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CLIMATE CHANGE AUTHORITY: SECTORAL PATHWAYS REVIEW SUBMISSION
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Introduction

Dear Sir/Madam,

This submission is provided by the Australian Electric Vehicle Association Ltd (AEVA). Thank you for the opportunity to make this submission on targets, pathways and progress.

Since 1973, AEVA 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, the association's origins represented the full breadth of the transport sector. To this day, the AEVA promotes 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; and advocating to governments for more electric transport-friendly policies.

AEVA's mission is simple – transition Australia's transport networks to electric drive as quickly as possible. In this submission, we have broadly addressed two questions from the Issues Paper across four classes of transportation: light duty vehicles, heavy duty vehicles, rail and aviation. Those two questions are:

4. What technologies are important for each sector's pathway to net zero and why?

5. How can governments use mandates, rules, and standards to accelerate Australia's decarbonisation? Is more planning by governments needed? If so, how should this be coordinated and how can this be done while making the transition inclusive, adaptive, and innovative?

Light vehicles

As the Issues Paper notes, battery electric vehicles (BEVs) offer the most immediate opportunity for reducing transport sector emissions. BEV technology is now mature. Since the introduction of the first modern commercially available BEVs around 2010, charging times, vehicle range and battery life have all improved and now meet the needs of mainstream buyers. Passenger EVs are now capable of making very long distance trips, facilitated by the growing fast charging infrastructure.

What is now needed to decarbonise light passenger vehicles is *consistent, long-term* policies to get BEVs into the vehicle fleet. The AEVA is particularly concerned that the New Vehicle Efficiency Standard, as proposed, does not set tailpipe emissions targets beyond 2029. Vehicle importers and consumers have little certainty about the trajectory beyond this decade. AEVA believes it is essential that the trajectory from 2029 to 2035 tightens emissions for both passenger vehicles and light commercial vehicles to 0 g CO_2-e/km by 2035. The draft NVES legislation contains a scheduled review and this will be the opportunity to specify a post-2029 trajectory.

The 2035 target is critical because any fossil fuelled vehicle purchased in 2035 will likely still be in the vehicle fleet in 2050 due to the long asset life of some passenger vehicles. Scrappage programs are best avoided as these can be inequitable to those who rely on being able to buy the oldest and cheapest vehicles. It is clear that Australia cannot reach any meaningful transport emissions targets primarily with hybrid vehicles – a 25 year old technology with limited scope for improvement.

The Australian Government has indicated its intention to replace the outdated New European Driving Cycle (NEDC) test procedure with the Worldwide Harmonised Light Vehicle Test Procedure (WLTP) by 2028. WLTP is widely regarded as producing more realistic figures for consumers in general, but has been criticised for continuing to dramatically underestimate the real-world emissions of plug-in hybrid vehicles (PHEVs). The WLTP calculation uses a *utility factor curve* which, for a given electric-only range, estimates the percentage of driving the vehicle will do in electric-only mode.

All vehicles sold in the EU since 2021, including PHEVs, have been fitted with on-board fuel consumption monitoring equipment to report true fuel consumption. Numerous studies in Europe, including a 2024 report[1] by the European Environment Agency, have found that the actual emissions from PHEVs are, on average, 3.5 times higher than their type approval values. Fuel consumption data are being used to adjust the utility factors in Europe. In 2025, new utility factors will be adopted in the EU followed by another revision in 2027. These improvements will bring type approval values for PHEVs closer to their true on-road emissions.

The European studies identified several explanations for the large gap between claimed emissions of PHEVs and what is produced in reality. The primary reason is that drivers are not as motivated to charge them as they are a BEV. Studies have identified even higher fuel consumption in fleet vehicles where the driver is given a fuel card but is not compensated for the use of their home electricity. Other reasons include some PHEVs having very small batteries or underpowered electric motors: for example, one luxury PHEV model has a V8 engine with a tiny electric range of only 13 km. Having an underpowered electric motor causes the vehicle to start the internal combustion engine to assist when power demand exceeds the capability of the electric motor. Even when its battery is sufficiently charged, PHEVs can continue to emit CO_2 in some circumstances. It is vitally important that the limitations of these vehicles be considered when regulating PHEVs and accounting for their emissions. **The AEVA recommends that the proposed 2027 EU utility factors be adopted as soon as WLTP is introduced in Australia to ensure that the emissions ratings of plug-in hybrid vehicles are realistic**.

[1] European Environment Agency. Climate and energy in the EU. https://climate-energy.eea.europa.eu/topics/transport/real-world-emissions/data

Heavy duty vehicles

Current policies at state and federal level have not focused on heavy duty vehicles because, historically, they have been seen as harder to decarbonise. This is problematic because these vehicles travel vastly more kilometres than light vehicles and decarbonisation of the heavy vehicle fleet is starting quite late.

Trucks used for freight and other operations have a range of capabilities owing to the varied operational requirements. These range from interstate road trains to 'last mile' delivery and everything in between. Fleet management company Geotab recently analysed two million vehicles in fleets worldwide and assessed their suitability for electrification[2]. For vehicles driving local routes, Geotab found that 58% of medium-duty and 46% of heavy-duty trucks did not travel more than about 300 km per day. Furthermore, such vehicles are generally not in continuous operation, providing opportunity for recharging. While there may not be EV truck models suitable for all use cases right now, many applications can be satisfied with battery electric trucks today. Moreover, the fuel savings for operators are very considerable. Analysis of the barriers to EV truck deployment should find that the economics are already quite favourable.

For long distance trucking such as freightliners operating between Australian capital cities, battery electric trucks are already making significant progress in other countries. Battery electric semi-trailers are now entering the freight vehicle fleet in countries such as the USA with very fast charging infrastructure[3]. The Megawatt Charging Standard provides for standardised fast charging at around 1 MW initially and ultimately up to 3.75 MW. A number of manufacturers, including Tesla and Volvo, have trucks in operation and these have been recently trialled on routes exceeding 1,000 km per day.

One very promising direction being taken in Australia is the work of Janus Electric in New South Wales, who has developed a system for converting diesel prime movers to electric drive[4]. The diesel engine is removed when it is due to be overhauled and is replaced with an electric drivetrain and a swappable battery. The batteries can be exchanged quickly using a forklift at designated "swapping stations" and re-charged more slowly than would be otherwise required. The main advantage that we see of the Janus system is that it allows vehicles to be converted at the time of engine overhaul rather than waiting for the prime mover to be replaced at the end of its service life. The decarbon-isation of the heavy vehicle fleet can therefore happen much more quickly. Ideas like this have considerable merit and should be encouraged by the Federal Government through incentives for conversions or investment in battery swapping stations.

It is the view of AEVA that hydrogen has very limited value in the land transport sector. Assuming "green hydrogen" is produced from renewable energy, electrolytic hydrogen for an FCEV requires about three times more electricity[5] compared with charging an equivalent BEV directly. Even if the production cost of hydrogen is reduced to competitive levels with (eg, $2/kg) through cheaper electricity, it will always be cheaper again to use the electricity directly (via the battery) than to convert electricity to hydrogen and back again.

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[2] Geotab. Taking charge. https://www.geotab.com/uk/taking-charge-download/

[3] For example, see: Dashdoc. https://www.dashdoc.com/en-US/blog/companies-making-electric-semi-trucks

[4] Janus Electric. https://www.januselectric.com.au/

[5] EnergyPost.eu. https://energypost.eu/toyota-vs-tesla-can-hydrogen-fuel-cell-vehicles-compete-electric-vehicles/

AEVA recognises that hydrogen is absolutely essential for some applications and quite likely for others. Liebreich Associates maintains a chart called the Hydrogen Ladder[6] which shows the suitability of hydrogen to various applications ranging from domestic heating to fertiliser production. A considerable number of applications are very unlikely to be competitively suited to hydrogen. AEVA is not suggesting hydrogen 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. **Hydrogen remains very unlikely to find application in light or even heavy duty road vehicles.**

Rail

Australia currently moves over 400 billion freight tonne-kilometres by rail[7] as it offers the lowest cost means for bulk goods. 23 billion freight tonne-kilometres of containerised goods are also moved by rail, however certain routes are more economic than others, particularly the Adelaide-Darwin and Parkes-Perth routes. Meanwhile, suburban commuter services continue to move hundreds of millions of passengers each year, although inter-regional rail travel remains niche.

While diesel-electric locomotives are up to three times more energy efficient than road freight, they are still responsible for up to 4% of all transport emissions[8]. Full electrification of rail freight by means of overhead electric power has been enormously successful, particularly in India[9] which boasts over 63,000 km of electric overhead rail - much of this capable of supporting double-stacked container freight. Queensland continues to benefit from rail electrification; a decision made 40 years ago to mitigate against fluctuating fuel prices. As far as rail electrification goes, overhead line equipment is a mature technology with over a hundred years of development underscoring its success. While it is a substantial investment upfront, the opportunity to move vast tonnages of goods on zero emissions electricity is substantial.

Hybrid and battery-electric locomotives are also being developed for the world's railways. Multiple manufacturers[10] have developed locomotives capable of running on both 1500 V DC (Sydney network) and 25 kV AC (Queensland, WA, SA) as well as fully battery electric options. This technology may be worth pursuing for sections where overhead power is difficult to install or the costs outweigh the savings.

Compared to road freight and private automobile transport, rail is a small player - an outcome of continued under-investment in rail infrastructure. Annual public investment in rail amounts to just $3.6 billion[11], while road infrastructure receives almost ten times this.

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[6] Liebreich Associates. https://www.liebreich.com/hydrogen-ladder-version-5-0/

[7] Australian Infrastructure and Transport Statistics. https://www.bitre.gov.au/sites/default/files/documents/bitre-yearbook-2023.pdf

[8] Climate Change Authority https://www.climatechangeauthority.gov.au/sites/default/files/2021Fact%20sheet%20-%20Transport.pdf

[9] Indian Railways. Status of rail electrification. https://indianrailways.gov.in/railwayboard/uploads/directorate/ele_engg/RE/2024/Status%20of%20Railway%20Electrification%20as%20on%2001_04_2024.pdf

[10] Siemens Mobility. https://www.mobility.siemens.com/global/en/portfolio/rolling-stock/locomotives.html

[11] Australian Infrastructure and Transport Statistics. https://www.bitre.gov.au/sites/default/files/documents/bitre-yearbook-2023.pdf

Australia must aim to move significantly more goods by rail in order to meet our 2050 emissions targets. This will take constant investment in rail infrastructure and intermodal facilities. **AEVA strongly believes that sections of interstate line should be electrified as soon as possible**, particularly the main north coast line (Broadmeadows to Acacia Ridge). The line from Sydney to Melbourne must be dual-track, and realigned where it crosses the Great Dividing Range, allowing for faster trains (both freight and passenger services). Once this work is complete, electrification of Sydney to Melbourne should be enacted.

In addition to rail freight, **high speed passenger rail services must be developed linking key centres, particularly Sydney-Newcastle and Sydney-Goulburn-Canberra**. Overseas experience has shown that rather than building long-distance high-speed rail, smaller sections with clear patronage demand should be developed first. Then as patronage increases, expand these lines to the next major centre. High speed rail in Spain[12] moves over 22 million passengers each year; mostly on trips that would have been flights. High speed rail in Australia has been something of a political football. More studies have been done on the matter than almost any other major infrastructure proposal, yet nothing is ever built. Infrastructure costs on projects such as Inland Rail are ballooning, making governments ever more shy about committing to truly transformative investments like high speed rail. If Australia is to get serious about sustainable high speed travel, we must commit to high speed rail, or at the very least, 'not-slow' rail. The longer the nation goes without building critical infrastructure, the more expensive and difficult it becomes.

Aviation

Aviation is widely acknowledged as one of the most difficult to abate sectors. As the energy density of electrochemical batteries has steadily improved, electric aircraft have become viable for short-haul flights (eg, one hour duration with a small number of passengers). Small electric training aircraft such as the Pipistrel Velis Electro[13] are lowering the cost of pilot training due to their exemplary running costs. The Australian aviation fleet consists of many different aircraft types with different workloads. Electric aircraft, even with modest capability initially, will be immediately useful in decarbonising Australian aviation.

Electric aircraft will satisfy short-haul sectors first, perhaps as soon as 2030. They will have particular use on shorter, less frequented regional routes. Their quiet operation also affords them advantages at airports subject to curfews. The low energy density of battery storage currently excludes electric aircraft from medium and long-haul air travel. For longer routes, the technologies with the highest levels of technology readiness are sustainable aviation fuel (SAF) and hydrogen fuel cells. Less commercially ready alternatives include synthetic hydrocarbons derived from renewable electricity. While the COVID-19 pandemic demonstrated to many businesses that videoconferencing could save considerable time and money for interstate business travel, it appears that business travel demand has rebounded. This demand reduction measure remains a very cheap option for reducing aviation emissions.

The rail and aviation sections of this submission are inextricably linked. Several high-patronage air routes in Australia (Sydney-Melbourne, Sydney-Canberra, Melbourne-Canberra) could be better served by a high-speed electric rail service in the longer term. This would reduce demand on these popular flights, making the decarbonisation of remaining air services more manageable. The

[12] Thales Group. https://www.thalesgroup.com/en/spanish-high-speed-rail-network-success-story#history
[13] Pipistrel. https://www.pipistrel-aircraft.com/products/velis-electro/

Japanese Shinkansen services are so fast, comfortable and punctual that airlines struggle to compete on shorter services such as Tokyo to Osaka. While costly, high-speed rail is a mature technology that could dramatically reduce Australia’s domestic aviation emissions, with a range of other benefits.

Summary

The AEVA suggests that there is considerable scope for reducing transport sector emissions based on proven technologies and, for a 2050 target, technologies that are already pre-commercial. Our key recommendations are:

1. Introduce a fuel efficiency trajectory to 2035 that leads to zero emissions for all light vehicles;
2. Urgently introduce realistic emissions testing of plug-in hybrid vehicles;
3. Recognise that many heavy-duty vehicles are already amenable to electrification;
4. Recognise that electric mainline rail for freight and passenger service is a mature technology that can reduce hard-to-abate emissions from the aviation sector; and
5. Don't rely on hydrogen for reducing road transport emissions.

Yours sincerely,

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