Australian Electric Vehicle Association
www.aeva.asn.au

AEVA POLICY RECOMMENDATIONS: A DISCUSSION PAPER
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Foreword

This document is intended as a definitive statement of AEVA's policy recommendations. It serves as a set of proposals to the Federal Government, and to the State and Territory Governments, aimed at accelerating the electrification of transport in Australia, and at meeting the needs of the EV drivers and riders AEVA represents. This document is intended to influence the further development of the Federal Government's National Electric Vehicle Strategy.

This document was developed through the following steps:

• An initial draft prepared by the National President (Chris Jones) in January 2023

• Discussion at AEVA Board meetings (24 January and 7 March 2023) and at a workshop involving AEVA Branch Chairs and Board members on 2 March 2023

• The present version, following the above discussions, which will form the basis of a survey of AEVA members, most likely in May 2023.

Introduction

Since 1973 the Australian Electric Vehicle Association has served as a friendly forum for sharing information on, and advocating for electric propulsion technology. Founded by a small group of automotive and transport engineers in Sydney, the association's origins represented the full breadth of the transport sector. To this day, the AEVA proudly elevates all kinds of electro-mobility – bikes, motorcycles and scooters, cars, vans, utes, trucks, buses, trams, trains, boats and aeroplanes.

Over the last 50 years, the AEVA has served many concurrent roles, including (but not limited to) assisting members of the public with advice on converting vehicles to electric drive; public education and information sessions on EV battery technology, motors and charging; fostering interest in science, technology, engineering and mathematics (STEM); and advocating to governments for more electric transport-friendly policies.

On the subject of public policy, AEVA's mission has been relatively simple – transition Australia's transport networks to electric drive as quickly as possible. Broad objectives like this are great, but the *means* by which this goal is realised is crucial. The organisation's public policies should ideally reflect the most effective means to achieve full electrification of transport.

Transport is a complex field, with many interrelated matters crossing paths with it. Decisions made in one arena will have substantial impacts on the success or otherwise of others. For example, federal tax arrangements allowing businesses to write down the value of a commercial vehicle purchase has resulted in an explosion in the number of heavy 4x4s and the associated demands they put on infrastructure and public safety. Thus it is necessary for an organisation such as AEVA to be across all aspects of the field, and be conscious of potentially conflicting or complicating factors. Sometimes it is necessary to take an informed position on matters beyond transport, as these issues ultimately impact the success, scale and speed of transport electrification.

With the above in mind, the AEVA should put forward a coherent, broad and scientifically sound policy suite which both achieves the objective of our mission, and recognises the wider impact of such policies on society, the environment and the economy.

AEVA's public policies have mostly been arrived at through a process of calling for contributions to government submissions. These are collated and presented as a single letter to a committee or panel, and are re-published on our website. The AEVA Board has resolved to improve this policy visibility by conducting a survey of AEVA members on matters previously covered in submissions, as well as emerging fields.

This document identifies 18 policy areas. Each of these areas is presented firstly with some context and a short discussion about the nature of the problems requiring resolution. A set of policy statements for each area will be provided. In a survey, AEVA members will be encouraged to provide a measure of support (strongly disagree, disagree, neutral, agree, strongly agree) as well as space to add further comments or perspectives. Policy statements with an average 'disagree' score will be dropped, while those with an average 'agree' score will be pursued. Those which are neutral may be adjusted if member responses justify it.

Policy Area 1: Financial incentives and support (including tax reform)

Like all commodities, electric vehicles are subject to the economic forces of supply and demand. As interest and buying intentions increase, the value of the commodity grows accordingly. If demand for the product declines, so too will its market value. Electric vehicles have generally commanded a higher price than equivalent internal combustion engine (ICE) vehicles for two key reasons – their production has been relatively scarce, and until recently demand was quite low. Over the past decade, new passenger electric car sales have increased exponentially, but the value proposition of an EV has generally improved too – a 2012 Nissan Leaf with 140 km range retailed for nearly $60,000 while in 2022, a Leaf E+ with 380 km range retails for just over $64,000. In 2023, global demand for passenger EVs is through the roof and manufacturers are struggling to maintain a reliable supply of materials. In particular, the price of lithium has risen sharply, along with nickel and graphite, cobalt and copper. These supply constraints are expected to persist for several years.

Jurisdictions which offered incentives for citizens to buy an EV saw rapid increases in uptake. The incentives ranged from direct financial subsidies to consumers (cash rebates), indirect financial support like tax relief (such as exempting EVs from stamp duty and indirect taxes), and other forms of support like home charging infrastructure, public fast charging infrastructure, and low-rate finance. These were initiated at a time when demand was low, supply was steady, and the public finances to support such a scheme were amenable.

However, subsidies and rebates can present an equity problem. Despite their low running costs, electric cars and motorcycles are still more expensive than an equivalent ICE vehicle, with the cheapest electric cars starting at around $43,000 in Australia, as at March 2023. Considering this is roughly one third of the average annual household income, one may question the fairness of public money being used to encourage households already in the market for a $43,000 car with rebates. Generally there is an upper price limit on such incentives, which has the added benefit of compelling manufacturers to offer more affordable EVs. Australian state and territory governments currently offer very different levels of support and different eligibility criteria, meaning EV incentives are more generous in some places than others. Means testing is another way of ensuring integrity, primarily through an assessment of household taxable income, but this is generally more difficult for state governments to oversee. That said, the Queensland government recently announced a massive expansion of their purchase rebates, limited to households with an income of $180k or less.

There is also the issue of inflationary pressure. At a time when supply of EVs is tightly constrained by production limits, governments offering a $3k to $6k cash subsidy would simply increase the market value of a new EV by the same amount. The extent to which this occurs depends on the nature of the scheme: a post-purchase rebate application process generally tempers the impact, but it also contradicts the original intention - helping buyers who struggle to afford the upfront cost.

Considering two-thirds of all vehicle purchases in Australia are of second-hand vehicles, a solid case may be made to offer financial assistance to low-income households who cannot afford a new EV. The second-hand marked for EVs in Australia is tight owing to the small number of vehicles currently on the roads, but will steadily grow over time. Many low-income, car-dependent households would still benefit from accessing EVs in the sub-$20k price range, so it may be possible to extend financial support to the purchase of used EVs, including parallel imports. However it must be noted that the inflationary impact will be greater for these vehicles unless the rebate is proportional to the market value of the vehicle. Stamp duty exemptions and registration fee relief are currently offered in several states and territories.

One financial incentive which is showing very positive results is the City of Denver's decision to support households with the purchase of an electric bicycle or cargo bike. So far nearly 5000 offers have been redeemed, with releases every two months to minimise gaming or scalping. Programs like this allow low income households access to the benefits of electric transport at a fraction of the cost of a car rebate, while simultaneously reducing motor vehicle congestion in the city. Australian governments have not included electric motorcycles, mopeds or e-bikes in the current schemes, but have not explicitly ruled it out.

The primary justification for excluding e-bikes is based on emissions reduction potential – the kind of person likely to take advantage of a cheaper e-bike, is someone who already rides fairly regularly, so the effective emissions reduction is lower than someone moving from an ICE car to an electric car. Moreover, until governments take safer cycling infrastructure more seriously, uptake is likely to flounder.

Governments may also employ indirect financial support, primarily through the provision of stamp duty relief, fringe benefits tax (FBT) relief and import duty relief. Stamp duty is a state/territory government domain, while the FBT, GST and import duties are federal. The Australian government recently changed the FBT legislation to exempt EVs, and removed the import duty mainly applied to European vehicles. Tax arrangements have been in place for ICE vehicles for decades, and these have

led to substantial (often perverse) changes in consumer behaviour. In particular, the fully tax-deductable purchase of dual cab diesel utes for business has seen this particular segment become Australia's best selling. These vehicles present a significant increase in mean kerb weights, and therefore fuel consumption and greenhouse gas emissions. They also present a significant safety risk to cyclists and pedestrians.

Most jurisdictions have a plan to phase out EV incentives when uptake exceeds a key metric, such as 30% of all new sales, or when a set number of offers are exhausted. Nations like Norway, with the most advanced EV policies and rates of uptake, have even begun implementing policies designed to encourage residents to abandon the private automobile in favour of mass transit wherever possible.

Area 1 policy statements

[1.1] Policy: AEVA supports specific financial incentives to stimulate uptake of passenger and commercial EVs, provided they exert minimal inflationary pressure. These incentives should extend to used EVs and first-time registered conversions, as well as new EVs. Incentives around stamp duty relief and registration discounts are preferred over direct cash subsidies.

[1.2] Policy: AEVA supports a limit to the retail value of a new EV eligible for financial assistance. This improves entry for lower income households, while motivating manufacturers to offer more affordable models.

[1.3] Policy: AEVA supports a further widening of the difference between the thresholds at which the Luxury Car Tax is applied to 'efficient' versus 'ordinary' vehicles, coupled with a tightening of the definition of 'efficient' so that only true zero-emission vehicles and exceptionally efficient hybrids are included.

[1.4] Policy: AEVA supports an exemption from Fringe Benefits Tax (FBT) where employers provide EV charging at work for their employees. This exemption could expire when new passenger EV sales exceed 30% of all sales, or when EVs represent at least 5% of the national fleet of passenger vehicles.

[1.5] Policy: AEVA supports extending financial support to households to purchase an electric motorcycle, moped, e-bike or cargo bike.

[1.6] Policy: AEVA implores state and territory governments to work cooperatively with the federal government on harmonising incentives, so that no one jurisdiction is more lucrative than the next.

[1.7] Policy: AEVA supports the removal of tax holidays for diesel utes, and recommends a tightening of eligibility criteria when offering tax deductions on electric work vehicles.

[1.8] Policy: AEVA supports an eventual phase-out of any financial incentives, but only when new passenger EV sales exceed 30% of all sales, or when EVs represent at least 5% of the total national passenger vehicle fleet.

Policy Area 2: Emissions standards and ZEV targets for light and heavy vehicles

Transport (road, rail, sea and air) is responsible for one fifth of Australia's domestic greenhouse gas emissions, with passenger and light commercial vehicles making up nearly two-thirds this total.

Australia does not currently have any minimum standard of fuel efficiency for passenger vehicles (gross vehicle mass of less than 4.5 ton). This relates specifically to the metric 'litres/100 km', which

extends to 'grams CO_2-equivalent/km'. We do however have emissions limits on noxious substances like carbon monoxide, nitrogen oxides and particulates for all new vehicles sold, based on the "Euro 5" standards. Thankfully, electric passenger vehicles do not release these substances in operation, but the emissions intensity of grid electricity used to charge these vehicles is well documented in the greenhouse gas accounts factors, updated annually. The Australian Government's Green Vehicle Guide uses these figures to determine the average emissions intensity of all vehicles; electric, petrol gas or diesel. In general, emissions standards are based on the tailpipe emissions of a vehicle – that is, it does not include the emissions associated with upstream processing of the energy source (petrol, diesel, or electricity). This makes sense, as manufacturers would be powerless to produce zero emission vehicles if the grid supplying that energy isn't also cleaned up.

Around the world, vehicle emissions standards have been implemented and are designed to be steadily tightened. By mandating improvements in vehicle efficiency, under threat of some financial penalty, overall emissions intensity is reduced. In the EU, a fleet average emissions intensity of 95 g CO_2-e/km is set for passenger vehicles and 147 g CO_2-e/km for light commercial vehicles. This has had the impact of motivating manufacturers to produce more fuel efficient vehicles and EVs for sale in those markets. Crucially, it also increased competition for specific vehicle segments, putting downward pressure on new EV prices. However it has also motivated them to offload their more polluting models into markets which do not have these restrictions, namely Australia and New Zealand. Thus, an enforced emissions standard for Australia would close this loophole.

Another risk is that the presence of two standards (one for passenger vehicles and one for light commercial vehicles) encourages manufacturers to re-define their passenger vehicle offerings as light commercial vehicles, allowing a less stringent emissions standard. This has fuelled the substantial growth in less efficient, heavier vehicles particularly in the USA.

Criticism of the measure largely revolves around limited access to low-emission vehicles for specific market segments, particularly motorcycles, vans, commercial and farm vehicles, heavy rigid and articulated trucks. The Australian government is actively considering fuel efficiency/emissions standards, but it remains to be seen if this will extend beyond passenger vehicles. For example, ICE motorcycles currently range from 60 g CO_2-e/km for a small-bore road bike, to over 130 g CO_2-e/km for a sports tourer. Therefore it is not inconceivable that motorcycles could be included in the passenger vehicle emissions standards, in an effort to drive innovation in efficiency and eventually full electrification. Suzuki Motorcycles have discontinued sales of their flagship sports bike in Japan and the EU, in part due to tighter emissions regulations.

By requiring automakers to achieve a *fleet average*, rather than a prescribed value for all new vehicles, manufacturers are still able to sell vehicles for key segments (such as utes, minibuses and vans) concurrently with zero-emission vehicles. Thus, a target of 95 gCO_2-e/km for *all new* light vehicles across a manufacturer's sales could be adopted. The higher profitability of larger, heavier and generally, more polluting vehicles remains a significant impediment to reducing emissions, so a timeline of increasingly stringent emissions targets should be employed to motivate change.

Emissions standards may also serve as a valuable way to timetable an eventual phase-out of polluting vehicles. Several jurisdictions around the world have set a goal of banning the sale of new ICE vehicles by 2035. Clear targets like this create an unambiguous timeline for manufacturers to adjust. In Australia the ACT government has committed to not permitting the registration of ICE passenger vehicles in the territory from 2035. While not an outright ban, it makes for a clear goal.

Heavy vehicles like trucks and road trains present a challenge as they are moving variable masses of goods, changing the CO_2-e/km considerably. As the tare mass varies depending on the class of heavy vehicle, a gross vehicle mass (GVM) component would need to be included to account for such variation in load sizes. The European Automobile Manufacturers Association found the average emissions intensity of the most common heavy vehicle class (5-axle, long-haul articulated tractor trailers) was 56.5 g CO_2/ton-km. They also found little deviation from this mean, indicating competition in efficiency measures was already strong. While electrification of heavy vehicles is progressing well, the step changes in battery energy density required for full electrification are yet to be realised. For this reason, a longer timeframe for the total phase-out of ICE heavy vehicles may be necessary. It also highlights the significant opportunity for more goods to be moved by electric rail in the coming years.

Area 2 policy statements

[2.1] Policy: The AEVA recommends that the elimination of greenhouse gas emissions from the transport sector should be the primary goal of governments, achieved through a suite of measures including improved efficiency, substitution of modes, and full electrification of all sectors. These measures should be reviewed annually for progress.

[2.2] Policy: The AEVA supports legislation which seeks to end the sale of new ICE passenger vehicles and motorcycles by 2035, and new ICE heavy vehicles by 2043.

[2.3] Policy: The AEVA supports the legislation of mandatory vehicle emissions standards for manufacturers of motorcycles, passenger and light commercial vehicles. This should be a fleet average of 95 g CO_2-e/km in 2023, which is tightened by 8 g CO_2-e/km every year until 2035, when all new light vehicles sold must be zero-emission in operation.

[2.4] Policy: The AEVA supports legislated mandatory emissions standard for road-going heavy vehicles (>4.5 tons GVM) of 56 g CO_2-e/km-ton in 2023. This standard should be tightened by 2.5 gCO_2-e/km/ton each year until 2043, when all new heavy vehicles sold must be zero-emission in operation.

Policy Area 3: DIY EV construction

Since its inception, the AEVA has helped Australians convert their own road-going vehicles to electric drive through workshops, internet forums, public meetings, advice on parts and determining specifications. For the longest time, the only way to drive or ride an EV was to build your own. Now that production EVs are commonly available, only the dedicated few continue to convert cars to electric, but convert they do! In general, Australia has a long, strong history of do-it-yourself car modifications and after-market accessorising, and this supports a multi-million-dollar retail industry. Workshops specialising in all manner of modification have sprung up, offering a range of services from sale of parts to full-blown restoration projects. You don't need to be a mechanic or an electrical engineer to convert a car to electric, but you do need to be reasonably competent and have the funds to make it happen.

While conversions may not make a lot of financial sense for passenger vehicles, they may still make sense for specific body types like vans, recreational vehicles and tray-back utes. Until global automakers offer a compelling electric option for these body types, converting ICE vehicles is a

viable way to go. In fact many firms around the country are already developing drop-in kits and complete conversions.

All vehicle modifications must be done in compliance with the relevant state or territory Department of Transport. It remains illegal to modify specific aspects of your vehicle (particularly the power train, brakes and safety features) without prior approval from the Department of Transport, and the vehicle may only be re-licensed after inspection by an approved Certifying Automotive Engineer. A National Code of Practice (NCOP14) was developed by the AEVA and others over 15 years ago specific to electric vehicle conversions, and it remains the go-to standard to this day. The New Zealand Low-Volume Vehicle Technical Association also has a very similar document in scope and detail and serves as another useful reference.

As more and more production EVs are retired, many of the drive train components, including batteries, motors, inverters, chargers and air-conditioning systems will become available for the DIY scene. Most components are designed to operate at voltages from 300 V DC to almost 1000 V DC. These voltages are certainly high enough to seriously injure or kill, but numerous safety features including fail safes and isolation interlocks exist.

All Australian states and territories have an Electricity Regulations Act which clearly defines what constitutes Electrical Work, and who may perform it. In all cases, any electrical work where the voltage exceeds 120 V DC, or 50 V AC is deemed 'electrical work'. Electrical work must be performed by a licensed electrical worker or electrical contractor; that is, they have completed at least a Certificate III in Electrotechnology, completed a four year apprenticeship in the electrical trades, and have been authorised by the Office of Energy in that state or territory to do such work.

However, some states have a clause in their Electricity Regulations Act *which explicitly excludes working on electric vehicles* from the definition of electrical work. Western Australia's is perhaps the most unambiguous (Section 4A, 1A), while Queensland has a specific exclusion for electric cars and motorcycles, but not heavy vehicles (Section 73). Other states don't mention EVs at all. The inclusion of such clauses arose from the unrealistic expectation that motor mechanics who will invariably work on EVs must also complete a four-year electrical trade qualification. Consistency across jurisdictions would be desirable and remove any ambiguity. To this extent, the harmonised Workplace Health and Safety legislation includes definitions of electrical equipment (section 144[2]) which is subject to licensed work, and this explicitly excludes electric vehicles.

Installation and repair of EV charge points is considered electrical work in almost all cases, and with the exception of installing a plug on an EVSE in some states, the work must be done by a licensed electrical worker.

Thankfully, to the best of the AEVA's knowledge, nobody has ever been seriously injured or killed when working on an EV. Long may this remain the case! The AEVA will continue to support members with their conversion projects through experience, sound engineering and access to information.

There are elements of the automotive industry pushing to regulate against DIY EV conversions, along with other 'closed-shop' measures designed to ensure only selected and (presumably) qualified technicians may work on EVs. They argue that safety is the primary justification; however the same standard is not applied when working on say, the fuel pump or brakes of an ICE vehicle.

Recent federal legislation changes sought to ensure Australians' "right to repair" was protected; the Motor Vehicle Service and Repair Information Sharing Scheme amendment to the Competition

and Consumer Law was passed, but it still only refers to 'eligible Australian repairers' – that is, workshops registered with the Australian Automotive Service and Repair Authority which is directed by members of key automotive industry bodies. Individual citizens are still unable to access essential repair information, including how to do it safely. Withholding information around the maintenance and upkeep of EVs may even be contrary to Australian Consumer Law. Given the comparative size of the DIY repair sector and the high cost of entry presented by a DIY EV conversion, the automotive repair industry is clearly not under any threat.

One suggestion to remove ambiguity around competency is to offer AEVA members who want to learn about working on their own EV the opportunity to participate in a recognised training course. The Automotive Retail Training Package offers a suite of units, with a foundational course (AURETH101 – Depower and re-initialise electric vehicles) being a prerequisite for all others. This unit can be completed in one day from a registered training organisation like TAFE.

Area 3 policy statements

[3.1] Policy: The AEVA supports clarification of state and territory Electricity Regulations Acts to include a clause which specifically and unambiguously excludes construction and maintenance of road-going electric vehicles, from the definition of "electrical work".

[3.2] Policy: The AEVA is committed to helping members learn about EV conversions, service, operation and maintenance, and supporting them with any training or skills development through branch activities.

[3.3] Policy: The AEVA remains committed to ensuring Australians can convert their own road-going vehicle to electric drive without hindrance, so long as the vehicle is compliant with NCOP14, passes engineering inspections and any other relevant local regulations.

[3.4] Policy: The AEVA fully supports the right to repair one's own EVs should they choose to do so, and insists that access to technical information not be withheld by manufacturers on grounds of safety or intellectual property.

Policy Area 4: Electric mass transit – railways, trams and buses

Electric mass transit represents one of the most efficient ways of using electricity to move large numbers of people. The extremely low rolling resistance of steel wheels on rails means less energy is required per kilometre travelled, while the corridor is generally constructed such that inclines are mild and turns are gentle, further improving efficiency. Up to 25,000 people per hour can be moved with commuter rail, requiring a corridor just 5 m wide – implying a flow capacity about 10 times that of a typical freeway lane. Maintenance on railways is also cheaper per kilometre than roads.

Pre-COVID, electric trains were responsible for almost 18 billion passenger-kilometres travelled every year in Australia. Suburban commuter rail networks in Brisbane, Sydney, Melbourne, Perth and Adelaide are the unsung heroes of electric land transport; moving millions of passengers each week using electricity from a grid which is only getting cleaner. Even more passenger-kilometres were delivered by buses; however these were primarily powered by diesel and compressed natural gas.

Electric trains and trams use overhead wires, meaning no traction batteries are required. However, battery locomotives and battery electric multiple units are employed around the world, with many able to be recharged using the overhead network. Likewise, battery electric buses are well

established in China and are becoming a major policy initiative of state governments in Australia. Some buses may use the same overhead power as electric trams – typically 600 V DC – however in Australia the growth of electric buses will exclusively be in battery-electric options.

Electric passenger rail remain Australia's most popular EV, and in most cities expansions are in place; Metronet in WA, electrification of remaining lines in Adelaide, the Suburban Rail Loop in Melbourne, and several new lines in Sydney and Brisbane. Queensland has been operating a twice-daily electric rail service Brisbane to Rockhampton since 1998. Intercity rail and road coach services provide a crucial link to key communities; youths who are not yet old enough to obtain a driver's license, low income households, pensioners, and the disabled frequently rely on these services to attend school or university, medical appointments or visiting friends and relatives.

Poor investment in these services citing low patronage has only resulted in more infrequent and slow services, which further turns passengers away. A significant return to investment is required.

Reassuringly, the Federal government has established a High Speed Rail Commission which will oversee planning and corridor works primarily around Sydney, but hopes to extend its scope to Brisbane, Canberra and Melbourne. Rail services need not even be 'high speed' – a recent evaluation of the Sydney-Melbourne rail line found several key track realignments across the Great Dividing Range, along with track duplication would slash hours off the trip using existing rolling stock, while electrification of this key corridor (with a branch to Canberra) would be transformative. The cost of such an upgrade would be a fraction of a new high speed rail corridor and could be implemented within a few years. As the line shares services with good trains, their service schedule would be vastly improved too. Regional passenger rail has been studied extensively by the federal government, but frustratingly, little progress is made.

Faster and more frequent rail services linking Adelaide and the eastern seaboard could significantly reduce road traffic on the Princes, Hume and Pacific highways. Reports of long queues at EV fast chargers during holiday periods are a reminder that long-distance travel by EV will require massive investments in charging and supporting infrastructure. If a competitive inter-city rail service were an option, these queues might not be so long.

Currently rail, tram and bus passenger movements amount to less than 10% of road traffic volumes. If reducing Australia's transport-related greenhouse gas emissions is a core goal, these patronage figures must increase. Electrification of metropolitan bus services will see substantially reduced emissions of noxious gases, along with acute improvements to public health.

The success or otherwise of an urban mass transit network is highly dependent on numerous other planning decisions. An example where things can go wrong was the development of Brisbane's outer suburb, Springfield. Established over 20 years ago, the suburb enjoyed explosive growth, but was largely dependent on road transport for connections to the rest of the city. Not only did an entire generation of residents learn to become dependent on private vehicles for transport, but the rail extension from Darra two decades later was vastly more expensive.

Finally, battery-electric multiple units may prove valuable in decarbonising several regional rail services. The Prospector in WA, V/Line in Victoria and the Trainlink network in NSW all serve communities hundreds of kilometres from the city centre using diesel locomotives. While some high-traffic lines may easily be electrified with overhead power, many would be uneconomical. A battery-electric hybrid train may recharge and operate using overhead power in the city and switch to

battery only further afield. Several electric, battery and hybrid rail options exist in Europe, with the need for interoperability driving innovation.

Area 4 policy statements

[4.1] Policy: AEVA recommends state and territory governments continue to invest in the full electrification of suburban bus services. Regional coach services should also be delivered by battery electric buses, ensuring the benefits of EVs are extended to those who cannot travel by car

[4.2] Policy: AEVA recommends an investigation into suitable Battery Electric Multiple Units for key rail services, and supporting local rolling stock fabrication.

[4.3] Policy: AEVA recommends continued expansion of electric suburban rail services in Australia's cities, along with further investments in new light rail services.

[4.4] Policy: AEVA recommends a massive investment in upgrading Australia's major rail links so that regular, high-speed passenger rail services may flourish. Lines should be upgraded to high ton-per-axle rail with minimal curve radii and duplicated in most places to ensure high quality passenger services.

[4.5] Policy: AEVA recommends overhead electrification of key high-traffic rail routes linking Australia's eastern seaboard, primarily Melbourne-Canberra-Sydney-Newcastle-Brisbane using standard 25 kV equipment.

Policy Area 5: Road user charging, road infrastructure and urban planning

Without publicly accessible roads, EVs are going nowhere. Australia has approximately 1.8 million lane-kilometres of road and these roads must be maintained to a high standard for the safe and efficient movement of people and goods. Most Australians are familiar with the fuel excise, which levies a 47c/litre cost on liquid fuels. It raised about $12 billion in FY20/21; a consistent source of revenue for the past decade. Since 1959, all Commonwealth government funding for roads has come from consolidated revenue. Prior to this, the fuel excise was explicitly hypothecated to road construction and maintenance.

Collectively, Australian governments have spent over half a trillion dollars in the past 25 years, mostly as new road project construction funding along with maintenance. On a per-capita basis, this is amongst the highest in the world. Roads take an enormous toll on life too – about 1100 Australians are killed each year in road crashes, while major arterial roads often divide communities, substantially limiting movement across their path. Wildlife and their supporting habitat are under relentless pressure from roads, risking local extinctions for birds and mammals.

Appropriate costing of roads and vehicles and their externalised impact on society will be crucial to driving a shift in how Australians move around. Congestion charging, toll roads, and other peak-responsive models are being explored as a means to make roads expenditure more efficient and better reflect the true cost of motoring. It looks increasingly likely that as EVs dominate the passenger vehicle segment, a road user charge (RUC) will become the primary means to raise revenue. AEVA has maintained this is a sensible thing to do on the condition *all road-going vehicles are subject to it.* Any RUC should be *multiplied by the mass of the vehicle*; accounting for wear and tear proportionally.

A mass-multiplied RUC serves three key roles. First, it ensures all motorists are directly paying proportional to their wear on road infrastructure, as opposed to the consumption of the fuel powering it. Secondly, the mass-multiplier will help drive a downward shift in vehicle mass; lighter vehicles cause less wear on infrastructure, are cheaper to run and safer for cyclists and pedestrians. Third, by being universal it ensures that EVs remain the more attractive option, given their lower marginal cost of operation compared to petrol or diesel vehicles.

An RUC in the order of 1 to 3 c/km would apply to the annual mileage of the vehicle, which is then multiplied by vehicle tare in tons. That is, total cost = km travelled x mass in tons x RUC. State or territory governments may wish to impose a mass-based 'parked cost' applied as well at say, $100 per ton. This would account for the non-mobile impact vehicles have on public infrastructure; larger vehicles require more public space for parking, while also contributing to the ever-increasing footprint of garages in new homes. Tare mass is probably more relevant than gross vehicle mass (GVM) because passenger vehicles spend most of their time moving just one person and minimal luggage. Any relevant compulsory third party injury insurance costs and administrative fees would also be applied.

Most state and territory transport departments already have a parked cost component to motor vehicle registration, but this could be reduced in lieu of the RUC. The RUC should apply universally to all light vehicles (<4.5 tons GVM) regardless of their fuel source. Heavy goods vehicles are currently entitled to a 50% subsidy on fuel so an effective RUC based on distance and tonnages carried could be optimised, allowing them to participate in the same scheme. Federal fuel excise may eventually be phased out, but its retention would effectively be a 'pollution tax' and generally serve as a disincentive to drive an ICE vehicle.

Crucially, the Federal government should collect this RUC revenue and redistribute the proceeds to states proportionally. The administration of such a scheme could be managed by the states and territories as they already have the mechanisms in place through vehicle licensing departments, with an annual odometer reading at renewal time. Such an RUC should not be implemented until EVs make up more than 30% of all new vehicle sales, and ICE vehicle sales are on a clear downward path.

Finally, the construction of road infrastructure (motorways, bridges and tunnels) follows a unique pattern of supply and demand. Road usage, primarily by passenger and commercial vehicles, always rises to meet the maximum capacity of a particular roadway, at which point congestion occurs. Providing more lanes, slipways and on-ramps in response increases this maximum capacity, only for motorists to keenly fill the new supply. This is because motorists, who would not have otherwise used the road, will now choose to drive because driving just got easier. This cycle of induced demand explains why despite spending half a trillion dollars on roads in the last 25 years, Australian cities *still* have a congestion problem. An RUC will go some way to reducing demand on roads through a broad price signal, although location-specific congestion charging might offer a more targeted approach. Relevant to this phenomenon is the extremely low marginal cost of driving an EV. This actually results in EV drivers driving further and more often than when they owned an ICE vehicle. This is leading to more vehicle-kilometres being travelled, exerting further demand on road infrastructure.

Efforts to brake this cycle of induced demand are underway in many cities around the world. Most notably, Barcelona, Paris and Amsterdam are all implementing 'road diets'; halting the construction of new roads and funding maintenance only, along with removal of on-street parking. The savings are being spent on alternatives to driving, like public transport, safe cycling routes, pedestrian malls

and re-zoning land for mixed use. Despite their initial unpopularity with businesses, the majority now keenly embrace their new, 'car-lite' cities. Reducing the need for car-related travel will help Australia achieve its transport emissions reductions sooner. Replacing all 15 million ICE passenger vehicles to electric at current uptake rates would take until 2050, but with the right policy settings and viable alternatives to road travel, Australia may only need a fleet of 8 million EVs.

Area 5 policy statements

[5.1] Policy: The AEVA supports a federally-collected, state-administered, mass-multiplied road user charge (RUC) applicable to all road-going vehicles under 4.5 tons GVM. State and territory governments should continue administer a mass based 'parked' registration fee, plus any other state or territory third-party insurance costs.

[5.2] Policy: AEVA recommends the fuel excise remains in place to serve as a disincentive to burn liquid fossil fuels for transport, and to motivate the shift to EVs.

[5.3] Policy: AEVA recommends such a scheme not be implemented until electric vehicles represent more than 30% of all new vehicles, or until they represent at least 5% of the national fleet of passenger vehicles. Implementation of the scheme any earlier risks slowing down the transition to EVs.

[5.4] Policy: AEVA recommends de-prioritising new road construction projects, and reallocating such funding towards other important transport projects such as mass transit and active transport infrastructure.

Policy Area 6: Electric heavy haulage – rail and truck freight

Railways represent the most efficient wheeled transport option for moving large tonnages of goods long distances. A typical diesel electric locomotive is three to four times more efficient in terms of litres per freight-ton-kilometre than the same goods moved by road on articulated semi-trailers. Electric overhead rail is even more efficient still, with the added benefit of increasingly cleaner electricity as more renewable energy joins the electricity grid. Railways are typically cheaper to build per kilometre than roads, while maintenance costs are similarly low.

Despite these advantages, rail has seen only a fraction of the investment allocated to roads, and rail currently moves less than a quarter of all non-bulk freight (containerised and intermodal goods). However rail still moves over half of all bulk goods like coal, iron ore, cement and grain. In the summer of 2022/2023 heavy flooding damaged sections of the Broken Hill line, meaning goods normally carried by rail were diverted through Melbourne. This saw an increase in heavy haulage road freight, resulting in significant damage to already water damaged roads. Rail posted some of its worst productivity in decades in 2022, and without massive investments in infrastructure, the situation is not likely to improve. The head of Pacific National, Australia's largest rail freight logistics company, recently argued that a major re-investment in the state of Australia's rail corridors is desperately needed if we are to prevent more freight being moved by road, and the significant costs associated with roads built to withstand high volumes of heavy vehicles.

The easiest and fastest way to decarbonise rail freight is to deploy overhead electric power for all key mainline freight routes. Corridors not slated for major realignment work could be electrified first, while further electrification would best be done after major realignments, particularly on the

Sydney-Melbourne line. Inland Rail (Melbourne to Brisbane and beyond) would be a prime candidate for electrification, considering large sections will be built from scratch. International standard 25 kV AC overhead power should be used, and set to a height accommodating double-stacked containers.

Delivery and pickup of freight is done exclusively via road-going heavy vehicles. The average mileage of a heavy vehicle is ~80,000 km per year, meaning the majority of heavy vehicles travel fewer than 300 kilometres per day – well within the capabilities of an off-the-shelf electric option. Considering the energy density problems facing battery electric trucks, and the massive charging infrastructure required to service a busy logistics operation, a clever combination of electric overhead rail and electric delivery trucks would significantly reduce emissions in the land-transport freight sector.

While heavy road trucks continue to dominate long-haul freight transport, there are opportunities to electrify this sector through the conversion of trucks coupled with highway battery-swapping services. In particular, we note the emergence of Janus Electric, which has already converted five different makes of heavy (Class 8 and above) trucks. The conversion involves replacing the diesel engines with equivalent-power electric motors, and replacing the diesel fuel tanks with 620 kWh battery packs. The batteries can be swapped in a few minutes at "Charge & Change" stations located at truck rest stops on major highways. While the conversions cost around $160,000, Janus claims a payback time of as little as 12 months because of the savings in fuel and truck maintenance. Even a payback time of three years would represent an attractive investment.

Australian company SEA Electric is gaining success in the heavy vehicle market with its rapid-conversion system for power trains into medium duty electric trucks. Heavy rigid (non-articulated heavy goods vehicles) are common on Australia's roads, being responsible for transporting the majority of building materials, parcels and bulk goods.

Heavy vehicles are the main reason Australia's roads are engineered to very high standards, and consequentially, cost so much to build and maintain. Like light vehicles, a road costing scheme which better reflects the wear and tear on infrastructure caused by heavy vehicles should be implemented. Eventually all heavy road traffic will be electrified, so the diesel fuel excise will deliver less revenue over time. Thus, an extension of the proposed universal road user charge to heavy vehicles would address these problems, but may need to be staged to better reflect the transition to electrification. By multiplying the kilometres travelled by the tonnage carried, a more representative measure of road usage can be costed. Implementation of this scheme will add to retail logistics costs unless the overall system is carefully designed, but it must also be noted that heavy vehicle logistics are already extensively subsidised by other road users.

Area 6 policy statements

[6.1] Policy: AEVA recommends massive investment in Australia's mainline rail routes, through improved grades and alignments, and dual-tracking where possible. All major rail freight routes should be electrified by 2050 with overhead 25 kV AC catenaries and powered by interoperable electric locomotives (utilising both 1.5 kV DC and 25 kV AC).

[6.2] Policy: AEVA recommends a truly cooperative management system be adopted, where rail corridors are efficiently managed in the public interest, while maintenance and operations are contracted out as needed.

[6.3] Policy: AEVA recommends that the Federal Government (through ARENA, the CEFC or direct support) provide financial assistance to accelerate the conversion of heavy trucks to electric drive, and to accelerate the roll-out of battery-swapping and recharging stations on national highways.

[6.4] Policy: AEVA supports an eventual Heavy Vehicle Road User Charge which better reflects the wear and tear caused by heavy vehicles on road infrastructure. This too must be a federally collected revenue, be based on the distance travelled and multiplied by the laden mass of the vehicle combination.

Policy Area 7: Electric bicycles and micro-mobility

Electric bicycles and personal electro-mobility devices are any lightweight power-assisted vehicle which is not required to be licensed with a transport department. Generally they have power outputs of less than 250 W, and have a powered top speed of 25 km/h. The electric bicycle is the world's most efficient EV. No other technology can move a person as far on so little energy. E-bikes are also very good for the environment; requiring a battery one-hundredth the size of most electric car batteries, their resource impact on the planet is miniscule. They are also the best selling EV on the planet, with e-bike sales beating electric car sales ten-to-one. Cycling (electric or human-powered) is arguably the best way to decarbonise our daily commute, considering the costs associated with it are so small and the societal benefits so immense.

So why are we not seeing more trips made by e-bike? Cycling's mode-share in Australia has steadily dropped since the 1980s, and the reasons are complicated. Generally, cars got cheaper and safer, while road design and construction has been accelerating ever since. The introduction of compulsory helmet laws saw a pronounced drop in cycling, but it also created a perception that cycling was somehow more dangerous than before. Combined with a lack of planning effort dedicated to safer cycling infrastructure, most Australians simply don't feel safe riding a bike on our streets. This is a trend playing out around the western world, with disastrous consequences for public health and safety.

In addition to supporting and promoting electric bicycles, governments must back up their statements with infrastructure required to genuinely boost active travel. The United Nations Environment Program explored national commitments to non-motorized transport infrastructure, and recommended 20% of all transport funding be allocated to cycling and walking. Considering the engineering associated with paths designed to support cyclists (as opposed to hundreds of tons of road traffic) this would be transformative for our cities. While many Australians live too far from their regular daily commuting destinations for cycling to be a popular choice, at least one third of the population could conceivably ride a bike on a daily basis. Efforts to motivate participation include paying residents to ride a bike to work, which has shown remarkably positive results.

Investment in safer urban cycling infrastructure pays dividends for retail businesses. Adding weight to the old adage that "cars don't spend money, people do", cities like New York, Salt Lake City and Vancouver have seen significant improvements in retail trade after the removal of cars and construction of protected bike paths. The human-human interactions we've largely eliminated through motoring are re-kindled with cycling and walking – essential precursors for high street trade.

Electric motorised scooters – the type you stand on, rather than sit on – are hugely popular around the world. Trips exceeding 10 km can be completed with ease, and the space required to

accommodate them is miniscule. Most jurisdictions allow these to be ridden under the same rules and regulations which apply to electric bicycles – In Australia, no more than 200 watts, and no faster than 25 km/h. Several Australian states have made owning a private electric scooter illegal, although there are moves to address this. Currently several corporations operate a sophisticated hire scheme which have had various degrees of success, but attracted plenty of criticism primarily around the public storage of scooters. Needless to say, privately owned scooters would not be left on the streets unlike some other private property.

The main appeal of a privately owned electric stand-up scooter is their portability; riders can take it with them at the end of their trip or on the train for longer trips. The 'last mile' segment of transport is frequently described as an impediment to increased public transport use, so being able to bring your wheels with you is a major advantage. There is a risk, however, when people charge their electric scooters in apartments or offices. More poorly built scooters are susceptible to battery damage, while questionable quality control on the manufacture might risk a fire. Electric scooters and 'hover boards' have attracted plenty of media attention with some high profile fires. Emergency services strongly encourage users to always charge their scooters and e-bikes outside the home or office.

More powerful e-bikes can still be purchased in Australia, provided they are used off-road. Retailers simply inform the customer that riding such a machine on the road is illegal, and remains their responsibility. However many riders complain that 200-250 W limit is needlessly restrictive, and given the high average weight of the Australian adult, this seems a fair point. In Canada, e-bikes may be up to 500 W and no faster than 32 km/h, while in the USA it can be as high as 1000 W. Enforcement of power limits is difficult, requiring suspected non-compliant bikes to be tested on a mobile dynamometer. Speed limits are rarely enforced on shared paths, although safe road design which naturally limits speeds in dense pedestrian areas would largely achieve the same goal.

Area 7 policy statements

[7.1] Policy: AEVA supports harmonised legislation around electric bicycles, scooters and other personal mobility devices.

[7.2] Policy: AEVA recommends that any personal mobility devices such as e-scooters comply with the following criteria:

- Weigh less than 30 kg, or 15 kg if foldable
- Be less than 750 mm wide
- Have a functioning, proven-effective brake system
- Have a front facing white light, and rear facing red light which must operate whenever the vehicle is in motion
- Be limited to a verifiable powered top speed of 25 km/h on roads, and 15 km/h on pathways

[7.3] Policy: AEVA supports any measures aimed at increasing the uptake of electric bicycles, stand-up scooters and other electric rideable devices. This can include financial assistance for low-income households to buy an electric bike or cargo bicycle, as well as initiatives to motivate greater participation in active transport.

[7.4] Policy: AEVA encourages governments to increase the active transport infrastructure spend to 10% of transport budgets, allowing for protected bike lanes, connected cycling routes and establishing low traffic neighbourhoods.

[7.5] Policy: While continuing to support a 25 km/hr speed limit for e-bikes on roads and shared paths, AEVA recommends that increasing power limits to 500 watts be considered, in order to foster greater uptake of e-bikes.

[7.6] Policy: AEVA believes state public transport agencies should make provision for appropriate bike racks on buses and in suburban rail carriages. E-bikes and scooters make end-of-journey transport easier for patrons and should be encouraged.

Policy Area 8: Environment, climate, mineral resources and recycling

EVs may have 30% more emissions at manufacture, but in operation, emit only as much CO_2-e as the electricity which charges them, which in Australia can range from zero (on-site renewable energy) to about 0.82 kg/kWh (Victorian electricity generation). Countless studies have found that EVs charged from a typical fossil-dominated electricity grid will still result in fewer CO_2-e emissions per kilometre than an equivalent diesel or petrol vehicle, and depending on the generation mix, match the emissions of an ICE vehicle within 5 years. So from a greenhouse gas emissions perspective, EVs are demonstrably better than the current ICE dominated road transport fleet. But as EVs are generally heavier than ICE vehicles for equivalent body types, they also produce more tyre wear particulates. While the particle size is generally large enough to not pose a substantial risk to human lungs (yet still coat nearby infrastructure with a black grime) the particles themselves are known to contain chemicals which interfere with aquatic animals, particularly 6-*para*-phenylene diamine. This is not a problem unique to EVs, but further highlights the need to reduce road traffic overall.

The substantial environmental concerns for EVs stem from the production of battery packs. Global interest in EVs has led to unprecedented demand for key battery minerals, namely lithium, graphite, nickel, cobalt, manganese, copper, zinc and tin. Other elements like phosphorus, fluorine and aluminium are also required, but these have many markets outside of battery manufacture. Such demand has pushed prices up, meaning that for the first time in a decade battery costs have increased on a per kWh basis.

This in turn has driven a renewed focus on mineral exploration, increasing production from existing mines and processing plants, and even research into alternative battery chemistries and recycling. Modern life demands resources and energy from the earth, and EVs are no exception. However, the sheer size and scale of mineral demands associated with full electrification of global transport is focusing attention on the environmental impact of this new technology.

It must be reiterated, however that compared to the annual extraction, refining and irreversible combustion of 5500 Gl of crude oil, global battery production still has significantly less impact on the environment and climate. But the highly localised impact on specific environmental niches cannot be ignored.

Humanity never exploits a resource down to the last ton; alternatives are typically found, but not before significant and often permanent environmental impacts are made. Some of these mines will reside on endangered ecosystems, creating a conflict of values. In other instances, residents and workers may suffer human rights abuses at the hands of mine owners. The prevalence of 'blood

metals' has led to several battery manufacturers seeking alternative sources, or excluding metals like cobalt their formulations entirely. Existing reserves (that is, known ore bodies currently approved for extraction) of lithium, graphite, nickel and cobalt will see production continue for another 5-10 years, but after that the future is far less certain.

Australia is a global powerhouse when it comes to battery minerals, with every key ingredient present in reserves or in production. We are seen as a 'safe' country, with minimal corruption, high safety standards and stable government. Several opportunities are beckoning, but this should not come at the expense of our rare flora and fauna. A robust Environmental Protection and Biodiversity Conservation (EPBC) Act could ensure some key ecosystems are completely off limits to exploration. Without such conditions, the trend of relentless degradation will simply continue as it always has.

Australia has traditionally exported ores and raw materials to processing facilities around the world, only to buy them back in the form of manufactured goods. Not only does this impact Australia's terms of trade, it's wasteful and inefficient. Battery minerals like spodumene (2% Li) are exported for processing into lithium hydroxide (56% Li) essential for all Li-ion battery chemistries. Australia's first hydroxide plant has commenced production in Kwinana, WA, and is hoped to be the first of many. Eventually, whole battery packs could be manufactured on Australian soil, improving the economic security of the battery electric transport sector and improving our terms of trade.

An ethical conundrum persists in the transition to battery EVs. Will more EVs mean less nature? Like many systems, a hierarchical pyramid of control may be applied. At its base is elimination – remove the need for the issue all together. While the need to transport people and goods cannot be eliminated, we can remove the more inefficient and wasteful aspects of transport; flights and cross-city meetings may be eliminated with teleconferencing, for example. Above this sits substitution – using an alternative with fewer downsides. An example is exchanging a car trip with taking an electric bus or train, or riding an e-scooter. Above this sits engineering, administrative, or legislative solutions which help resolve a problem, but rely heavily on technology, cooperation and goodwill. This might entail developing the use of more abundant and less controversial battery materials, as well as legislating that key environmental ecosystems are completely off-limits. Finally at the top is the least effective, but easiest to implement solution. In the context of battery EVs, this might be implementing a heat pump for energy conservation, or a solar panel on the roof to power a cabin ventilator. Too great a focus on these measures belies more effective solutions elsewhere.

The above pyramid may be used as a guide to decarbonising transport. Rather than seeking to replace all 15 million passenger vehicles in Australia with EVs, 7 million EVs could be the end goal, with the remaining transport needs met through other modes. Australian households have 1.8 cars parked onsite; unless viable alternatives are both convenient and affordable, this will continue to be the case. Further up the pyramid, priority might be given to the production of batteries for high capacity EVs like buses, or small EVs like motorcycles and e-bikes. China's push to electrify nearly half of its entire bus and coach fleet was in part driven by a need to prioritise battery production (although, most of the passenger vehicle battery market was for export).

Area 8 policy statements

[8.1] Policy: AEVA supports a robust Environmental Protection and Biodiversity Conservation Act which legally enshrines protection for Australia's rare flora and fauna, and reverses the decline of ecosystem health.

[8.2] Policy: AEVA supports Australia's role in supplying the world with critical battery minerals, and encourages governments to foster development of value-added processing, up to and including complete battery manufacture onshore.

[8.3] Policy: AEVA supports measures which advance the supply and encourage the uptake of high passenger capacity EVs like buses, and high-efficiency, lightweight EVs like motorcycles, scooters, and small EVs. These vehicles have much higher battery resource utilisation, lower particulate emissions, and offer more equitable access to the technology.

[8.4] Policy: AEVA supports mandatory EV and battery re-purposing and recycling. A product stewardship scheme should be implemented, while financial support for resource recovery and recycling facilities should be made available to keep batteries out of landfill.

Policy Area 9: Parallel importation of cars and bikes

Equitable access to affordable EVs continues to remain an issue in Australia. While production of EVs is supply constrained and demand is high, retail prices for new EVs remain high. Any increase in the supply of used EVs will improve this equity of access. For this reason, AEVA has long argued the current limitations on the importation of second-hand EVs should be removed. The *Road Vehicle Standards Act 2018* (RVSA) and the subordinate *Road Vehicle Standards Rules 2019* (specifically clauses 129 and 129A) are currently restricting the trade and importation of used zero emission vehicles. These clauses prevent the importation of vehicles which have been previously imported into Australia by the manufacturer, even if only very small numbers (say 100 or so) were imported. An amendment to allow independent importers to import previously imported vehicle models would allow a greater variety of cheaper EVs to be offered for sale in Australia.

In addition, manufacturers and their dealership representatives in Australia do not currently support or service vehicles brought in through parallel importation. Australian Consumer Law only requires the seller of a product to adhere to the requirements of the law. While a dealership could offer service and parts for a vehicle their own company represents. Access to factory-supported battery upgrades for early model vehicles would represent a more sustainable and environmentally responsible pathway.

Vehicles imported under the Specialist and Enthusiasts Vehicle Scheme (SEVS) already meet the Australian Design Rules as they have met equivalent standards in the source markets such as the UK and Japan.

The FCAI has argued that independent imports should be discouraged on the grounds that

- SEVS was never intended to accommodate "common use vehicles"
- these vehicles are not supported by Original Equipment Manufacturers (OEMs) or the importers in Australia and therefore, they cannot provide ongoing support and service
- there are no guarantees these vehicles meet relevant Australian safety standards
- the charging equipment for these vehicles is designed to operate on different voltages and frequencies and that this represents a significant electrical risk
- Operators' handbooks supplied with these vehicles are often only in the domestic language, such as Japanese.

AEVA rejects the claim that there are risks in such imports. Such vehicles meet Australian standards by default, because the European standards are acceptable standards under the Australian Design

Rules. The Certificate of Conformity which the manufacturer must produce on the build of the vehicle is the proof that the vehicle has met our standards. Furthermore, the Japanese legislation is aligned with the European, which is now becoming the world standard.

To take a striking example, it is currently not permitted to import 2018 Hyundai Ioniq hatchbacks from the United Kingdom, even though Hyundai dealerships in Australia have been servicing this model since late 2018; the operators handbook is in English; Hyundai has announced that it has ceased production of this model anyway; and the only changes needed for Australian roads are the substitution of an Australian mains plug on its portable charge cord and the substitution of Australian maps in the navigation system.

For other EV models such as the Nissan Leaf, there is now a growing number of independent mechanics (not affiliated with dealerships) who can properly service EVs and in some cases offer battery upgrade packages. It is essential that these workshops are able to continue their good work.

Finally, electric motorcycles and scooters are not encumbered with steering wheel location issues, and as such, ought to be easier to import than a car. However, despite there being dozens of makes and models of e-motorcycle on the international market, they remain very difficult and expensive to homologate into the Australian market. Reducing barriers to the parallel import of electric two-wheelers would deliver more lightweight, congestion-busting EVs for Australia.

Area 9 policy statements

[9.1] Policy: AEVA recommends that the *Road Vehicle Standards Act 2018* and the *Road Vehicle Standards Rules 2019* be amended to allow independent importers to import previously imported vehicle models into Australia.

[9.2] Policy: AEVA recommends that the Federal Government eliminate or at least work to reduce any barriers to the parallel importation of electric motorcycles (all L-class vehicles).

Policy Area 10: Hydrogen and its applications to transport

Saul Griffith (*The Big Switch*, page 60) has asserted that "there will be some uses of hydrogen – for example, in creating ammonia and other fertilisers without natural gas" but he adds that "investment in hydrogen is not as wise as investment in electrification". In AEVA's view, hydrogen has very limited value in the transport sector.

For ordinary light vehicles, hydrogen fuel cell EVs (FCEVs) are in our view, a solution in search of a problem. The problem they purport to address is recharging speed, but for most people, most of the time is spent charging at home or work, or while shopping; basically wherever charging does not need to be fast. With larger battery capacities, one rarely needs a full charge to have ample range for the vast majority of trips. During long trips, current models of many cars can add sufficient charge for several hundred kilometres of range in the time that is needed for short toilet or coffee or meal breaks. Charging equipment manufacturers continue to push the envelope with charging speed, so it is expected that an electric car may be fully charged within 10-15 minutes.

Assuming "green hydrogen" is produced from renewable energy, electrolytic hydrogen for a FCEV requires about three times more electricity compared with charging an equivalent battery EV directly. This is due to the energy losses at each step of electrolysis, and the energy required to compress the hydrogen and run the fuel cell. Furthermore, a battery is still required in a FCEV to buffer the output of the fuel cell against rapid changes in power demand. Other forms of energy

storage such as stationary batteries and pumped hydro are more efficient ways to align electricity generation and demand. Australia already has an electricity grid which can be augmented as more renewable generation and demand is connected.

Hydrogen is hazardous to transport, weakens metals and other materials over time, and requires a substantial maintenance regime to maintain safe operations.

Despite the above, we recognise that hydrogen is absolutely essential for some applications and quite likely for some other applications. We are not suggesting the technology should be ignored; indeed it may prove successful (directly or in a carrier form such as ammonia or synthetic hydrocarbons) for extremely heavy, extremely long-range vehicles such as intercontinental shipping and aircraft. But it remains very unlikely to find application in light vehicles.

Finally, it has recently been recognised that hydrogen has a very considerable indirect Global Warming Potential (GWP) from its ability to increase the residence time of methane in the atmosphere so it is very important to ensure that hydrogen leakage is avoided. Avoiding leakage is a difficult task since hydrogen is the smallest molecule that exists.

Area 10 policy statements

[10.1] Policy: AEVA recommends governments should not tie hydrogen investments to the land transport sector. Hydrogen for transport represents a higher risk compared to general electrification and support for battery EVs, which are known to deliver results already. Hydrogen may see application in key non-road heavy haulage transport applications, particularly shipping and aviation.

Policy Area 11: Home charging and multi-dwelling EV readiness

Charging at home: detached housing

EV owners who live in detached housing, and who already have (or can install) a power outlet in their garage or carport, often find their EV charging needs are easily met. Residential charging rarely needs to be fast as the cars spend a long time parked. An ordinary 10 amp power point servicing a portable Electric Vehicle Supply Equipment (EVSE) often supplied with the car is often sufficient. This can add around 150 to 200 km of range over an 8 hour charge.

Single phase 32 amp charging (7 kW) or 15 amp three phase charging (11 kW) with a portable or wall-mounted EVSE allows faster charging in a narrower time window, and enables the driver to make use of off-peak tariffs or peak solar output. Some home charging equipment can even track home solar output and vary the EVs charging rate to maximise solar charging, and minimise imports from the grid.

Some commentators have expressed concerns about increasing demand on the grid, but these concerns are easily addressed by existing measures to discourage charging during the evening peak. Incentives such as time of use tariffs should encourage people to shift charging away from the evening peak, particularly if there is sufficient education about the financial benefits of doing so.

Most EVs can be set to automatically pause their charging, deferring to off-peak periods or avoiding peak periods. This enables a driver to plug in whenever it is convenient without adding to the evening peak. Education for awareness of this facility would be beneficial as a campaign by governments and/or by electricity providers.

Charging at home: apartments constructed from October 2023

Apartment buildings constructed after October 2023 will be subject to the updated National Construction Code, approved in August 2022. AEVA made this submission which influenced the updated Code. Compliance with this Code will be introduced through changes to state and territory Building Acts. It will be important to ensure that there are no state or territory variations in the Code appendix which weaken the intention of these changes.

The key concepts in our submission were:

- Charging capability should be available at every parking space
- Charging does not need to be fast where cars are parked all day or night
- Charging can be set up to avoid adding to a building's peak demand
- Load management equipment can slow or pause charging at times of high demand
- When many cars are plugged in and charging (eg. earlier at night but after the evening peak), the available capacity for charging can be shared (eg. just 6A/1.5kW each)
- When fewer cars are charging (eg. later at night or by day), charging rates for each vehicle can be increased automatically by the load management equipment
- A gradual increase to a 7kW (32 A single phase) maximum would provide ample charging – 5 hours at 7 kW would provide over 200 km of range for most cars.

Charging at home: apartments constructed before October 2023

EV owners who live in existing apartment buildings (which in most cases lack power outlets at parking spaces) face a challenge in charging their vehicles. Some drivers may need to rely on public charging infrastructure (discussed below) or will need to persuade their Owners Corporation (OC) to undertake a retrofitting project.

The cost of retrofitting EV charging infrastructure to existing apartment blocks is significant. The OC could provide a 'spine' of cabling and load management equipment to which individual unit owners may connect at their own expense via an approved management-compatible wall-mounted EVSE outlet. Financial assistance in the form of state or territory government grants could be provided to fund the installation of such equipment.

Owner's corporations may face substantial initial costs in providing this 'spine' when the demand might be low and the costs hard to justify. The first few EVs in a building can sometimes be accommodated without problems by ad hoc arrangements such as allowing the use of one or several common property power points. Some OCs choose to provide or allow a wall-mounted EVSE charging outlet in a shared parking space for the first few to share while explicitly acknowledging that this can only be an interim arrangement. Useful resources for OCs considering a retrofitting project have been produced by Wattblock.

Area 11 policy statements

[11.1] Policy: AEVA recommends that governments, electricity providers and AEVA undertake an education campaign to encourage EV owners to charge at home outside of the normal periods of peak electricity use.

[11.2] Policy: AEVA recommends that State and Territory Governments do not weaken the EV charging requirements in the updated National Construction Code through a variation in the relevant state or territory appendix.

[11.3] Policy: AEVA recommends that State and Territory governments provide financial assistance to Owners Corporations to retrofit residential apartment buildings to create a 'spine' of cabling and load management equipment to which individual unit owners may connect at their own expense.

Policy Area 12: Public charging infrastructure

The need for accessible, reliable and convenient EV fast charging infrastructure is substantial, but won't come close to the current ubiquity of petrol filling stations. This is because the bulk of EV charging will happen at home or at work on lower powered AC charging, and only occasionally will the need for a convenient, rapid charge arise.

Public charging should ideally comprise a mixture of 50 kW+ DC charging, and slower charging (typically < 7 kW). The 'destination' chargers may be installed at a modest cost by businesses, retailers, pubs, shopping centres and motels.

It is essential that governments who are planning on installing charging infrastructure select the most appropriate charger types, and determine the necessary redundancy for different locations. In some locations, several DC fast chargers with redundancy is most appropriate – such as in small towns between major centres. Other locations may benefit from a larger number of relatively slow AC chargers, such as in recreational centres, libraries, civic centres and parks. 'Park and Ride' and other long-stay carparks are ideal locations for lower powered AC charging. Local governments or retailers may also plan to develop car parks with solar roofs to supplement their EV charging facilities.

Where there is no off-street parking for each residence, kerb-style charging (e.g. lamp posts with a charge socket) could be introduced, as proposed by ConnectedKerb. Similarly, lamp posts around shopping centres, cafés and other commercial precincts which offer street parking could be similarly retro-fitted. Some charging providers such as Jolt offer charging at moderate speed directly from pre-existing substations adjacent to parking lots. Jolt offers the first 7 kWh (enough for about 50km of city driving) free, but subsequent charging is billed at a higher rate. The bulk of its revenue model is centred on digital advertising screens placed around the substation.

For highway touring, EV drivers must have confidence that reliable charging will be available at regular intervals along major intercity routes and country towns. Since EV uptake is likely to grow rapidly in the mid 2020s, there is a clear need for substantial banks of EV chargers at regular intervals on Australia's highways. Suppliers of rapid chargers should be able to make these investments and receive an economic return through charging fees. For this reason, AEVA has long opposed free chargers such as those provided in many locations by the NRMA, even though it applauds the pioneering work by the NRMA to install single 50 kW DC chargers in many towns throughout regional NSW. Where free charging at a DC fast charger is offered, it often attracts over-use by spendthrift locals, and this de-values the amenity of a crucial piece of transport infrastructure. If a culture of 'free' is allowed to persist, the collective motivation to maintain the network drops, dragging reliability down with it.

Where governments provide financial assistance to instal charging infrastructure, such agreements should require on-going reliability guarantees. Chargers left out-of-order for extended times are a cause of considerable frustration among EV drivers and could erode public confidence in EVs.

AEVA welcomes moves by Tesla to open up its 'Supercharger' network to non-Tesla vehicles. Tesla has an excellent reputation for the reliability of their chargers and the addition of Tesla as a further supplier of charging services would be a valuable broadening of competition. Non-Tesla EV owners are charged a higher rate per kWh for electricity than Tesla owners.

The CHAdeMO rapid charging standard used by Mitsubishi and Nissan is becoming less prevalent over time. AEVA accepts that the current 1:1 ratio of mutually exclusive CHAdeMO and CCS2 functionality creates a choke point in the delivery of service, and CHAdeMO's eventual demise is inevitable. However, there remains a need to maintain the CHAdeMO standard for the next 5 years at least, particularly since a significant number of affordable, used EVs will be imported from Japan under the parallel importation scheme. It appears likely that Toyota, Lexus and Subaru EVs will also insist on using the CHAdeMO standard, prolonging its presence further still.

Some state and territory governments plan to impose significant penalties to drivers who park in EV charging spaces with a vehicle that either is not an EV or is not charging. This is largely supported by the EV driving community, however one may question if a >$3000 fine is appropriate, considering the more callous act of not rendering assistance after an accident attracts a mere $362 fine. EV drivers may wish to learn from organisations like AEVA some of the dos and don'ts of EV charging etiquette. An example can be found in the ACT etiquette statement.

The needs of EV drivers with respect to public charging infrastructure are summarised as follows:

- Chargers must be accessible 24 hours a day, be well signposted, with fees clearly visible
- EV drivers with disabilities should have no difficulty accessing and using chargers
- Chargers should be located near accessible amenities, such as toilets and food outlets
- Chargers should be able to cater for a wide range of EVs, including cars, motorbikes and e-bikes, whether personally-owned or hired
- Payment should be through the use of a credit or debit card as a priority, with company-specific apps or RFID cards a reliable alternative
- Charging for longer than 30 minutes at rapid (150 kW+) chargers should be discouraged through fee structures (e.g. idle fees)
- Access to charger information in real time, as is planned in the UK, using the Open Charge Point Protocol allows users to better plan their trips
- Faults, damage and interruptions must be easy to report, 24 hours a day
- Maintenance and technical support must be prompt, reliable, and effective. Charging station hosts should expect contractual requirements for service up-time of at least 95%.

Area 12 policy statements

[12.1] Policy: That state, territory and local governments seek advice from AEVA on how to develop a well-planned regime of local charging infrastructure which meets the needs of EV drivers, including drivers with disabilities

[12.2] Policy: AEVA recommends that any charging infrastructure which is supported by state or federal funding should be subject to "idle fees" and that any rules on the misuse of EV charging spots are properly enforced.

[12.3] Policy: AEVA opposes 'free charging' business models, particularly for DC fast chargers, including inducements offered by car dealerships or automotive clubs. Free charging results in excessive occupation by thrifty EV drivers, and devalues the amenity of the infrastructure.

[12.4] Policy: AEVA recommends that, where governments provide financial assistance to install charging infrastructure, contractual agreements should mandate specific reliability guarantees.

[12.5] Policy: AEVA recommends that providers of EV rapid chargers continue to enable the CHAdeMO standard in some proportion of their chargers, in support of many imported used EVs.

[12.6] Policy: AEVA will keenly support the development and distribution of CCS2 to CHAdeMO adaptors, where appropriate, to allow these older EVs to use newer fast charging infrastructure.

[12.7] Policy: AEVA recommends that governments commence a dialogue with providers of EV rapid chargers concerning flexible payment mechanisms, open charging data and the visibility of fees.

Policy Area 13: Training and competency

Australia has a long history of developing industry-led vocational education and training through TAFEs and other Registered Training Organisations (RTOs). Those wishing to pursue a career in the electrical, engineering and automotive trades normally start a three to four year apprenticeship with a business and attend an RTO for what is normally a Certificate III in some recognised industrial trade. Higher levels of training are offered within these industries, but the most common pathway is through an apprenticeship.

Industries relevant to the necessary electrification of transport include manufacturing and engineering, engineering fabrication, automotive retail service and repair, electrotechnology, information and communications technology, transport and logistics. All of these sectors have industry-specified training packages with hundreds of units of competency and recognised qualifications embedded within them. Units of competency are often developed and tweaked annually to ensure they remain current with emerging trends and innovations, ensuring students are provided with the most up-to-date technologies relevant to their industry.

Graduates who complete their apprenticeship with a Certificate III are able to start businesses, access insurance and work in the field, confident in the knowledge their training is recognised under a national framework. Likewise graduates with Certificate IV and above can find themselves entering the workforce with a solid foundation of engineering technical principles – skills which are in high demand as the world electrifies transport and industry.

Unfortunately, not all RTOs have access to the best equipment, the right training or even the best staff. Under the current economic climate, the labour market for highly skilled tradespeople is extremely tight, and RTOs struggle to provide attractive remuneration for an ever shrinking pool of workers. This is particularly frustrating for the nascent electric vehicle industry and related industries in Australia. A severe shortage of mechanics, technicians, engineers, electricians and trainers means workshops are being overwhelmed with work they cannot service.

Thus, it is essential that governments, in partnership with industry, ensure that all training facilities are well resourced with equipment, staff and learning facilities relevant to the burgeoning electric transport industry. TAFE colleges around Australia and other RTOs aligned with their relevant industry must not only offer courses essential for supporting the field, but continue to invest in developing their resources as the technology evolves.

For example: the Automotive Retail Service and Repair training package covers over 30 qualifications, but only one specific to electric vehicle technology. This course is offered at just 11 RTOs around the country. An EV Skillset exists for tradespeople who already have a Certificate III in Automotive Technology, and wish to extend their repertoire of skills; this is offered by just 19 RTOs. Moreover, the units of competency which make up this Skillset are only designated as electives, and not core units for the Certificate III program. This means RTOs are not compelled to offer the training. Remarkably, the only pre-requisite unit for all work performed on an EV is AURETH101 – (Depower and reinitialise battery electric vehicles) and it is not a core unit for any automotive qualification. This unit would also serve as a solid base for any non-trade qualified people who wish to work on their own vehicles; the AEVA would be in a position to facilitate training of members through collaborations with TAFE colleges around Australia.

Considering the uptake of EVs in Australia, it is essential that the units relevant to working on electric vehicles become core units of the Certificate III Automotive programs. This must be backed up with the necessary financial and practical support of governments through provision of facilities, equipment and experienced trainers.

Area 13 policy statements

[13.1] Policy: AEVA supports a substantial investment in TAFE colleges by state and federal governments, ensuring these RTOs have access to the resources, facilities and training staff needed to accelerate the transition to electric transport.

[13.2] Policy: AEVA supports upgrading all 7 of the EV Skillset units of competency to core units of the Certificate III in Automotive Technology, and related trade qualifications.

[13.3] Policy: AEVA will keenly facilitate collaboration with TAFE colleges and/or any relevant RTOs in providing access to training on the safe isolation of EVs (AURETH101 – Depower and reinitialise battery electric vehicles) for its members, particularly those keen on converting their own vehicles.

SECTIONS TO BE DEVELOPED:

[Area 14] Equity and accessibility, including car share and fleet buying
[could include encouragement of "neighbourhood electric vehicles"; see https://en.wikipedia.org/wiki/Neighborhood_Electric_Vehicle]

[Area 15] Electric motorcycles and mopeds

[Area 16] Energy security, energy policy, renewable energy and V2G

[Area 17] EV manufacture and supporting industries in Australia

[Area 18] Education, advocacy and public events