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Established 1973

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To: Productivity Review Inquiry
Productivity Commission
GPO Box 1428
CANBERRA CITY 2601

Re: Submission to the Productivity Commission discussion paper on the 5 year productivity review November 2016.

On behalf of the National Executive of the Australian Electric Vehicle Association Incorporated, please accept the following submission to the Commission.

The AEVA is a not-for-profit, membership-based association dedicated to educating, advocating and promoting the use of electricity for private and public transport. Established in 1973, the AEVA has provided a forum for those interested in electric vehicle technology, and assists in the dissemination of information on the benefits of electric transport. It also supports informed policy concerning the uptake, supporting infrastructure and safety standards of EVs.

Regarding the terms of reference of the discussion paper, the AEVA feels it can make a contribution to item three in the scope "potential policy changes to improve Australian economic performance and the wellbeing of Australians". This shall be in the manner of indicating an area where a significant efficiency gain and cost saving can be realised using available and proven technology.

Adopting this suggestion can also result in additional benefits to the populace and economy of Australia not covered by the terms of reference.

Transport represents a substantial portion of the Australian economy. Population growth and urban sprawl have increased the dependence of many Australians on their private car. With over 17.7 million vehicles on the road, of which 13 million are passenger vehicles, Australia consumes about 32.4 billion litres of liquid fossil fuel a year[1].
If 5 million of these cars were replaced EVs, a direct fuel cost saving to the national economy of at least $2.2 billion annually in fuel costs could be realised. In addition to these savings, servicing and maintenance costs for electric vehicles are lower, further improving the value proposition. 5 million battery electric cars in the national fleet would lower the annual vehicle service cost by $500 million annually.

1. Australian Bureau of Statistics 9208.0 – "Survey of Motor Vehicle Use, Australia, 12 months ended 31 October 2014"

Battery electric cars are portable energy storage units. Through the use of 'smart grid' technology, use of supply-side charging would increase the efficiency of electricity generation. With enough cars connected, the stored available power could substantially assist grid balancing. If half of the Australian vehicle fleet were EVs, a secondary market in used batteries would flourish, allowing discounted home energy storage systems. This could save citizens who fit battery back-up to their homes up to $9 billion. If all these were grid connected this scenario provides 32 MW additional on tap grid capacity with the generating assets funded by consumers..

The Zero Carbon Australia – Electric Vehicles report, using conservative value and benefit estimates, and proposing a short time frame for transition, reported that: *"A rapid shift to electric vehicles operating on 100% renewable energy is both realistic and affordable"* A transition based on natural attrition and a target percentage will be more affordable. This same report also estimated a 12% saving in costs by transitioning to 100% electric buses as part of a dedicated strategy.

Fuel Cost Savings

Electric vehicles are far more efficient than internal combustion engine (ICE) vehicles. Electric drive efficiency can be as high as 95% and petrol as low as 25%. Even highly efficient diesel engines achieve only 35% efficiency. Using current costs, even a comparison highly in favour of petrol gives a reduction in fuel costs of 25% by switching to electric propulsion for an ordinary passenger car. Factoring in the current mix of the Australian passenger fleet, or cheaper electricity, savings of 50% are not unrealistic. Moreover, ICE vehicles become progressively more inefficient as they age, unlike an electric motor which has no detectable drop in efficiency over its lifetime.

Table 1: Comparison of petrol vehicles and a common EV

4 door saloon	Fuel Cost*	Consumption	Cost/100km	Factor
Toyota Camry	$0.69 / litre	7.9 / 100 km	$5.45	1.3
Toyota RAV4	$0.69 / litre	6.0 / 100 km	$4.14	1.0
Nissan LEAF	$0.22 / kWh	140 Wh / km	$3.08	0.74

Retail cost of petrol ($1.20), less excise and GST. Electricity cost can feasibly be cheaper, for example using solar panels at your workplace equate to roughly 8-10 cents per kWh. Half of daily use = 36 million litres / day at $0.69 = $8,942 million per year. A 25% reduction to this = $2,235 Million

This analysis assumes price parity between petrol and electric cars, and no battery replacement during the life of the car. While this scenario is feasible, price parity between EVs and ICE vehicles is expected to occur within the next 3 to 5 years. Factoring in a replacement battery after 105,000 km for the Nissan LEAF, at current prices this only increases the cost per 100 km by $4.40 ($2.20 / 100 km over a 10 year life of the car)[2]. Given price parity even this scenario indicates electric cars are economically competitive even with cheaper petrol and highly efficient cars.

The main restraint to lower upfront purchase costs currently is manufacturer reluctance and low volume sales. Wholesale battery costs have reduced by 40% since the first mainstream EVs arrived in 2010. Larger battery packs are now being supplied in 2017 models, enabling longer range and a longer battery calendar life.

2. Based on $300 per kWh storage price and 30% cost recovery for old battery in secondary market

Service Cost Savings

An electric motor consists of a single moving part (the rotor) which does not get appreciably hot under normal operation. This elegant simplicity results in significantly reduced maintenance compared to an ICE. Electric cars still require servicing to maintain roadworthiness but the lifetime cost can be less than half that of the petrol alternative. The 2016 Beyond Zero Emissions report on electric vehicles found over a twenty year period, maintenance cost could be between 31 and 38 percent lower on electric vehicles than an ICE vehicle. Brake wear is a significant component of the savings, as regenerative braking in an EV results in a 30 to 50 percent longer brake life.

Table 2. Comparison of maintenance schedules for an ICE vehicle and an EV.

Service components	Engine and transmission oil change	Engine oil/fuel filters, spark plugs	Brake, tyre and suspension	Pollen filters/ Air conditioning	90,000 km total service cost
Toyota Camry	YES	YES	YES	YES	$2020
Nissan LEAF	NO	NO	YES but reduced brake wear	YES	$1909

Motor vehicle companies may still encourage EV drivers to service their vehicles more frequently than needed, particularly given the potential decline in revenue. For example, Mitsubishi recommend changing the brake fluid at every service on their sub-compact i-MiEV, but only every 2 or 3 years on petrol models which have higher demands on their brakes. Nissan recommends servicing the LEAF every 10,000 km while the same technology in a Mitsubishi is serviced every 15,000 km. Over a 10.5 year period with distance travelled 210,000 km there is $1,000 service cost saving, despite the probable over servicing. This represents a 20 percent saving, but up to 40 percent may be realistic[3].

If we applied these calculations to 5 million cars in the Australian car fleet, assuming an average $100 per year service cost saving at current value for vehicles travelling 20,000 km a year, the cost savings equate to over $500 million per year.

Security of Transport Fuel Supplies

Australia is increasingly reliant on imported oil for transport. The situation regarding oil for transport has gone from self-sufficiency at the turn of the century to an estimated 80% dependency after 2020. This reliance will expose the Australian economy to effects caused by price changes, exchange rates and global market fluctuations. Australia also holds very low fuel reserves should supply be interrupted. In our largest cities, traffic disruptions caused by local accidents result in millions of dollars of lost productivity and loss of amenity to citizens. A prolonged fuel shortage would do immense damage to the economy. The AEVA strongly believes that a significant opportunity exists to commence a switch of our transport energy needs from liquid fossil fuels to electricity to safeguard against these circumstances. Using locally produced electricity is demonstrably cheaper, and will help reduce the impact of price fluctuations.

3. The Zero carbon Australia- Electric Vehicles report (2016) –the high cost scenario applied a discount of 25% for electric vehicle maintenance costs.

Australia already has enough generating capacity in its networks to support 100% electric transport with minimal change in load profiles. As cars spend most of their time parked, there is added potential to supply them with power when there is excess generating capacity on the grid. This dovetails with Australia's potential wealth of renewable energy.

Balance of Payments Benefits

As noted under fuel security, Australia is increasingly reliant on imported fuel. Australia imports 29 gigalitres of crude oil a year (roughly 500,000 barrels a day) producing just over 14 gigalitres of automotive grade petroleum fuels[4]. At AUD$ 66 a barrel[5] this equates to $33 million per day. As local production declines, over $15 billion a year in foreign income will be needed to fund national demand for fuel. Any significant portion of the fleet running on electricity would reduce this commitment and put spending power back into the Australian economy. In a nation increasingly reliant on manufactured imports, a balance of payments deficit in an increasingly volatile world economy will impact every Australian.

Australians could spend as little as $10.8 billion on transport energy should the fleet be completely electric, compared to our current spend of $17.8 billion on petrol[6]. An annual saving of $7 billion in transport energy is achievable.

Electricity Supply Benefits

Household electricity prices have increased in recent years, largely due to major investments in distribution networks. Upgrades to the distribution networks to deal with peak loads can represent a significant over-capitalisation, when distributed-system alternatives are available. The AEVA suggests that electric vehicles may play a role addressing peak loads not only because their daily load profile is very predictable, but because the recharging load can be managed in real time. Moreover, electric vehicles present a significant, potential electricity storage option for the grid, as vehicle-to-grid energy flow would allow more intermittent sources of electricity such as that from solar and wind, to be utilised as the need arises. The development of "smart" electricity distribution networks is essential, and would deliver considerable efficiencies if executed properly. One of the characteristics of distributed generation such as household solar PV, is that the electricity will be consumed by the closest source of demand, limiting transmission losses. However generating more electricity than there is demand for represents an underutilisation of assets. Enough electric vehicles on a supply-based charge cycle can readily absorb oversupply, making generation during off-peak periods far more cost effective.

As mentioned earlier, EV batteries will find their way into second-life applications for grid stabilisation and load levelling. Bearing over 80% of their original capacity, these batteries will offer at least another half-decade of useful life as stationary storage. Undoubtedly a secondary market for these will develop, and significantly reduce the cost of energy storage for households with PV based generation. This will enable demand management by households. Smart metering of the grid and enhanced reselling capability for households will enable stabilisation of energy prices as well, leading to better capacity planning and cheaper, more reliable power.

4. Australian Petroleum Statistics, Issue 242, September 2016 report
5. Brent crude oil price US$50 barrel at November 2016
6. Assuming electricity price of $0.22 per kWh, petrol wholesale at $.69 per litre, and EV economy of 14 kWh/100 km.

Theoretical example: *Assuming 2 million homes with installed PV. Providing battery storage from second hand LEAF battery packs (22kWh usable) to all homes at 30% cost of $6600 = $1980. Saving of $4620 per home = $9.24 billion and offering 264 MWh of capacity. At a nominal 2 kW of output per household, this may provide up to 4 GW to the grid at any time it is demanded.*

Driving Energy Productivity

Increasing energy efficiency measures into all aspects of the generation, transmission and consumption chain is essential for reducing costs. Demand side management has proven to be one of the most effective, market-based approaches to reducing peak loads during hot days. However, having significant numbers of electric cars on the roads presents another opportunity. Current capacity in the grid is able to accommodate a large number of EVs recharging at the same time, however time of use metering facilitates a delay in charging the vehicle until after midnight; when both grid-wide demand has fallen and electricity tariffs are cheaper. EV recharging can increase the demand for electricity by a sizable margin, and can be supplied when distribution and generating assets are underutilised. This would increase return on investment and theoretically could result in cheaper electricity.

Workforce Productivity

Australia needs to avoid a skills shortage in the development and roll-out of "smart" electricity grids, vehicle-to-grid infrastructure, and the impact this may have on achieving the benefits of the EV fleet. Development of specialised training on these technological advances is essential and will require immediate attention given the rate of progress. There is a massive opportunity to further develop these technologies in Australia, provided the appropriately skilled workforce can be built around them.

The renewable energy sector has countless synergies with electric vehicle technologies, the innovations destined for our electricity grids and renewable energy needs a well trained workforce. This will ensure greater productivity from both sectors and a decreased reliance on skilled workers from outside of Australia.

Secondary benefits where savings are not calculated

Migrating a large proportion of the vehicle fleet to electric power combined with increased use of renewable energy enabled by this transition, would also substantially reduce Australia's greenhouse gas emissions.[7] This would enable the country to meet requirements of agreements such as the Paris accord while saving costs, in place of increasing them.

The reduction of traffic fumes and ground level pollution in major towns and cities would have undeniable health benefits, especially for young children.

The reduction of traffic noise and pollution on major trunk routes in cities would be a major bonus for residents of those corridors.

Regenerative braking and the awareness of reduced range results in EV owners driving less aggressively, also very few electric cars are capable of, or efficient at, sustained very high speed, this could act to reduce the frequency and cost of road accidents and trauma.

7. The passenger and light commercial vehicle segment accounts for 17% of Australia's total CO_2 equivalent emissions. With cleaner electricity and mass EV uptake could reduce this by 16 to 47%. Source: Climateworx submission –'The path forward for electric vehicles in Australia'

The costs of developing offshore liquid petroleum and gas reserves are increasing. This is unsurprising as fossil fuel resources become increasingly harder and technically challenging to extract, not least due to the environmental sensitivities of the ecosystems which contain these petroleum reserves. The long term benefits to the environment of reducing our domestic reliance on fossil fuels could be immense.

Regulatory Reform and Role of Government

The AEVA supports efforts to reduce unnecessary regulation in the energy markets, provided measures designed to keep the market fair are maintained.
Universal availability of time of use tariffs and 'smart' metering could enable electric vehicle owners to recharge their vehicles when prices are low, and export their power when the market returns are high. The AEVA believes there are multiple areas where reasonable government action would encourage the adoption of electric vehicles.

***Recommendation*:** That the further development of 'smart' metering and 'smart' grid functionality be fostered and standards and rules for demand and supply balancing covering fair financial practice and device communications protocols be developed.

***Recommendation*:** A premium should be offered to households who can supply electricity to the grid from fully charged EVs, or home battery supplies as this represents a premium reserve of electricity which can be accessed rapidly.

The availability of charging while at work during the day is a proven incentive to drive an electric car, increasing desirability by 20-40%. Additionally solar PV fits perfectly with the profile of daytime and supply side driven charging. This would also place no additional demand on the existing grid. However current regulations in Australia discourage workplaces from offering this to employees.

Recommendation: Exemptions be provided on regulations regarding on-selling of electricity to enable businesses to offer this to employees, visitors and customers on a cost recovery basis.

***Recommendation*:** An amendment be made to fringe benefit regulations to exempt the supply of electricity for free or less than cost to employees for own vehicle re-charging.
Recommendation: That a study be made to determine which measures would best incentivise the supply of at work, or place of business recharging for electric vehicles.

Recommendation: That the regulations pertaining to light vehicle emissions standards, (currently under review) be updated to the extent of adopting the European and Californian standards. Providing fleet based standards for emission reduction. This would bring Australia into line with other developed nations and incentivise manufacturers to offer to Australian consumers a greater range of affordable electric vehicles.

Recommendation: That a comprehensive plan or targets down to the local level be set, to provide a nationwide network of public access recharging stations. This would mitigate 'range anxiety' and provide greater utility for electric car owners. The infrastructure will need to be built anyway, particularly as EVs begin to displace petrol powered vehicles.

Recommendation: That at state and local levels of government, regulations and by-laws be modified to provide incentives for electric car uptake that require no expenditure. Examples: Preferential parking at reduced or no cost, reduced tolls and access to transit lanes.

Many Australians are not financially able to purchase new motor vehicles and rely on the second hand market. Private buyers tend to not change cars purchased new for a number of years. A lack of second hand electric cars will disadvantage many citizens and delay achieving a high proportion of EVs in the national fleet. If car purchases at all levels of Government heavily favoured electric, this could help redress this situation.
This option would result in the least distortion of vehicle prices in both the new and used car markets while providing a supply of affordable second hand electric cars.

Recommendation: That Government at all levels purchase only full electric or plug-in hybrid vehicles for their fleets where appropriate. These vehicles should be sold locally into the second hand market with a replacement schedule of two years in the short term. Target vehicles in the short term would be passenger vehicles which travel less than 200 km in a day.

Recommendation: That the Federal Government create a department of Vehicle Electrification with full Ministerial power to investigate, facilitate and co-ordinate initiatives in the area of vehicle electrification across all states and territories and all forms of transport[8], with the aim of achieving a very high percentage of migration by a specified date.

As noted earlier, research and development into EVs has directly reduced battery costs. With the continuing affordability of home solar PV and a boom in battery backed systems to enable consumers to maximise their investment and reduce costs, battery sales are increasing. This represents an opportunity for investment in local battery manufacturing and re-cycling.

Recommendation: That a subsidy or incentive be offered to re-cycle and re-manufacturer modern lithium compound and other battery types locally. This could also include new manufacture of modern lithium battery cells, giving potential to support local manufacture of battery electric vehicles or for home use. Regulations on the disposal of these battery types are necessarily rigid, and businesses should be encouraged towards local re-purposing and manufacture.

Elsewhere around the world, direct subsidies for the purchase of an electric car were offered, with significant uptake rates resulting. While clearly effective, they are expensive and alternative approaches may be taken. A tax rebate would still be an incentive to buy a new EV, but the benefits are not realised until the owner files their tax. The size of the rebate could feasibly be percentage based over two or three years.

Recommendation: That a taxation regime favourable to electric vehicles be introduced in the short term, including registration reductions and key exemptions.

8. National electric vehicle roadmap is recommended by the Climate works submission; –'The path forward for electric vehicles in Australia'

Growth and Investment

The AEVA also believes that the Australian manufacturing sector could build electric cars and motorcycles here in Australia. The departure of Mitsubishi, Holden and Ford and Toyota, represents a challenge to the local economy but also presents an opportunity to leapfrog to the vehicle manufacturing of the twenty-first century utilising existing labour capacity and expertise. This could be via a foreign automotive co-investment or local design expertise.

Australia is currently well placed to design, build and market specialist EVs to the world. As noted above there is also a significant opportunity in local manufacture and re-cycling and re-manufacture of modern chemistry batteries.

Negative Effects

Large scale adoption of electric cars may mean there will be concentrations in some urban areas requiring the grid infrastructure to be upgraded. As the power demand per charging car is comparable to an air-conditioning unit, smart infrastructure can mitigate risks in the area through circuit specific demand mitigation and time of use incentives.

Obviously petrol and oil companies will suffer revenue loss, however the bigger players are not Australian owned anyway. The majority of Australia's previous refinery capacity has long moved offshore. Regardless, there will be a reduction in jobs connected to importing oil and petrol, and delivering to outlets. Service station turnover will be affected, possibly causing the closure of half the existing sites. However this also frees up prime urban land for other use. There will also be significantly reduced demand for motor mechanics to work on petrol engines, although much of the running gear of a motor vehicle remains – brakes, wheels, bearings and tyres. As these cars still need servicing, under the scenario where half of the fleet is migrated, this may be 20% or less of this workforce. Finally, vehicle owners with no off street parking will continue to need access to public charging infrastructure, thus necessitating a continuation of access to charging points at, or in proximity of workplaces.

Thank you for the opportunity to provide comment to this discussion paper.

Edward Booth
President

Dr Chris Jones
Secretary

December 8th, 2016.

Co-authors Daryl Budgeon and Chris Jones

References:

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