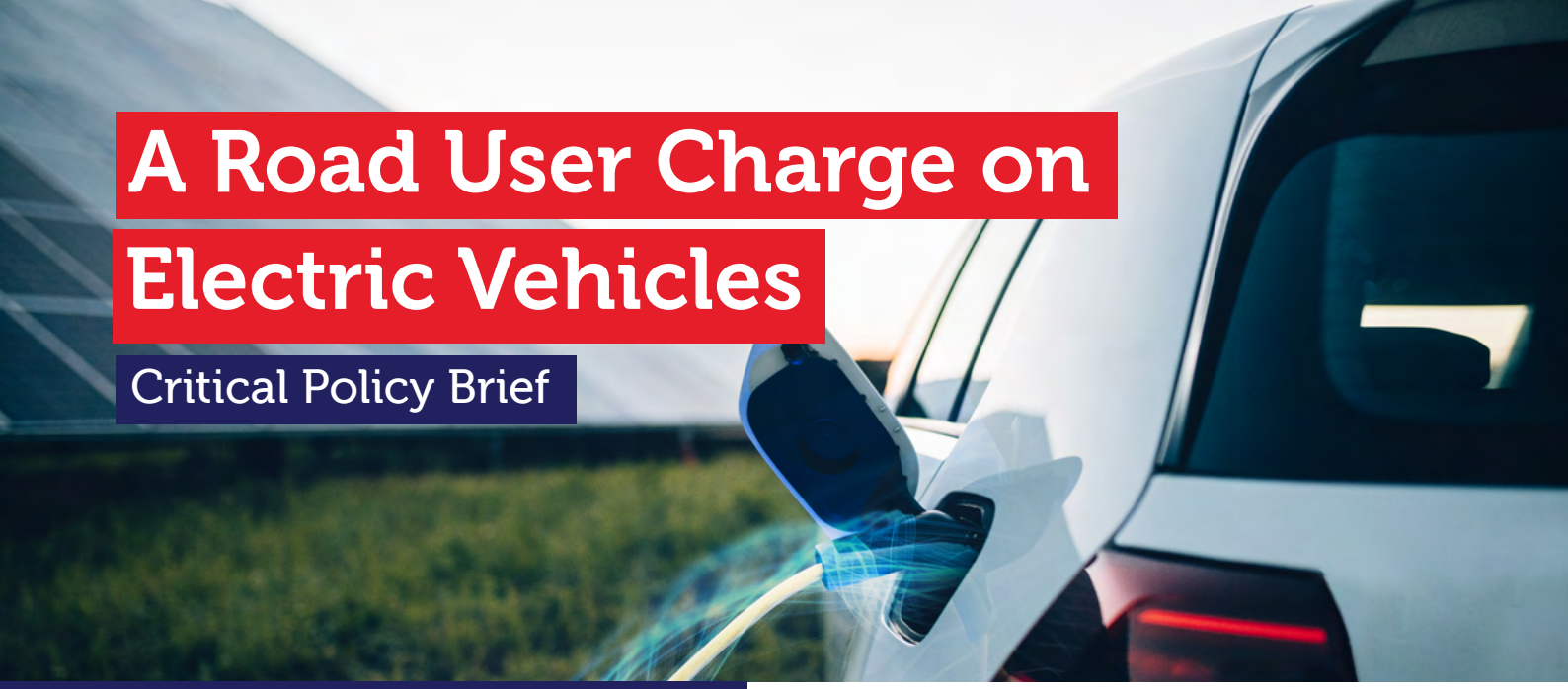

A Road User Charge on Electric Vehicles

Critical Policy Brief

This policy brief assesses the justification for a road user charge on electric vehicles (EVs), within the context of a likely transition away from internal combustion engine vehicles (ICEVs) to a primarily EV vehicle fleet, in the wider context of urban transport policy.

The Victorian Government has proposed a road user charge (RUC) of 2.5c per kilometre for EVs to partly substitute for revenue lost from the levy of fuel excise duty. A RUC for EVs may be considered justified to price the environmental and social costs of car use in cities and moderate potential rebound effects from the lower driving costs of EVs. Such an RUC scheme is best introduced as part of a comprehensive Transport Plan to transition urban travel away from ICEVs to public transport, walking and cycling.

Key Messages

- A transition to EVs will not eliminate the full set of costs that private motor vehicles impose on cities and the environment.
- A Road User Charge is an appropriate way of pricing for the costs of car use in cities.
- The Victorian Road User Charge will save EV drivers approximately 2.1 cents per kilometre compared to the average fuel economy ICEV.
- The Transport Integration Act 2010 requires the Victorian Government to prepare a Transport Plan for Melbourne, but this has not been delivered.
- The EV Road User Charge is best introduced within the context of a metropolitan Transport Plan that transitions Melbourne's transport system away from fossil fuels, equitably prices mobility via public governance, and increases the share of travel by public transport, walking and cycling.

Overview

Transport emissions

While transport emissions comprise 14 per cent of global carbon emissions, their emissions profile makes them the leading sectoral contributor to climate change[i]. The transport sector contributes 18 per cent of Australia's total carbon emissions while emissions from private passenger motor vehicles comprise approximately 69 per cent of Australia's carbon emissions from transport. Australian motor vehicles are among the most carbon intensive in the world.

Electric vehicles and the environment

EVs generate greater carbon emissions in the production phase compared to ICEVs, due to the high energy intensity of battery production. Over their full lifecycle EVs may offer carbon emission savings of 20-27 per cent compared to ICEVs, however this is dependent on length and intensity of use, with high variability between EV models[ii]. Large EVs may produce lifecycle emissions comparable to ICEVs. Australian research suggests negligible overall lifetime carbon emissions benefits from EVs over ICEVs (Figure 1)[iii].

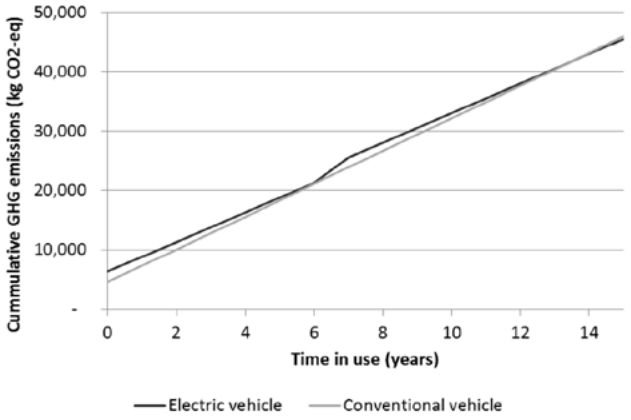

Figure 1: Comparison of the cumulative GHG emissions of an electric vehicle and a conventional vehicle used in Australia.
Source: Stasinopolous, Shiwakoti and McDonald (2016)

The operation of both ICEVs and EVs is the most emissions intensive phase over their lifecycles. Compared to ICEVs, EVs incur lower operational energy emissions due to their use of electricity compared to petrol or diesel. Electricity supply mix also influences lifecycle greenhouse gas emissions[iv]; where brown coal is used to power EVs their lifecycle emissions profile may be 12-31 per cent higher than for equivalent ICEVs[v]. Assessment of full lifecycle environmental impacts of EVs suggests they are similar to, or worse than, ICEVs[vi]. Such findings complicate common assumptions that EVs are environmentally superior to ICEVs.

Wider transport planning context

The introduction of EVs to Victoria is occurring within the context of an unbalanced transport system. By world standards Melbourne is a highly car dependent city, with approximately 80 per cent of kilometres travelled undertaken by automobile[vii], comparable to US cities. This level of car dependence has long been identified as a policy problem. Plan Melbourne 2017 acknowledged that "the share of trips by public transport, as well as active transport modes such as walking and cycling, must increase"[viii].

Electric vehicles face per-kilometre operational costs that are markedly lower than the fuel costs for an ICEV. Based on current electricity pricing of 22c/kwh the cost of an EV with efficiency of 15.3 kwh/100km (eg Hyundai Ioniq) may be as little as $3.40/100km, or 3.4c per kilometre. By comparison the average ICEV with a fuel efficiency of 10.9 L/100k pays $14.17/100km at a fuel price of $1.30/L, equivalent to 14.2c/km. The EV thus saves around $10.80 per 100km of travel, around 11c per kilometre, or an approximately 76 per cent reduction in per-kilometre cost.

Elasticity estimates for Australia suggest that the elasticity of driving relative to fuel prices is 0.1[ix], meaning that a 1 unit increase in fuel costs results in decreased driving of 10 per cent. The inverse elasticity for fuel price declines is not well understood however it is reasonable to assume that a one unit decline in fuel cost might produce an 0.1 increase in driving. A decline in per-kilometre costs of driving an EV compared to an ICEV risks encouraging more and longer urban car trips, placing extra pressure on road networks. An increase in car travel in Melbourne would contradict *Plan Melbourne 2017* mode shift goals.

The impacts of cars on cities

Car use in cities imposes multiple adverse consequences for the environment, the economy, and society.

While EVs do not emit exhaust, they may still produce carbon emissions if powered by fossil-fuel electricity. Approximately 85 per cent of electricity in Victoria is generated by coal or natural gas. EVs also produce non-exhaust emissions that are harmful to human health. These include particulates (PM_{10}) generated from wear of brakes, tyres, and road surface. Regenerative braking may reduce EV brake particulates compared to ICEVs but the greater weight of EVs due to batteries may increase tyre and road wear particulates[x].

Cars are one of the major causes of human injuries. In Australia motor vehicles are the leading cause of death by injury for children aged 1-14[xi]. In 2019 265 road traffic deaths occurred in Victoria, including 123 metropolitan deaths. Car use has been linked to health impacts through sedentary lifestyle, noise, heat island effects from roads and opportunity costs of health-promoting green space[xii].

Motor vehicles take up approximately one third of urban space as roads and parking, imposing costs on cities. In Australian cities car travel is generating demand for major road capacity expansion which is increasingly costly given the need for tunnel construction to avoid surface disruptions. The North East Link tunnel, for example, will cost $16 billion in Victorian government funding.

A road user charge

The proposed Victorian road user charge will impose a modest cost on EV travel that will assist to moderate potential rebound effects due to the large reduction in the marginal cost of travel compared to ICEVS. This includes partially compensating for the avoidance of fuel excise duty by EVs.

Even with the road user charge EV drivers will still pay less than half of the fuel excise paid per kilometre by the average ICEV with a $10.9 l/100km fuel economy (Table 1). In order to pay an equivalent level of fuel excise to the EV RUC an ICEV would require a fuel economy of 5.95L/100km, of which very few vehicles are sold in Australia.

EV Road User Charge Costs		ICEV Excise Costs	
Average daily commute (km)	25	Average daily commute (km)	25
RUC per km	0.025	Fuel used at average 10.9L/100km efficiency (L)	2.73
Daily RUC ($)	0.625	Daily excise ($)	1.15
Weekly cost ($)	3.125	Weekly excise ($)	5.76
Annual cost ($)	150	Annual excise ($)	276.64
Annual difference RUC vs ICEV ($)	**126.64**		

Table 1: Road user charge on EV travel compared to excise for the average fuel economy ICEV.
Source: Authors calculations

A road user charge is also an important step towards more rational pricing of road use in Australian cities to ensure road users bear the costs of the negative externalities they generate, including congestion, pollution and health degradation. Road pricing is viewed as reducing demand for road capacity, therefore delaying or avoiding the need for road capacity expansion.

Since the mid-1980s various Australian policy and advisory agencies have argued in favour of road pricing, including the Bureau of Infrastructure Transport and Regional Economics[xiii], Infrastructure Australia[xiv], Infrastructure Victoria[xv], the Productivity Commission[xvi], Infrastructure Partnerships Australia[xvii], the RACV and the Bus Industry Confederation. Engineers Australia[xvii] notes:

"Federal and state governments should proactively undertake planning for road pricing in advance of the widespread deployment of emerging technologies such as electric and automated vehicles as these are likely to act as an opportunity for change"

Infrastructure Australia has argued

"A comprehensive road user charging model offers opportunities to reduce congestion in our cities and make the current system fairer, more sustainable and more efficient."

Introduction of a road pricing regime is not without complexity. The application of generalised road pricing may be regressive, given the differential geographical distribution of dependence on automobiles for urban travel in Australian cities across income groups. The design of any generalised road pricing regime needs to account for capacity to pay and access to alternative travel modes with a strong social equity dimension. And any generalised road pricing regime requires transparent accountable public operation, management and governance. Nonetheless the Victorian EV RUC is an initial first step towards a more generalised scheme.

Integrated transport planning

The introduction of the RUC on EVs is merited by such vehicles' impacts on cities. But such introduction should occur within a coherent metropolitan transport plan. *The Transport Integration Act 2010* requires the Victorian Government to prepare a transport plan, but no Victorian government has yet delivered such a plan.

A Transport Plan for Melbourne would include objectives for EVs within the wider economic, social and environmental goals for transport, including supporting the *Plan Melbourne 2017* intent to shift car travel to other modes. The EV RUC would thus be integrated with wider transport aims rather than as a stand-alone policy.

In addition to a Transport Plan there is need for public debate and policy deliberation on the future of Australia's urban transport systems, the costs that alternative travel modes impose on cities, and mobility management interventions that can equitably allocate these costs. This would include road user charging as well as non-pricing measures to shift travel to public transport walking and cycling. Given Australia's constitutional arrangements coherent planning requires state and federal cooperation and coordination.

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