Submission to the Select Committee on Electric Vehicles

July 2018

Public Transport Users Association

1 Introduction

The Public Transport Users Association (PTUA) welcomes the opportunity to contribute to the Select Committee's inquiry into electric vehicles (EVs). At the outset we wish to express our strong support for a large increase in the proportion of EVs in the Australian motor vehicle fleet. EVs offer a range of benefits over conventional vehicles[1] that we expect to be extensively and enthusiastically outlined in other submissions to this inquiry. However, there is a risk that this enthusiasm may cause the limitations of EVs to be downplayed and for measures to be promoted that have unintended consequences (Holtsmark & Skonhoft, 2014). While trying to minimise duplication of the enthusiastic content of other submissions, we further discuss some of these issues below.

Unless otherwise stated, private EVs will refer to privately owned and operated road vehicles such as light passenger cars for personal use and commercial vehicles for carrying goods and equipment. Public EVs will refer to buses or rail vehicles used for scheduled passenger transport services. Active transport refers to walking and cycling.

2 Potential benefits of electric vehicles

Conventional motor vehicles have a wide range of negative impacts, including the production of air pollution that causes a large amount of illness and death each year (Barnett, 2014). However, many of these negative impacts are not resolved by switching from liquid fuels to electric propulsion (Jochem *et al.*, 2016). Transport consultant Jarrett Walker describes four main problems of urban transport, of which EVs[2] only address one (McMahon, 2018). As outlined below, many of the negative externalities of ICEV use also apply to private EVs. Therefore encouraging greater use of private vehicles, even if powered by electric motors, could exacerbate some of the numerous negative impacts of vehicle use.

In contrast, greater roles for public EVs and active transport could ameliorate many of these problems and bring wider benefits than offered by private EVs (Brueckner, 2018; Creutzig *et al.*, 2012; Xia *et al.*, 2013). This includes eventual solutions for all four of the urban transport problems described by Walker (McMahon, 2018).

[1] i.e. internal combustion engine vehicles (ICEVs).
[2] EVs should not be conflated with self-driving cars or autonomous vehicles. In fact, automation of public transport is likely to be easier than automation of private cars (Walker, 2016).

2.1 Noise pollution

Engine noise makes up most of the noise coming from vehicles travelling at low speed (e.g. up to 30 km/h), so EVs can therefore be expected to be quieter than ICEVs on some low speed roads. As discussed in Section 2.5, this presents a risk to vulnerable road users. Measures to address this safety risk to vulnerable road users, such as mandatory sounds when travelling at low speed, may limit the noise pollution benefits of EVs (Verheijen & Jabben, 2010).

At speeds above 30km/h the majority of vehicle noise is wind and tyre noise (*Ibid.*), so electric motors will not substantially reduce noise pollution at most speed limits applicable in Australia, particularly near motorways and arterial roads.

Public EVs produce much less noise under acceleration and when stationary than public ICEVs. Given the stop-start nature of public transport services, public EVs could greatly reduce noise from bus services. With carrying capacities of dozens of passengers per vehicle, shifting private car journeys onto public EVs could significantly reduce the number of vehicle movements and their associated noise (James *et al.*, 2014). Public EV services also allow travellers to avoid private ICEV journeys without the expense of buying a private EV, and offer mobility to people who are unable to drive themselves.

It should also be noted that active transport produces negligible noise pollution.

2.2 Land use

Some analysis considers land use to be the largest subsidy to motor vehicles due to the large amount of high-value land made freely available to road users (Diesendorf, 2002). The land requirements of public transport and active transport are much lower than private motor vehicles (Figure 2-1). Therefore public EVs offer substantial benefits over private EVs and ICEVs in terms of leaving land available for non-transport uses such as housing, commercial activities and public open space (Litman, 1995; Miskelly 2017). This also helps to minimise urban sprawl and to protect productive farmland and native habitat from encroachment (Litman, 1995; Carey *et al.*, 2015; Young 2016).

The land requirements of private EVs are comparable to private ICEVs, with the possible addition of extra space when parked for charging infrastructure, and additional road space required for any new journeys resulting from the rebound effect mentioned elsewhere.

Extensive parking and high capacity roads also lead to a barrier effect that impedes the movement of people on foot or bike and harms amenity (Jacobsen *et al.*, 2009).

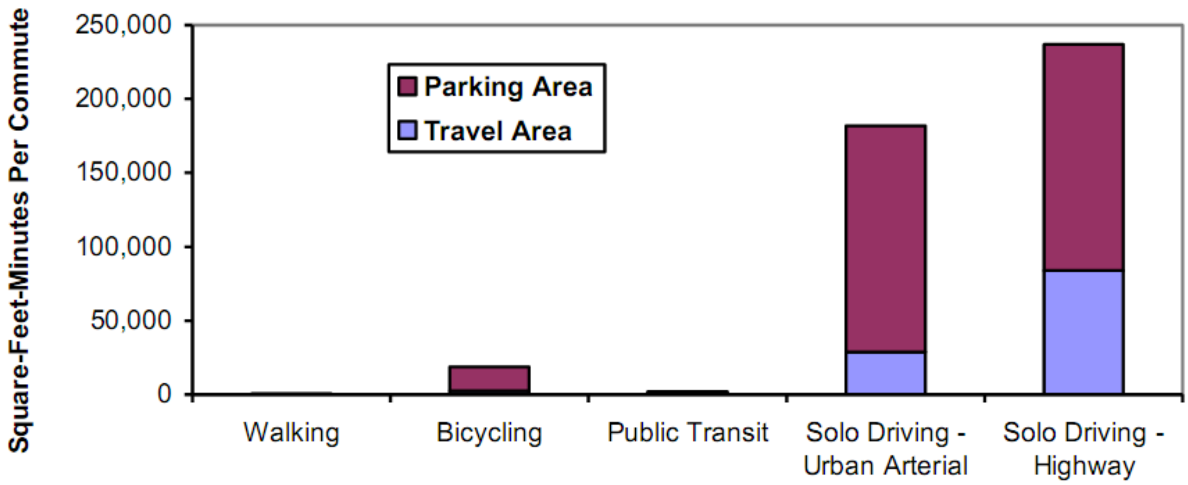

Figure 2-1: Space required by travel mode. Motor vehicle travel requires far more space for travel and parking than other modes (Litman, 1995).

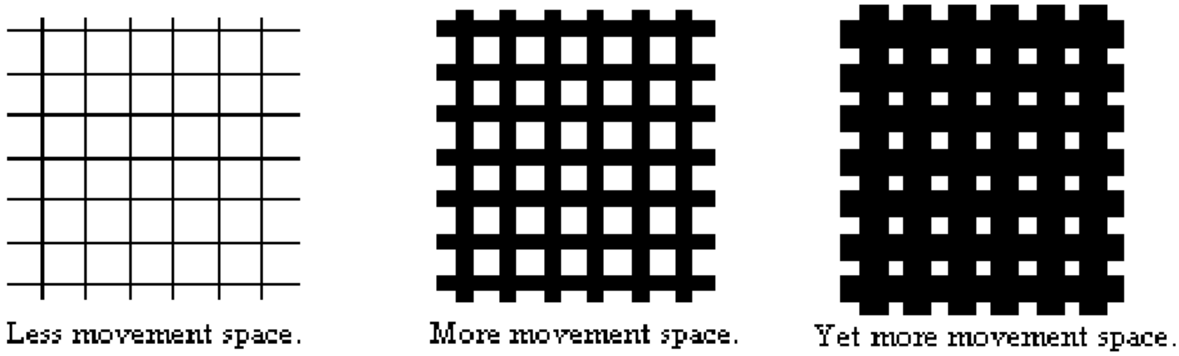

Figure 2-2: Land used for roads and parking. Private motor vehicle transport requires relatively large amounts of land for roads and parking (black lines), which reduces the amount of land available for other activities (white space). Higher motor vehicle traffic volumes require more movement space (thicker lines), regardless of propulsion technology. This tends to disperse destinations (Litman, 1995).

2.3 Air and water pollution

While tailpipe emissions are generally the most obvious air quality impact of motor vehicles, there are a number of other negative impacts. EVs can still produce unhealthy levels of small pollution particles from brake and tyre wear (Barnett, 2014; Timmers & Achten, 2016; Kelly, 2017). Runoff of these and other substances from roads is also a major cause of water and ocean pollution (Trombulak & Frissell, 2000; Boucher & Friot, 2017).

The climate benefits of EVs are contingent upon the carbon intensity of the energy source, and Australia has one of the most carbon-intensive energy mixes in the world due to the historical dominance of coal (Lal, 2015; Zivin *et al.*, 2014; Jochem *et al.*, 2016; Holtsmark &

Skonhoft, 2014). While the climate credentials of EVs would be enhanced by a rapid transition to renewable energy, this appears to face some political opposition in Australia (Whittaker, 2017; Murphy 2018).

Although charging EVs from small-scale PV systems may avoid the use of coal-fired electricity in that vehicle, it may also reduce the level of solar energy exported from those systems for use by other consumers on the grid (Young, 2017). Such solar energy will still be available for export to the grid where the householder chooses to travel instead by public EV or active transport, since the marginal energy consumption of a public transport passenger is negligible. We also note the planned addition of new renewable generation capacity to power some of Melbourne's public EVs (Wahlquist 2017).

2.4 Physical activity

Lack of physical activity is a key risk factor for numerous lifestyle-related diseases that pose a major challenge for the Australian health system and economy more broadly (Ding *et al.*, 2016). Car-based travel is strongly linked with a lack of physical activity, while active travel is associated with higher levels of physical activity, including when part of a public transport journey (Burke *et al.*, 2014; Liao *et al.*, 2016; Mueller *et al.*, 2015; Xia *et al.*, 2015).

Use of private EVs may come at the expense of public transport usage and active transport, thus increasing the social costs of private car use outlined in this submission (Holtsmark & Skonhoft, 2014). Motor vehicle traffic in general can also deter use of active transport by others due to its effects on safety and amenity (Jacobsen *et al.*, 2009), thus reducing physical activity across the community. Furthermore, as outlined in Section 2.5, EVs pose a heightened safety risk to people undertaking active travel.

2.5 Road trauma

Private motor vehicles are a relatively high risk form of transport (Figure 2-3), and road trauma is one of the leading causes of death in some age groups in Australia (PTUA, 2011).

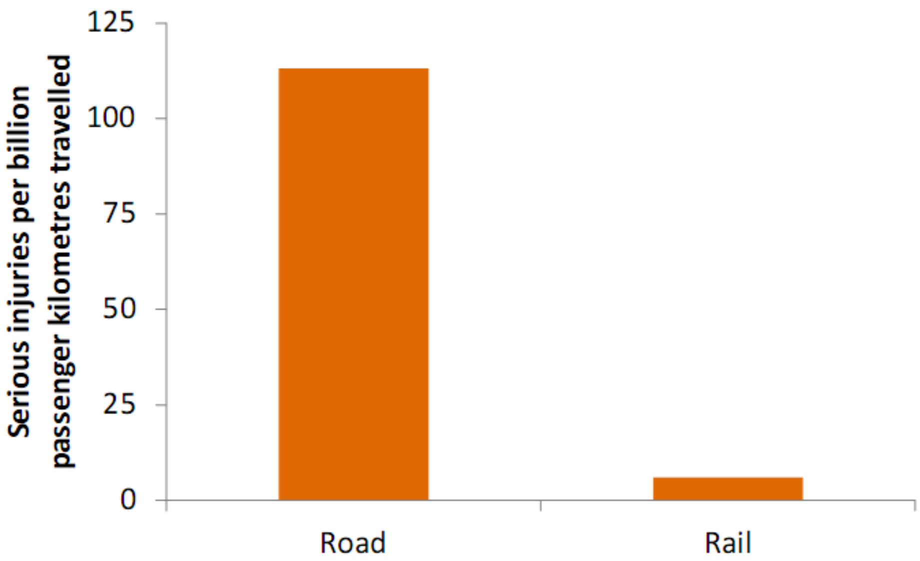

Figure 2-3: Serious injury rate by transport mode (BITRE, 2012, p.114)

EVs can be expected to be involved in collisions with other vehicles at a comparable rate to ICEVs. However, there is potential for a higher number of collisions with vulnerable road users given EV's lower engine noise which provides less warning of the presence of a moving vehicle (Brand *et al.*, 2013; Wu *et al.*, 2011). In particular, it appears that vulnerable road users are less able to locate a car sound when it is coming from directly behind them as an overtaking car would (Stelling-Kończak *et al.*, 2016). In light of this, there should be greater focus on reducing the risks posed by motor vehicles to vulnerable road users including pedestrians and cyclists. This includes speed limits that minimise stopping distances and the consequences of a collision (Rosén & Sander, 2009), physical separation from traffic (as distinct from just lane marking (Parkin & Meyers, 2010)), improved priority and visibility for vulnerable road users, and the introduction of Minimum Passing Distance legislation across all jurisdictions (Amy Gillett Foundation 2018).

Increasing the proportion of motorised journeys on public transport, including public EVs, would have large road safety benefits (PTUA, 2011).

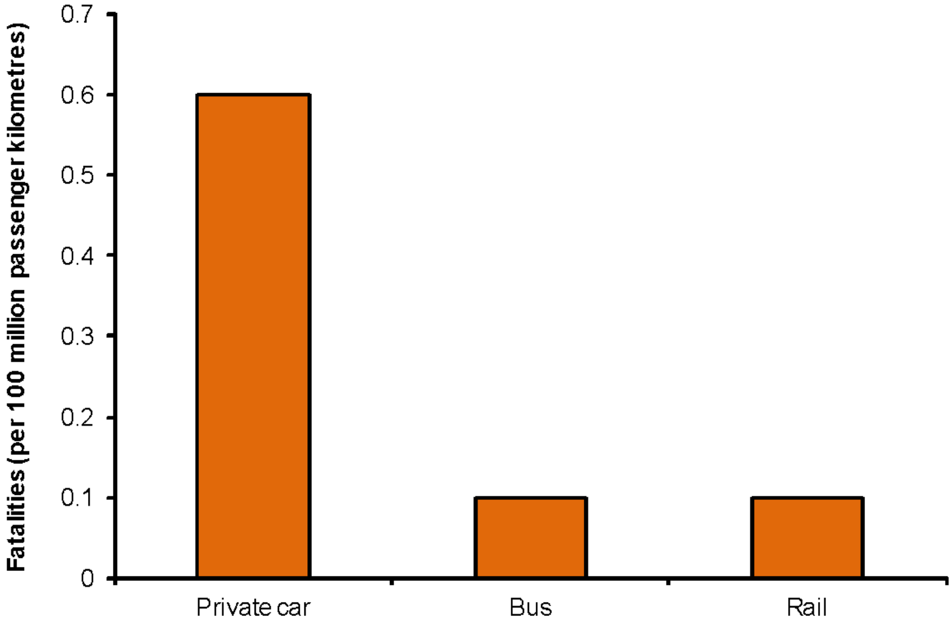

Figure 2-4: Risk of fatality by transport mode. Source: Australian Transport Safety Bureau

2.6 Congestion

Congestion is the consequence of private transport that often receives most attention in Australian cities. There are no congestion benefits from switching a given journey from private ICEV to private EV (Jochem *et al.*, 2016; McMahon, 2018), however there are congestion benefits from shifting journeys from private ICEV or EV to public EV (Figure 2-1). Furthermore, incentives for the uptake of private EVs and/or their lower operating costs relative to ICEVs could result in a rebound effect that worsens congestion and other costs outlined in Section 2 by increasing private car use (Litman, 2005; Hirte & Tscharaktschiew, 2013; Holtsmark & Skonhoft, 2014). On the other hand, a larger role for public EVs would have substantial benefits for congestion management (Lee & Lee, 2007; Adler & van Ommeren, 2016).

3 Supporting electric vehicle uptake

While we support increasing the proportion of EVs in the Australian motor vehicle fleet, Section 2 has highlighted that many of the negative impacts of car use apply to both ICEVs and EVs. Therefore great care should be taken to avoid implementing measures that encourage greater use of private motor vehicles relative to public transport and active transport. We discuss some commonly proposed measures below.

3.1 Toll exemptions and access to priority lanes

The value to road users of access to priority road space such as bus lanes is highest in areas where road space is most limited and potential time savings are greatest (Diamond, 2008, p.53). Therefore such privileges would be most likely to induce greater usage of private EVs in congested urban areas that are a high priority for mode shift away from private motor vehicles and towards public transport and active transport (Figure 2-1).

Furthermore, making bus lanes available to private EVs would harm the efficiency of bus operations and cause delays to buses that are potentially carrying dozens of passengers per vehicle compared to the average car occupancy rate in Melbourne of 1.2 people per car (Aasness & Odeck, 2015; Bento *et al.*, 2014). This would encourage increased private vehicle use (both EV and ICEV) and discourage public transport use in the very areas where the opposite is most needed from the perspective of congestion management.

Allowing private EVs to use bus lanes would create more capacity in general traffic lanes for private ICEVs. Increasing road capacity is widely known to induce additional traffic (Næss *et al.*, 2012), so increased capacity for private ICEVs would lead to increased ICEV traffic and negate the air quality and emission reduction benefits of the private EVs that are allowed to use bus lanes (Bigazzi & Figliozzi, 2011; Noland & Quddus, 2006).

Melbourne also has a poor record of turning bus lanes over to general use. For example, a bus lane was introduced on Stud Road in Melbourne's east following the opening of Eastlink in order to lock in the supposed complementary benefits of the new motorway for public transport. However, this bus lane was subsequently returned to general traffic use once it became apparent that Eastlink did not solve congestion on existing arterials[3].

While it has been proposed that private EVs only have access to bus lanes while they are in a minority, once EV market penetration reaches a significant level there will be substantial political pressure to preserve their favoured access to bus lanes (Diamond 2008, pp.54-55). This would see public transport services hindered and delayed on an increasing basis over time, and their ability to contribute to congestion reduction severely compromised.

Granting toll exemptions to private EVs would also encourage motor vehicle usage and add to road traffic (Holtsmark & Skonhoft, 2014). A study in Sweden found that exempting "green" cars from tolls reduced the effectiveness of Stockholm's congestion charge and resulted in higher traffic volumes than when the exemption was removed (Hultkrantz & Liu, 2012). Bakker and Trip (2013) found that toll exemptions and access to bus lanes were the least effective and efficient policy measures under consideration to support the adoption of EVs. They also noted "[t]hey may turn out to be costly when they are successful and may

[3] https://www.ptua.org.au/myths/compete/

also counteract other attempts to make the urban transport system more sustainable (e.g. clogging bus lanes)" (*Ibid*, p.23).

Increased car use due to incentives for private EVs would increase congestion with a direct impact on fuel consumption and emissions by other road users (i.e. ICEVs). The additional EV use would also result in additional stationary energy sector emissions either directly from charging the motor vehicle from fossil fuel derived electricity, or indirectly as a result of consuming additional renewable energy that could have instead displaced fossil fuel derived electricity used by other consumers on the grid (see also Section 2.3).

If private EVs are to be granted priority road space, this should be achieved by reserving existing general traffic lanes for EVs (and buses where bus lanes are currently absent) so that bus services are not hindered and additional motor vehicle traffic is not induced by expansion of road space for private motor vehicles (Næss *et al.*, 2012; Zeibots & Elliott, 2011). As implied above, this should not be achieved by adding new general traffic capacity to replace the lanes reserved for EVs since this would induce additional ICEV traffic and negate the benefits of the uptake of EVs.

If the benefits of EVs are to be realised, their use should *replace* ICEV use rather than add to it. Thus any road space priority should be granted by reallocation of existing space used by private ICEVs and not from space used by public transport or active transport, nor through a net increase in capacity for private motor vehicles. We note that fears that sometimes precede reductions in general traffic capacity are largely overblown, especially if alternative transport is available and the intent is to encourage a switch away from private ICEVs as in this case (Cairns *et al.*, 2002; Mayerthaler *et al.*, 2010). However, we also note that priority for private EVs would have equity impacts (Diamond, 2008, p.44), so we recommend that any such measures be accompanied by improvements to public transport and active transport to provide attractive and affordable alternatives to private vehicle use.

3.2 Reserved and free parking

As for access to priority road space (see Section 3.1), access to free parking is also likely to be of most value to EV drivers in areas where use of private motor vehicles should be discouraged in favour of more space-efficient modes (see Figure 2-1). Making parking freely available to private EVs in such areas would act as a major incentive to drive rather than use other modes of transport (Holtsmark & Skonhoft, 2014; Christiansen *et al.*, 2017). As described by Shoup (2017), free parking comes with a hefty price tag for the rest of the community.

Bakker and Trip (2013) found that reserved parking for EVs ranked poorly among policy measures to support adoption of EVs, especially given its inconsistency with other transport goals such as encouraging use of public transport and active transport.

On the other hand, public EVs enable access to destinations without the large space requirements of private vehicle parking.

3.3 Free or subsidised charging

One of the purported benefits of EVs is lower operating costs relative to ICEVs. This suggests that further subsidising the operating costs of EVs through free or subsidised charging would be unwarranted. Furthermore; subsidised charging would exacerbate any rebound effect resulting from reduced operating costs, leading to increased vehicle usage, and increase social costs outlined in Section 2 (Litman, 2005; Hirte & Tscharaktschiew, 2013).

3.4 Tax rebates and subsidies

Economic analysis of subsidies for EVs has found that they are likely to decrease welfare due to an increase in external costs (such as those outlined in Section 2) and tax interaction effects, suggesting that emission taxes and public transport subsidies may be more efficient for mitigating climate change (Hirte & Tscharaktschiew, 2013).

The effectiveness of financial incentives for private EVs is further questioned by research showing that many recipients of such incentives would have made the purchase in the absence of the subsidy, meaning taxpayers helped to finance a private purchase (often by comparatively high income households) while achieving no additional reduction in emissions (Bennear *et al.*, 2013; Li & Xing, 2016, pp.8-10; Chandra *et al.*, 2010). In addition, there is potential for manufacturers to capture some of the value of the subsidy rather than the retail price being lowered (Bakker & Trip, 2013).

The external costs of private motor vehicles, even if powered by electric motors, exceed the revenue from taxes and charges applied to road users (PTUA, 2016). Fuel excise is one of the more significant means of internalising some of these costs, however this falls short of covering external costs in most countries (Tscharaktschiew, 2015). Furthermore, EVs are not subject to fuel excise meaning a large portion of their external costs will not be recovered. This would be exacerbated by financial incentives for private EVs such as rebates or reduced taxes or charges.

Nonetheless, fuel excise can help to accelerate EV uptake since it shifts the operating cost comparison in favour of EVs relative to ICEVs (Chandra *et al.*, 2010). For example, fuel excise in Norway is NOK 5.21 per litre[4], or approximately AUD 0.90, and an additional CO_2 tax is

[4] https://www.skatteetaten.no/en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/road-tax-on-fuel/

also payable of NOK 1.16 per litre[5], or about AUD 0.20. This combined fuel taxation of approximately one dollar per litre is about two and half times higher than fuel taxation in Australia (where fuel taxation is among the lowest in the developed world) and would provide a strong incentive for the take-up of EVs in Norway. While this suggests scope for increasing fuel taxation rates in Australia, we would recommend this only be considered alongside improvements in the availability and quality of public transport services and active transport infrastructure in order to provide affordable transport alternatives.

3.5 Charging infrastructure

Range anxiety and the availability of charging infrastructure have been among the key deterrents to buying EVs (Carley *et al.*, 2013; Metternicht & Broadbent 2018). Therefore ensuring the availability and suitability of charging infrastructure has one of the strongest cases for government intervention among the commonly discussed measures for increasing the uptake of EVs (Bakker & Trip, 2013).

Federal, state and territory governments should work together to ensure consistent standards for charging equipment (e.g. plugs and sockets) to avoid incompatibilities akin to the break-of-gauge problem that still afflicts Australia's rail network. Governments should also ensure that public charging stations are open access and not restricted to members of particular networks (Metternicht *et al.*, 2017).

Building standards should also allow for vehicle recharging in private car parking, particularly in multi-dwelling developments where it is more problematic for residents to install independently. However, in all cases this should not result in an increase in total parking requirements since this would increase development costs and encourage additional private vehicle use with the accompanying harmful effects outlined in Section 2 (Shoup, 2017; Weinberger, 2012; Christiansen *et al.*, 2017).

3.6 Emission standards

Perhaps the one key potential benefit of EVs is the reduction (but not elimination) of local pollution relative to ICEVs (Section 2.3). However, this potential will only be realised if we see a reduction in ICEV use, and not if EV use is additional to polluting ICEV use or the dirtiest ICEVs remain in the vehicle fleet. It should be noted that new EVs may often substitute for comparatively clean ICEVs (Chandra *et al.*, 2010) if the focus is on carrots for new EVs and not on sticks for dirty ICEVs.

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https://www.skatteetaten.no/en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/mineral-product/

In addition to encouraging mode shift to public EVs and active transport, a complementary measure to address ICEV emissions without increasing other private vehicle use is through emissions and vehicle standards. For example, an obvious way to reduce the number of ICEVs entering the Australian vehicle fleet would be to ban them as some other nations are planning (Asthana & Taylor, 2017). Similarly, tighter fuel quality and vehicle emissions standards could be introduced that favour cleaner fuels and vehicles such as EVs. Vehicle emission regulations and compliance activities by state EPAs could also be enhanced to remove the dirtiest (and noisiest) vehicles from the road.

4 Electric vehicle manufacturing and value chain

We are not aware of any evidence indicating a high likelihood of a mass production electric car industry establishing and succeeding in Australia. Similar factors that led to the demise of conventional mass production car manufacture seem likely to apply to electric cars. Therefore incentives for the purchase of private EVs seem likely to encourage higher automotive imports.

However, there are stronger prospects for more specialised manufacturing activities in Australia. Production of electric commercial vehicles, buses and other specialist vehicles is already taking place on a small scale in Australia (Bailey, 2017; Payne, 2017; Schmidt, 2018). Rail-based EV manufacturing is also established in Australia (Deloitte Access Economics 2017) and could grow to supply rolling stock to support expanded networks and higher service levels. There are likely to be synergies between rail-based and road-based public EV production that enable knowledge spillovers, and critical mass in component supply chains. Public transport vehicle procurement policies could support the development of these sectors domestically.

5 Government cooperation

Electrified public transport offers the benefits of EVs (e.g. reduced engine noise and tailpipe emissions) but without many of the problems outlined in Section 2. There are many proposals to expand electrified rail networks in Australian cities[6], and we encourage all tiers of Australian government to cooperate to bring forward their delivery. International experience has indicated significant potential for the adoption of electric buses as part of

[6] e.g. https://www.ptua.org.au/campaigns/every10minutes/plan/

public transport fleets (Gao *et al.*, 2017; Mahmoud *et al.*, 2016), and this could also be applied in Australia.

While there does seem to be interest in electric buses as a future option, concerns remain among operators over operational performance (Mohamed *et al.*, 2017). In common with the concerns of potential private EV purchasers, equipment standards and recharging requirements are among the key issues needing to be resolved to enhance confidence among fleet operators (*Ibid.*). Issues that are more specific to fleet operators include the availability of suitable skills for fleet maintenance and the substantial upfront cost of vehicles and fleet-scale charging infrastructure (*Ibid.*).

Australian governments could help to address these barriers by facilitating the training of mechanics so that the required skillsets are available to fleet operators. This may form part of a transition program for former workers in the automotive or thermal electricity sectors.

Governments could also fund demonstration projects as proof of concept and learning opportunities for fleet operators. For example, a number of cross-town electric bus routes could be introduced in inner Melbourne to enhance non-radial transport options, such as the once-proposed “blue orbital” Smartbus linking suburbs such as Footscray, Moonee Ponds, Brunswick, Clifton Hill and Elsternwick. This would provide real-world experience in the Australian context to inform future expansion of electric bus fleets.

Governments could also boost investor certainty for businesses in electric vehicle value chains by delivering a pipeline of public investment in expanding and upgrading rail networks and public EV fleets.

For reference, we also summarise other measures described elsewhere in this submission that governments should undertake to prepare for the expansion of EVs in Australia:

- Avoid financial or non-financial measures that encourage private motor vehicle use, including private EVs (Section 3);
- Increase the availability and quality of public EV services and active transport infrastructure to encourage and enable mode shift away from private cars, and to provide greater investor certainty in specialist EV value chains;
- Develop consistent technical standards and open access regimes for charging infrastructure across Australia (Section 3.5);
- Improve safety and amenity for vulnerable road users (Section 2.5);
- Strengthen vehicle emissions and fuel quality standards and enforcement (Section 3.6).

6 Conclusion

While we recognise that it may seem otherwise based on parts of this submission, we reiterate our support for increasing the proportion of EVs in the Australian motor vehicle fleet and acknowledge there will be valid points in favour of their adoption in some other submissions. However, we also emphasise that doing the wrong thing in a slightly less harmful way is a poor objective.

The benefits of EVs don't come from EV use *per se*, but from the non-use of private ICEVs. Alternatives to private ICEV use also include public transport, active transport, tele-commuting and more efficient land use patterns. Given the numerous and serious negative effects of car dependence and usage that are not ameliorated by EVs (see Section 2), we recommend a focus on transport *system* efficiency rather than just *vehicle* efficiency (Litman, 2005). This can only be achieved by prioritising public transport and active transport (and rail freight) to make them genuinely viable alternatives to private motor vehicles, and then discouraging the use of ICEVs where possible among those that do choose to drive.

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