National Electric Vehicle Strategy - **RA Submission**

31 OCTOBER 2022

Background:

Roads Australia (RA) is the peak body for roads within an integrated transport system, representing an industry that contributes $236 billion annually to the economy and supports 1.4 million jobs. RA has over 150 members and brings industry, government, and communities together to lead the evolution of Australia's roads, integrated transport and mobility.

RA prides itself on being a leader in the industry. The organisation strives to be at the forefront of setting the industry up for success and pioneering new ways to be able to attract and retain highly skilled people now and into the future. This is iterated in the RA Strategic Plan 2022-2024 which outlines our four strategic values as being:

The leader

To be a leading voice of influence.

RA is recognised by government, industry and the community as driving value and connectedness for the Australian roads and integrated transport sector.

The facilitator

To facilitate contributions to the industry and public policy.

Develop and communicate sound, evidence-based policy solutions encompassing safety, capacity, transport reform, customer experience and sustainability.

The collaborator

To collaborate on the efficiency, development and national priority of Australia's roads and integrated transport systems which underpin the social, economic and cultural fabric of the nation.

Promote recognition by government, industry and the community of the critical importance of Australia's roads and integrated transport in infrastructure assets and networks.

The champion

To champion a diverse, inclusive, sustainable and values-led organisation and industry.

Support our people to be high performing through our culture and systems.

Our main priority in embodying these characteristics is to make positive changes to the integrated transport system and our member organisations – both of which sit within the context of the construction industry.

The RA Strategic Plan 2022-2024 outlines RA's four policy themes: Place Making; People; Data & Technology; and Resilience.

Our strategic plan also includes three policy goals:

- Optimise the use of our roads for environmental, social, economic and cultural outcomes.
- Improve the stewardship of our roads for the workers on them and the people who use them.
- Decarbonise the economy through integrated transport and the efficient use of resources and energy.

RA welcomes the opportunity to make this National Electric Vehicle Strategy submission.

Introduction:

Transportation across the globe is transitioning to Zero Emission Vehicles (ZEVs) – with various fuel sources such as biofuels, electricity and hydrogen being pursued.

Along with measures to promote the uptake of ZEVs many countries have legislated dates for the effective banning of the registration or sale of new petrol and diesel powered light vehicles. These actions are solidifying the sense of urgency within the global community towards this transition.

In the global light vehicle market, Plug-In Hybrid (PHEVs) and Battery Electric vehicles (EVs) appear to be the preferred choice of the public. Hydrogen Fuel Cell Vehicles (HFCV) are being pursued as suitable replacements for diesel-powered vehicles, especially in the heavy haulage and long-distance public transport markets.

Over the last few years, Roads Australia (RA) has been actively exploring this transition with governments, industry and connected parties to help distil the various challenges and opportunities and make recommendations to accelerate transition.

These discussions have led us to the realisation that to deliver a successful transition we need to facilitate the convergence of transport, energy and technology policy.

Australia's energy grid and the transport network currently are separate, mature systems that have developed over time to be relatively resilient and meet the needs of the population. Connecting these two complex, disaggregated systems together (whilst simultaneously continuing to deliver safe and efficient operation) will require changes to existing behaviour, expenditure, regulation, taxation and planning. In attempting to produce a net-positive outcome for the community and the environment there are also increasing risks of negative impacts that will need to mitigated and managed.

Technology will play a large role in assisting these changes, including current systems and those still to be developed.

If implemented correctly, this transition can not only accelerate the development of a net-zero economy but can also deliver other benefits such as:

i. Improved public health through decreased air pollution.
ii. Stabilised revenue streams that pay for the transportation systems we will use.
iii. Transportation energy security no longer reliant on international supplies of fuels.
iv. New industries and jobs in Australia.
v. Amended public policy tools to tackle social issues such as the renewable energy roll-out, taxation and income inequality.

To secure optimised outcomes, we require a national transition strategy, supported by transparent reporting of the right metrics and continuous reviews. To paraphrase a presenter at one of RA's webinars discussing this transition, we need to ensure the transition takes the form of a rising tide, rather than getting hit by a tsunami of change.

If EV sales exceed the pace of required changes to energy generation and supply, then there will be disgruntled EV customers whose negative sentiment risks slowing down take up in communities that are already harder to transition. If the energy transition occurs before EV sales have increased sufficiently, then consumers will have to not only pay for petrol, diesel etc, but also through their electricity bills for the increased investment needed to support the expanded energy infrastructure.

Measuring the success of the strategy should look not only at the average emissions intensity of new vehicle, but also the intensity of the registered Australian vehicle fleet to calculate overall change.

1. **RA recommends the transition to Zero Emission Vehicles (ZEVs) should be nationally coordinated and closely aligned with the transition of the energy sector, to ensure the productivity gains are maximised through an effectively planned and implemented rollout.**

2. **RA recommends to monitor the success of the government strategy, there should be regular evaluation using existing reports such as the NTC's Carbon Dioxide Emissions Intensity for New Australian Light Vehicles and expand its scope to include annual assessments of the entire registered Australian vehicle fleet, including heavy vehicles.**

Vehicles:

In Australia, transport accounts for around 18% of emissions[1], predominantly from light vehicles.

Australia's uptake of light EVs lags significantly behind that of comparable countries. While demand appears to be growing exponentially, there are a number of issues that are impacting Australia's supply of EVs, including:

- No fuel efficiency standard means that international manufacturers are financially incentivised to focus their supply of EVs in other OECD countries.
- A small right-hand drive market with unique and bespoke safety standards often requiring costly and specific Australian runs on global manufacturer's assembly lines.
- International supply chain issues impacting the supply of new vehicles globally.

Norway, an early adopter of incentives for EV take-up, continues to approach 100% new car sales, with battery electric and plug-in hybrid vehicles making up almost 90% of all new car sales in the first half of 2022[2]. New Zealand, an even smaller right hand drive market than Australia, has this year seen months where EVs have made up more than 20% of all new car sales[3].

As seen from these and other international examples, the uptake of EVs can increase dramatically once supply issues are sorted.

3. **RA recommends the Commonwealth Government should take actions designed to increase the supply of zero emission vehicles across different price points and different vehicle categories. Part of this response should include a fuel emission standard.**

4. **RA recommends that any fuel emission standard introduced by the Commonwealth should consider transport's changing share in national emissions reduction targets as well as the fuel emission standards of comparable nations, especially other right hand drive markets such as Japan, Britain and New Zealand.**

According to the Australian Bureau of Statistics, more than half the kilometres travelled by vehicles in Australia are for business purposes or to travel to and from work[4]. Government, rental and business fleets also make up almost half of all new vehicles purchased in Australia[5].

With fleet buyers generally rolling-over their vehicles every 3 to 4 years, the types of vehicles they buy new now will soon become a large part of the second-hand market.

Large fleet buyers are likely to be well positioned to make their own assessments as to what, when and how they transition to EVs. Small and medium enterprises with only a few vehicles may not have the time or skills to assess the benefits of transitioning to an EV, especially with barriers such as Australian Tax Office assessments and supporting at-home charging.

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[1] Australia's National Greenhouse Gas Inventory estimates that the transport sector contributed to 18.3 per cent of Australia's emissions in 2020 (94 MtCO2e) and is projected to increase to 100 MtCO2e by 2030.

[2] https://insideevs.com/news/596027/norway-plugin-electric-car-sales-june2022/

[3] https://www.stuff.co.nz/motoring/128776979/which-region-is-leading-the-charge-when-it-comes-to-electric-vehicle-uptake

[4] https://www.abs.gov.au/statistics/industry/tourism-and-transport/survey-motor-vehicle-use-australia/12-months-ended-30-june-2020

[5] https://www.carexpert.com.au/car-news/vfacts-australias-2021-new-car-sales-detailed-in-full

Additionally, with mobility an imperative for these organisations, businesses and fleet operators will need the assurance of a readily available public vehicle charging network. Removing the risk of having vehicles and employees stuck on the side of the road due to unforeseen circumstances would help provide more confidence for those with a financial need to keep things moving.

Incentives and advice, especially for smaller business, will improve the take-up of EVs for business and work use and will not only have a direct impact from the distances travelled for work purposes, but will also support a future vibrant second-hand market.

5. RA recommends that to create a second-hand market for EVs the Commonwealth Government should provide incentives and advice to fleet buyers, especially for small and medium enterprises.

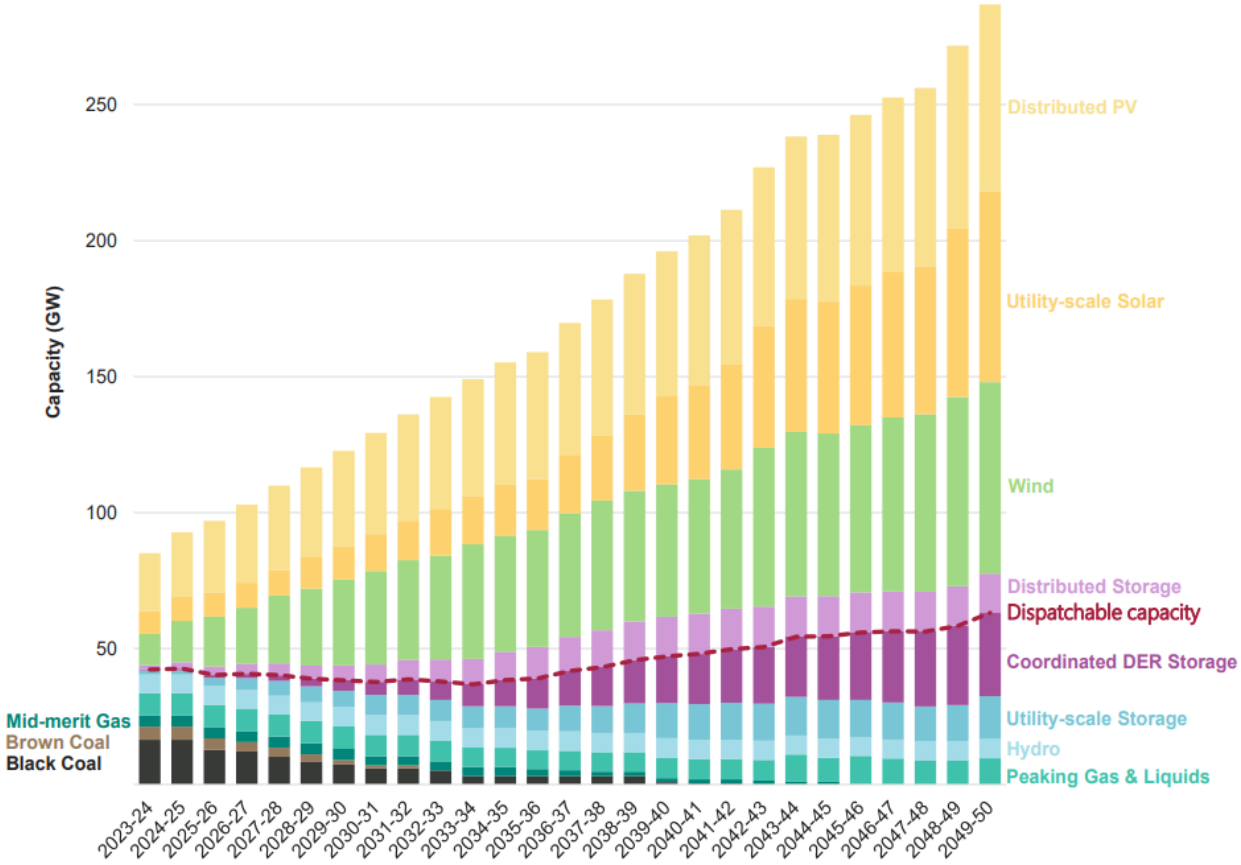
Energy:

The expanding electrification of transport, industry and households will have a significant impact on the way we manage our energy generation, transmission and use.

In the National Electricity Market zone, the Australian Energy Market Operator[6] has forecast:

- Roughly the doubling of electricity to be delivered per year (from 180TWh to 320TWH) to meet domestic requirements (ie, excluding any energy requirements should a green hydrogen export industry be established in Australia).
- A nine-fold increase in the amount of utility-scale variable renewable energy (VRE) capacity to support the increased demand and the reduction in energy from coal.

Figure 1 Forecast NEM capacity to 2050, *Step Change* scenario



[6] 2022 Integrated System Plan, *Australian Energy Market Operator.* June 2022

- The installation of more than 10,000km of new transmission lines to connect new energy generation to consumers.
- Market reforms to help manage the power system and the demands of two-way electricity flow.

Not only will there be a need for significant builds of new hard infrastructure but interweaving all of these (and enabling the last point) will be the use of current and future technology.

6. **RA recommends strong policy connections between the rising numbers of EVs and the generation, transmission and distribution of renewable energy so that both go forward in lockstep and do not create further inefficiencies or drive confidence from the marketplace.**

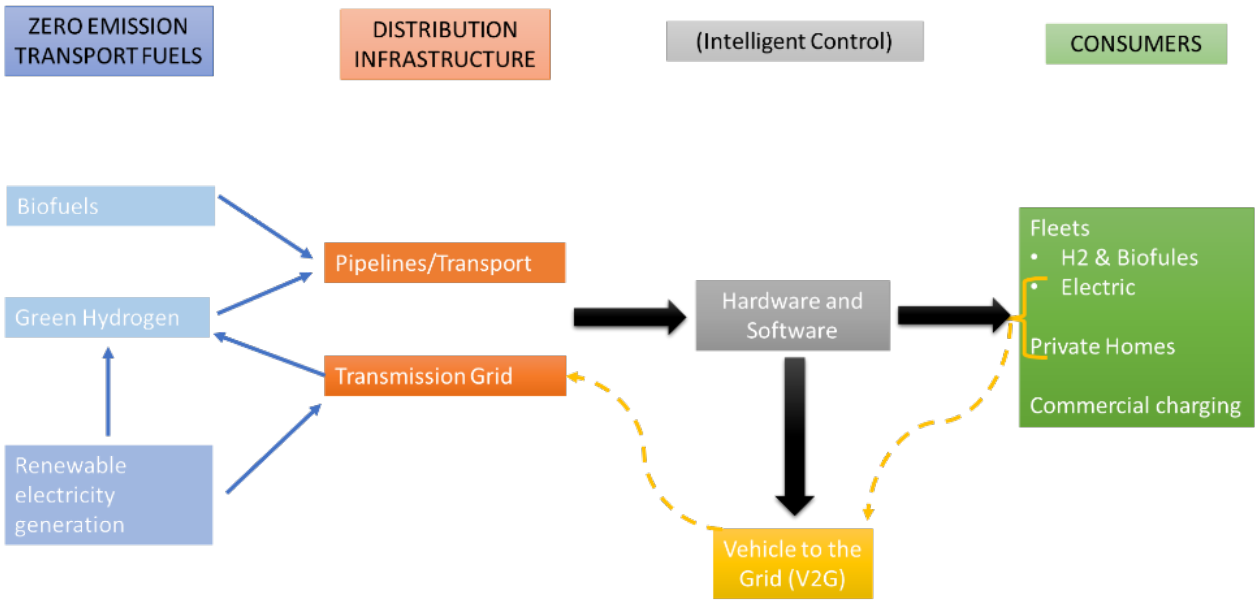
To help manage the grid's ability to balance supply and demand, consumers will need to be presented with incentives and disincentives for the time and place of their energy consumption. Simple pricing signals can encourage off peak charging (especially during the increasing solar peak hours in the middle of the day) but something like Vehicle to Grid capabilities could also see incentives for feeding some of the energy stored in a vehicle battery back into the system at times of higher demand and lower supply.

In creating a future smart grid, technology, including both hardware and software, will need to sit in between distribution and consumers, helping to keep the system in balance. The figure at the bottom of this page provides a basic view of this.

The technology and regulation required to support this should be developed to help all consumers, not just the technologically inclined, to take advantage of lower charging prices when available and feed-in tariffs when best placed.

7. **RA recommends that energy regulation most be allowed to evolve to allow current and future energy providers and retailers the flexibility to offer Australian consumers choice that encourages positive outcomes and reduce the need for over investing in our energy assets.**

The changed nature of land use to accommodate EV recharging infrastructure poses a new set of technical, commercial and design challenges for stakeholders. These include local governments, developers, petrol and diesel vendors transitioning to alternative fuels, fleet managers and bus operators.



RA stakeholders have raised the high cost of electrification of their depots as well as the additional space electric buses may require compared to their diesel equivalent and the limitation on vehicle numbers to manage charging and not overload the local network. This will likely lead to new models for bus distribution, requiring significant change to their depot size and layout. As a positive, with vehicle to grid technology, in times of high demand, bus depots may be used as neighbourhood batteries supporting the smart grid.

Managing these design and land use changes would be best dealt with through a national strategy, including the use of coordinated building standards and other standards-related frameworks. Updated building codes (and technical standards) are needed to enable accommodation of larger, more bi-directional and dynamic, tariff-triggered electrical loads.

Having a national strategy for land use and urban development guidelines for zero emission transport will reduce duplication of testing and trialling between states and ensure Australia adopts national harmonised standards wherever possible.

8. **RA recommends urban development guidelines, plans and strategies should consider the energy and transport transition as a whole, led by a national strategy for land-use and urban development that considers future mobility systems.**

Technology:

Australia is starting this transition well behind other comparable countries. Standards have already been developed and tested in these countries for many of the new elements required in the new charging grid. Early adopters of technology in Australia have faced significant delays to accessing some parts as they have waited for local approval for a product that is operating safely in many international jurisdictions.

For example, vehicle to the grid (V2G) standards were identified as being needed to support the uptake of EVs in Australia[7] - but cars capable of supporting V2G were in the Australian market well before regulations and standards were approved[8].

In planning Australia's public and private charging system and other parts of the EV ecosystem, the experience of countries that are more advanced in this journey should be taken on board. New standards and regulatory changes necessary to support the roll-out should be adopted from experienced jurisdictions, or where necessary Australian only standards developed well before they are required.

9. **RA recommends in accepting the technology change, Australia should not put in place unnecessary barriers to accepting international standards by requiring the development, testing and wide consultation on the development of bespoke national standards unless absolutely required.**

The transition to zero emission vehicles and the reduced use of petrol, diesel and other fuels will have an impact on taxation revenue raised by the Commonwealth.

This creates an opportunity to shift to a more direct pricing system to pay for the upkeep and development of our transport networks and future mobility systems.

It is also an opportunity to fix some of the social inequalities present in the current system, where those who have to travel more kilometres on average (eg, regional Australians) and those on lower incomes who generally drive older, less fuel efficient cars, end up paying more tax.

[7] https://www.standards.org.au/news/blog/2021/june/the-road-ahead-for-electric-vehicles

[8] https://thedriven.io/2021/05/12/nissan-leaf-owners-could-start-feeding-into-grid-by-end-of-year/

To maintain the confidence of industry and road users, it is essential that road pricing and investment reform models are transparent and equitable for all road users. The methods must be part of a nationally consistent move towards road user charging reform that measurably boosts productivity.

Norway, a global leader in the transition to ZEVs, has recently started a trial of a new road user charging system[9]. Many Australian states have announced their own distance charges for EVs registered in their jurisdictions, but this could create inconsistencies between jurisdictions and continue the same social inequalities present in the fuel tax system.

10. **RA recommends the development of a nationally consistent road user charging mechanism for all vehicles that strengthens links between the need for road-related revenue and road-related investment.**

The new industries and opportunities from this technology transition will also require increased numbers of skilled workers in existing and new fields.

In the UK, the Institute for the Motor Industry has pointed to a shortfall of automotive technicians by 2026[10] if no action is taken to increase the retraining of the existing workforce. With a significant public charging network being developed by jurisdictions in Australia, appropriately qualified electricians and electrical engineers will also be needed to install and service these high speed chargers, as well as undertake the installation of the at-home charging network. These skilled roles are in addition to the roles required to meet the renewable energy growth and development pointed out earlier in this submission.

With the same demand for these roles across the globe, Australia will not be able to rely on skilled migration to fill the gap, will experience inflationary wage pressure for specialist skills and will instead need to ensure that we have an appropriate national education and training regime. This needs to start now, allowing us to retrain and develop the national workforce necessary to deliver all the programs needed to underpin a successful transition to ZEVs and future net-zero mobility systems.

11. **RA recommends a national skills strategy for the development of the workforce to transition the energy and transport sectors to net-zero.**

[9] https://www.q-free.com/new-road-user-charging-system-piloted-in-norway-with-q-free-as-technology-provider/

[10] https://tide.theimi.org.uk/industry-latest/news/2026-marks-cross-roads-ev-skills-gap

APPENDICES FOR:

National Electric Vehicle Strategy Submission
31 October 2022

APPENDICES

1	**RA International Insights: Moving from ICE powered vehicles to EVs** (September 2020)
2	**RA International Insights: The future role of hydrogen fuel cell technology in our public transport system** (December 2020)
3	**RA Policy Insights: Convergence in Transport** (March 2022)
4	**RA Policy Insights: Convergence in Transport – Energy** (March 2022)
5	**RA Policy Insights: Convergence in Transport – Fleet** (April 2022)

APPENDIX	**NO. 1**
Document	**RA International Insights: Moving from ICE powered vehicles to EVs** (September 2020)

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POLICY WEBINAR *proudly sponsored by* ARUP

ABOUT ROADS AUSTRALIA

Roads Australia (RA) is the peak body for roads within an integrated transport system, representing an industry that contributes $207 billion annually to the economy and supports 1.3 million jobs.

RA brings industry, government and communities together to lead the evolution of Australia's roads, integrated transport and mobility.

The nation's only roads champion, RA's 150+ members includes all of Australia's road agencies, major contractors and consultants, motoring clubs, service providers and other relevant industry groups.

RA's current policy focus extends across five activity streams: Safety; Capacity; Transport Reform; Customer Experience; and Sustainability with Diversity and Inclusion an underlying commitment across each stream.

Register for upcoming policy events to contribute to the debate.

BACKGROUND

In lieu of the deferred 2020 Study Visit to UK and Europe announced earlier in the year, RA has introduced an International Insights webinar series.

Our second webinar focused on the transition from Internal Combustion Engines (ICE) to Electric Vehicles (EVs), including an update on the progression to EV's in Europe, and the challenges being faced.

EVENT SUMMARY

Over 100 attendees joined RA's webinar on 16 September 2020 to hear from:

- **Sharon Masterson,** Manager, Corporate Partnership Board, International Transport Forum (ITF) at the Organisation for Economic Co-operation and Development (OECD)
- **Pierpaolo Cazzola,** Advisor - Energy, Technology and Environmental Sustainability, ITF at the OECD
- **Sandra McKay,** Executive Leader, Sustainability, National Transport Commission (NTC)
- **Mark Rowland,** Transport & Highways Advisory Leader – Australia, Arup

Individual speaker presentations are available on the RA website.

The webinar was moderated by **Clare Gardner-Barnes**, Transport Reform Policy Stream Chair, Roads Australia and Head of Strategy, Planning and Innovation, Infrastructure NSW and sponsored by Arup.

POLICY INSIGHTS

The webinar brought together leading experts from across Europe and Australia.

Sharon Masterson from the International Transport Forum (ITF), kicked off the session by providing an overview of the work of the ITF. The Corporate Partnership Board (CPB), which Ms Masterson manages, is ITF's official platform for engagement with the private sector.

She explained that with businesses at the cutting edge of a rapidly changing world of transport and mobility, the CPB allows private sector stakeholders to contribute their valuable business insights to policy discussions, and provide an effective mechanism for collaboration on issues of common interest.

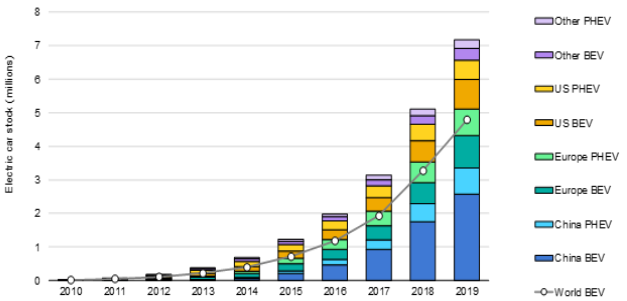
She also outlined how the work is organised into a number of different work-streams, one of which was the Decarbonising Transport Initiative. This Initiative focuses on promoting carbon-neutral mobility to help stop climate change, and provides decision-makers with the tools to select CO_2 mitigation measures that best deliver on their climate commitments.

For more information on the ITF (of which Australia is a member country), including their extensive body of leading research covering areas such as road, rail, infrastructure, energy and new mobility, visit their website.

Pierpaolo Cazzola, Advisor in the Energy, Technology and Environmental Sustainability area of the International Transport Forum (ITF), provided the keynote presentation, focusing on the policy drivers and market development of vehicle electrification in Europe.

He explained the importance of electrification in helping to promote the transition to clean mobility, and highlighted the current mix of vehicle technologies, including plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEV). He further highlighted the crucial importance of increasing the use of renewable or low-carbon energy for such electricity generation.

F1. Electric Cars on the Road

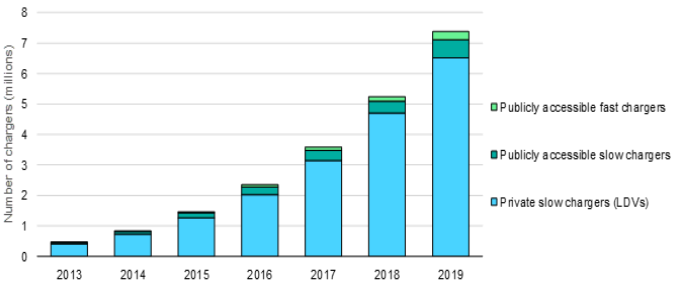


Source: IEA Global EV Outlook 2020

In terms of EV take-up, Mr Cazzola described how this was accelerating at a rapid pace, noting that in 2019, the global electric car fleet had reached 7.2 million, up 2 million from 2018, with China having the world's largest EV market, and Norway the highest electric car market share, as shown in Figure 1.

As to the key drivers for such increases, he explained a number of policies were being utilised, including economic instruments that help bridge the cost gap to ICE-powered vehicles as well as support for the deployment of essential charging infrastructure, which had almost doubled since 2017 (Figure 2). It was also noted that with advances in battery technology, there will be significant reductions in battery costs, and corresponding increases in battery performance.

F2. Global Installation of Electric Charging Points, 2013-2019



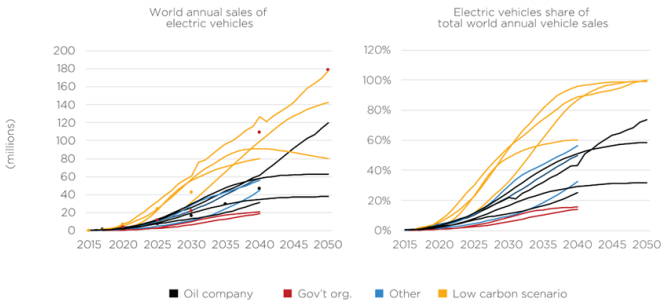
Source: IEA Global EV Outlook 2020

Mr Cazzola also highlighted that other major policy drivers included governments planning to legislate bans on the production of ICEs, with countries such as Germany and the UK planning such bans by 2030 and 2035 respectively.

These bans, together with initiatives such as the European Green Deal and other policy frameworks such as CO_2 emission standards, differentiated tax regimes favouring EVs (including significant taxation of fossil fuels), and the Clean Vehicles Directive, to name a few, would help to significantly drive take-up of EVs.

Taking these multitude of factors into consideration, Mr Cazzola indicated the outlook for the increased deployment of electric vehicles and charging infrastructure was very positive. According to research done by Columbia University, this included approximately 130 million EVs or more on the road by 2030, with the coexistence of both BEVs and PHEVs (refer to Figure 3 over page).

F3. EV Sales Volume and Market Share



Source: Columbia University, 2019

Sandra McKay, Executive Leader of Sustainability at the National Transport Commission (NTC), provided an overview of the Australian experience and new car buying trends over a decade. Ms McKay explained that the NTC was accountable to all Australian Governments, and aimed at achieving greater integration and national consistency in areas including vehicle automation, electrification and rail reform.

Ms McKay emphasised that Australian consumers were driving change, and welcomed the fact that the Commonwealth Government was about to release its National Electric Vehicle Strategy and a Technology Roadmap.

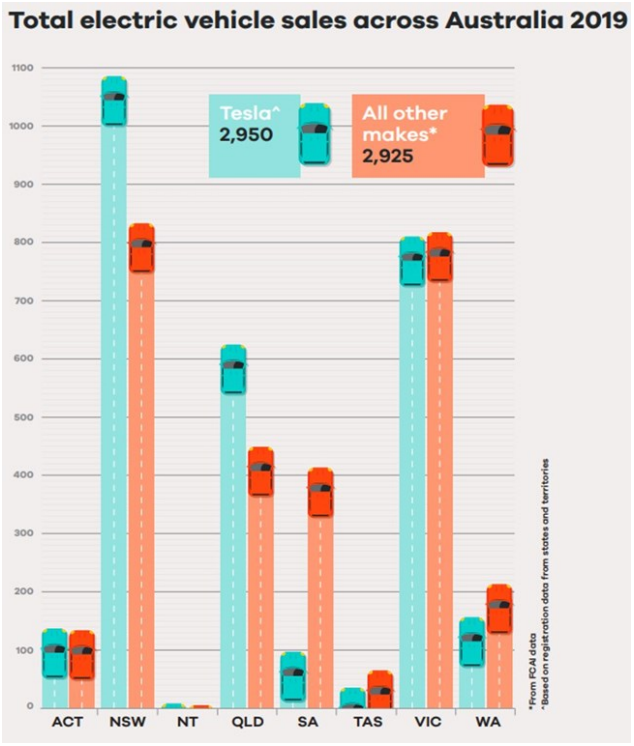
She also highlighted that Victoria, South Australia, Western Australia and the Northern Territory all have EV strategies coming out this year, while Queensland, the ACT and NSW were already advancing theirs.

Nevertheless, it was noted that Australia had significant work to do to change the trajectory of emissions if we are to meet our commitments to the Paris Agreement by the target date of 2030.

In regards to Australia embracing EVs, Ms McKay explained that although we were coming off a low base, we were starting to build pace. In fact Australia had substantially increased sales of EVs in 2019, with 40% of all EVs on the road in Australia sold last year (5,875), largely driven by a tripling of private sales (refer Figure 4).

Although still a minor user of EVs, the Federal Government fleet had increased from 1 to 16, State Government fleets from 34 to 123 and Local Government from 36 to 215.

F4. Total EV Sales Across Australia 2019



Source: FCAI, Registration Data 2019

However, looking at total national vehicle sales in 2019, whilst the purchase of EVs had increased by 149% since the previous year, the overall number of EVs on the roads (14,500; 0.08%) was still small in comparison to the nation's almost 18 million cars and light trucks.

Nevertheless, consumer sentiment indicated that there were encouraging signs that would help drive up-take of EVs. For example, according to a survey carried out by NRMA, RACV and RAA on behalf of the Electric Vehicle Council, 56% of surveyed consumers would now consider purchasing an electric vehicle as their next car.

There were also positive developments with the rollout of ultra-fast charging network along Australia's highways. This included 42 charging sites to connect a number of Australia's capital cities, as well as 21 ultra-rapid charging stations, to connect Australia's most trafficked inter-city routes along major highways.

Ms McKay also highlighted a number of other positive state-government based initiatives, including current and future commitments to the electrification of government fleets and further roll-out of charging infrastructure.

She concluded that, taken together with the soon-to-be-released National Electric Vehicle Strategy, Australia was moving in the right direction.

Mark Rowland, the Transport & Highways Advisory Leader from Arup, presented on de-carbonising Australia's on-road public transport system and opportunities for accelerating the transition of the bus fleets. Mr Rowland noted that although 17% of the world's buses are electric, 99% of them are operating in China, with very few operating in Australia.

Taking Sydney as an example, with a fleet of approximately 5,000 buses, and an average electric bus cost of $750,000, it would take a significant investment of around $3.75 billion to electrify the fleet. In terms of performance however, those electric buses that were currently being trialled were reportedly capable of doing up to 500 kilometres in a day, which included topping up with 30-35% through regenerative braking.

Mr Rowland also spoke about the franchise model ('Fleet as a Service' models) and noted that this was a significant policy lever for governments. Specifically, it would create an opportunity to accelerate the electrification of the bus fleet as those contractual arrangements started to come up for renewal over the short- to mid-term.

He also highlighted the importance of having clear definitions around what constituted zero and low emissions vehicles, noting a broader scope beyond just tail-pipe emissions needed to be consistently applied. Specifically, the carbon footprint associated with electricity generation, and for hydrogen fuel cell vehicles (FCEV), the manner in which that hydrogen had been produced (i.e. 'green' vs. 'brown' hydrogen), needed to be factored in.

Another key challenge was the length of the franchise cycles and associated contractual rules. In Australia, this meant that buses of up 25 years old were being used (this contrasts to 10 to 12 years in London) and then would continue their service in the second-hand market.

Considering the lifespan of the bus, this means that an ICE-powered bus purchased today could still be operating in 2050, which it was noted was misaligned with current climate change goals, particularly accounting for the 2030 Paris Agreement emission targets to which Australia had committed.

Therefore, the next round of franchise contracts would create a rare, yet vital, opportunity to accelerate the electrification of Australia's bus fleets, and help contribute towards lowering greenhouse gas emissions.

This would however require new and innovative thinking on vehicle electrification, together with a harmonised strategy, including but not limited to, investment in charging infrastructure, possible local manufacturing of buses using 3-D printing technology, and low carbon power generation.

RECENT DEVELOPMENTS

In further developments, the Commonwealth Government has just announced business incentives to invest in new electric car fleets to aid the push towards net-zero emissions beyond 2050.

The Electric Vehicle Council has also just commissioned Ernst & Young (EY) to analyse the costs and benefits of electric vehicles to the government and society.

EVENT OUTPUTS & NEXT STEPS

A snapshot of the event was promoted through Roads Australia's LinkedIn channel.

A second webinar, on active transport and the role it plays in a multi-modal transport system was held on 15 September. The synopsis of that event can be downloaded on the RA website.

Future topics to be discussed in the International Insights series include Road Worker Safety and Hydrogen, both of which are planned for November and December 2020.

In addition, Roads Australia plans to host further webinars on this and related topics.

APPENDIX	**NO. 2**
Document	**RA International Insights: The future role of hydrogen fuel cell technology in our public transport system** (December 2020)

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POLICY WEBINAR proudly sponsored by Advisian Worley Group

Katy Taylor
The Go-Ahead Group plc

James Hetherington
Department of Industry, Science, Energy and Resources

Dr Fiona Simon
Australian Hydrogen Council

Phil O'Neil
Advisian

Becky Wood
Aurecon and Roads Australia

International Insights:
The future role of hydrogen fuel cell technology in our public transport system

TUESDAY 8 DECEMBER 2020

ABOUT ROADS AUSTRALIA

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Visit our website for upcoming policy events.

BACKGROUND

Presented as part of RA's ongoing policy focus on the impact of new technology on the transport sector, the event followed on from an International Insights webinar in September 2020, where RA facilitated a discussion on the transition from Internal Combustion Engines (ICE) to Electric Vehicles (EVs).

The impact of these technologies were also covered in RA's two most recent study visits in 2018 (Cities for the Future) and 2019 (Future Transport: Smart Cities).

This latest session explored the role hydrogen is expected to play in the electrification of buses and whether hydrogen fuel cell buses will be embraced in Australia. The session also considered the importance of looking beyond just tailpipe emissions, and using renewables to generate green hydrogen to achieve low / zero emissions. Panellists were also asked to provide their view as to whether Australia is likely to use hydrogen in other forms of public transport.

EVENT SUMMARY

Over 90 attendees joined RA's webinar on 08 December 2020 to hear from the following speakers:

- **James Hetherington**, Manager of Hydrogen Strategy, International Climate and Technology Division, Department of Industry, Science, Energy and Resources
- **Dr Fiona Simon**, Chief Executive Officer, Australian Hydrogen Council
- **Katy Taylor**, Chief Strategy and Customer Officer, The Go-Ahead Group plc (UK)
- **Phil O'Neil**, Senior Associate – New Energy, Advisian

Several of the speakers' presentations are available on the RA website.

The webinar was moderated by **Becky Wood**, former Transport Reform Policy Stream Deputy Chair, RA, and former Managing Director - Transportation ANZ, Aurecon, and was proudly sponsored by Advisian.

POLICY INSIGHTS

The webinar brought together leading experts from across Europe and Australia.

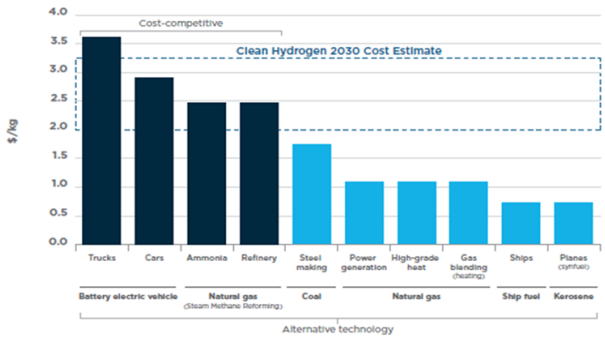
James Hetherington, Manager of Hydrogen Strategy, International Climate and Technology Division, Department of Industry, Science, Energy and Resources, kicked off the session by highlighting Australia's National Hydrogen Strategy, released in 22 November 2019. Mr **Hetherington** set the scene by explaining why there has been significant interest in clean hydrogen in recent times. He noted that with energy linked to over 70% of global emissions, a clean fuel option, alongside clean electricity production to help decarbonise, is required.

Clean hydrogen (i.e., hydrogen produced with little or no CO_2 emissions such as renewable energy) and its derivatives could be this fuel, particularly given its only by-product is water (i.e., no carbon emissions), it has a high energy content on a weight basis, and is highly versatile. From a transport perspective, hydrogen can be used in fuel cell technology to power buses, trains and other road-going vehicles. It can also be used to store energy when there is excess capacity from the power grid, which could prove a particularly effective way to harness unused power from renewable energy such as solar and wind. He also highlighted that there were significant export opportunities for Australia.

Mr Hetherington explained that transport offers a promising early use case for hydrogen. With costs falling, hydrogen fuel cell technology can complement battery electric vehicles, particularly for heavy load and long-distance applications. It also offers shorter refuelling times when compared to recharging a battery electric vehicle. However, there are challenges and barriers to be overcome to make hydrogen in transport a reality. Refuelling infrastructure needs to be deployed, hydrogen fuel cell vehicles need to become widely available and cost competitive, and low-cost hydrogen supply will need to be in place. In this regard, refuelling stations and hydrogen supply will need to develop in step with each other to ensure the businesses involved can be commercially viable (refer to Figure 1). Furthermore, rollout will need to be structured in a way that overcomes any anxiety about vehicle range.

He explained the importance of electrification in helping to promote the transition to clean mobility, and highlighted the current mix of vehicle technologies, including plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEV). He further highlighted the crucial importance of increasing the use of renewable or low-carbon energy for such electricity generation.

F1. Breakeven cost of hydrogen against alternative technology for major applications in 2020



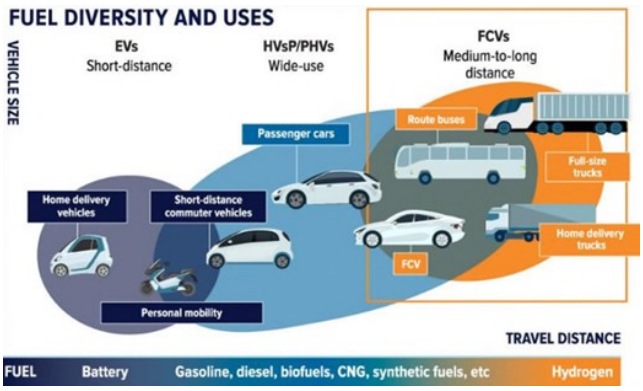
Source: McKinsey & Company 2019

Mr Hetherington explained that through the National Hydrogen Strategy, governments have agreed to encourage consortia models which will bring together vehicle manufacturers, hydrogen producers and fuel suppliers to build up supply and demand at the same time, and to lower project risk. The initial focus will be on transport tasks that do not rely on a network of refuelling stations and which offer compelling advantages. Early opportunities include 'back to base' transport applications, such as fleet vehicles, metropolitan public transport, and freight transport (refer figure 2).

In the longer term, the Strategy seeks to encourage deployment of refuelling stations along major transport corridors as well as promoting open access to government supported infrastructure to enhance vehicle range.

Mr Hetherington also explained that in the future, hydrogen production and use will create new sectoral linkages, which if intelligently managed, could create additional value and accelerate the commercial case for hydrogen in transport.

F2. Expected Opportunities for Hydrogen in Road Transport



Source: Green Cars Report

In the future, hydrogen production and use will more closely link operation of the electricity grid, the gas distribution network and the infrastructure supplying fuel for vehicles and will create new linkages between the transport, energy, industrial and agricultural sectors.

These properties mean that that the opportunities from hydrogen need to be thought about more broadly than through a focus on transport uses alone. Done well, intelligent sector coupling could improve the viability of projects and provide broader benefits such as greater fuel security through domestic fuel supply, improved electricity grid reliability and security, health benefits from cleaner air, more efficient and lower cost energy supply, as well as major export revenue and job opportunities.

Mr Hetherington concluded by highlighting the significant support from Australian governments to help accelerate hydrogen industry's growth. This includes a $1.9 billion investment package for future technologies to lower emissions, including hydrogen, as well as over $500 million of funding that has already been specifically committed to hydrogen industry development. From a transport perspective, some of the noteworthy initiatives being supported include a $74.5 million investment in refuelling infrastructure and schemes to promote the expansion of future fuels, including hydrogen.

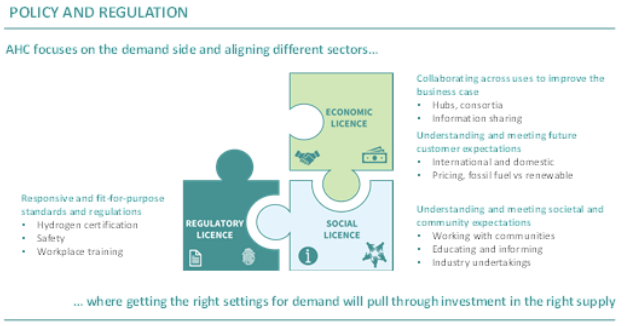
Dr Fiona Simon, Chief Executive Officer, Australian Hydrogen Council (AHC), provided an overview of the AHC. She explained that the AHC is the peak body for the emerging hydrogen industry, with the objective to grow the industry to have clean hydrogen as a key part of Australia's energy mix.

Dr Simon highlighted several key characteristics of hydrogen that make it desirable, particularly in the context of the transport sector. First, hydrogen is storable over time and transportable, and unlike batteries, does not lose its energy potency. Second, hydrogen is made, not found, which means it is not a limited resource. Furthermore, hydrogen can be made in different ways, with the clean and green versions presenting the longer-term opportunity. Third, hydrogen is versatile, and can be converted for different uses across energy, transport and industrial processes. She stated that in the opinion of the AHC, it's not a matter of *if* Australia could be a global hydrogen powerhouse, but *how*, and *by when*.

Dr Simon reinforced the importance of the AHC working with Government and other key stakeholders to ensure a coordinated approach to delivering against the National Hydrogen Strategy, including development of policy and regulation. She highlighted that there is already great interest in hydrogen in Australia, with recent estimates that there are over 50 industry projects and 30 research projects currently in progress or announced.

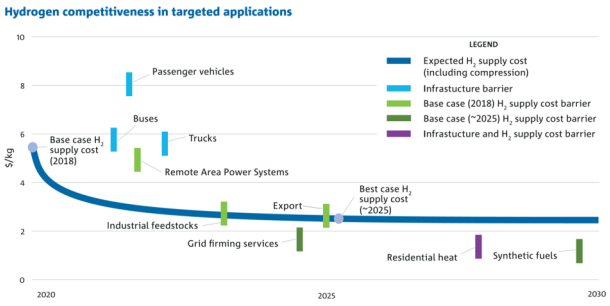
Dr Simon explained that from the AHC's perspective, the nation's immediate policy focus was on two key objectives. The first related to developing the export market, and it was noted that the National Hydrogen Strategy set an objective for Australia to be a top three exporter by 2030. The second related to the cost of hydrogen, and helping to reduce this price to a point where we can achieve the Low Emissions Technology Statement stretch target of below $2 per kilo. She highlighted that to achieve such objectives, a robust set of standards and regulation needed to be further developed, and presented the AHC's model showing that with the pursuit of economic, regulatory and social licence, supply and demand could be properly aligned (refer Figure 3).

F3. AHC Hydrogen Policy and Regulation



Dr Simon identified possible early adopters (Figure 4). Consistent with James Hetherington's earlier comments, the AHC's position was that there would be an industry-wide need to replace diesel vehicles. This would likely include: (1) **buses**, a 'back-to-base' segment, which were typically operated by public agencies and therefore amenable to policy-driven procurement; (2) **light commercial vehicles**, with this category considered to include vehicle fleets operated by public agencies (also 'back-to-base' fleets), with public agencies also amenable to policy-driven procurement; and (3) **heavy road trucking**. She concluded that as the world moves to decarbonise, Australia has the chance to boost its resilience to economic and environmental shocks through using clean and green hydrogen in the energy mix.

F4. Hydrogen Demand



Source: CSIRO 2018

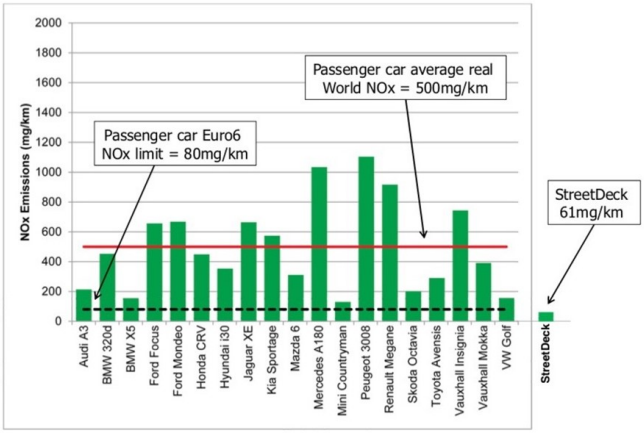
Katy Taylor, Chief Strategy and Customer Officer, The Go-Ahead Group plc (UK) (Go-Ahead), joined to provide an overview of Go-Ahead, with a focus on their bus services, one of the transport modes identified by Dr Simon as an early adopter of hydrogen technology.

Ms Taylor explained that Go-Ahead operates buses and trains, primarily across the UK. In terms of volume, this includes a third of all journeys in the UK, and a quarter of all buses in London. She highlighted that the organisation also operates buses in Singapore and in Ireland, and trains in Germany and Norway.

Considering the UK market, **Ms Taylor** explained that UK buses are already some of the cleanest vehicles on the road, even taking into account that most are still diesel powered (Figure 5).

However, many are converting these buses to battery-electric operation, with hydrogen fuel-cell trials underway. Furthermore, when considering the number of passengers moved on a bus, they offer a very clean alternative to the equivalent number of cars. It was noted that in the context of hitting the UK's net zero emissions target for 2050, shared and low or zero emissions vehicles will be priorities for the Government.

F5. Diesel Vehicle Emissions



Source: Go-Ahead Group plc (UK)

Ms Taylor set out Go-Ahead's experience with battery-electric and hydrogen fuel-cell buses. Go-Ahead now operates two all-electric bus depots, both in London. They also have 22 hydrogen buses currently in production for use around Gatwick airport, with delivery expected in late 2021. Additionally, a further 32 hydrogen buses are in production for use in the south-east of England, which are expected to be in operation by 2022. Once operational, Go-Ahead will be become the largest operator of hydrogen buses in Europe.

To help build the case for hydrogen buses, **Ms Taylor** contrasted the differences between battery-electric and hydrogen fuel-cell buses. For electric buses, significant changes were needed to depot layout, with charging taking place over 8 hours. This longer charge time meant that a larger fleet size was required.

Furthermore, current battery-electric technology offered limited range. Additionally, battery-electric buses were relatively more expensive to operate, particularly given the high battery cost (approx. £100K), which typically needed to be replaced up to three times during the lifecycle of the bus (12-15 years).

In contrast, hydrogen fuel-cell buses could be fuelled in a similar way to diesel buses, with refuelling taking between 5-8 minutes. The other major advantage was that depot layouts required minimal modifications, and no charging infrastructure was required, thereby saving £Millions. Significantly, there were no range issues, making it extremely flexible for route planning and operations.

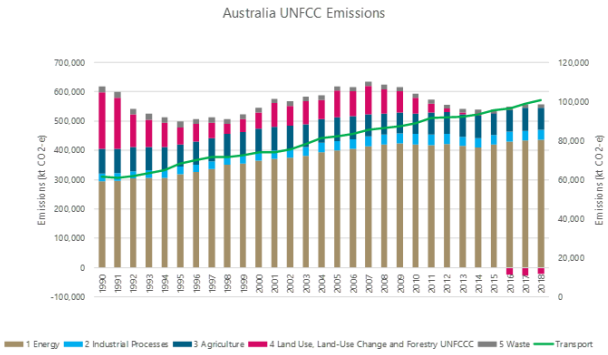
She conceded that whilst the upfront capital costs of hydrogen fuel-cell buses (£400K) were much higher than their battery-electric (£300K) and diesel (£200K) counterparts, the lifetime costs were much lower, making a compelling business case. **Ms Taylor** acknowledged that although hydrogen was currently a more expensive fuel option, it was more efficient, and in the longer term, the price of hydrogen was expected to drop significantly as scale was increased (noting again the Low Emissions Technology Statement stretch target of below $2 per kilo).

Ms Taylor went on to explain, however, that there was a role for government to provide innovation funding to help kick-start manufacturing. It was noted that this would help to bring prices of hydrogen fuel-cell buses down further, thus reducing that initial capital outlay and speeding up investment. She also highlighted that there were already robust systems in place (including to address safety) for storing and transporting hydrogen. Furthermore, and based on trials, the customer experience was further enhanced by the fact that hydrogen fuel-cell buses were even quieter than their battery-electric counterpart.

To provide context as to the emissions buses generate in the UK, **Ms Taylor** concluded by pointing out that only 4% of roadside emissions came from buses. As such, the journey to creating an entire zero emissions bus fleet was only one piece of the puzzle of tackling climate change and improving air quality.

Phil O'Neil, Senior Associate – New Energy, from Advisian, further expanded on the important role hydrogen could play in the transport sector, particularly in the context of helping to reduce emissions as tracked as part of United Nations Framework Convention on Climate Change. **Mr O'Neil** explained that emissions from transport had steadily been climbing since 1990, with a 64% increase to 2018, making up over 20% of all emissions (Figure 6). As such, the sector required urgent attention to reverse this trend and bring about meaningful reductions.

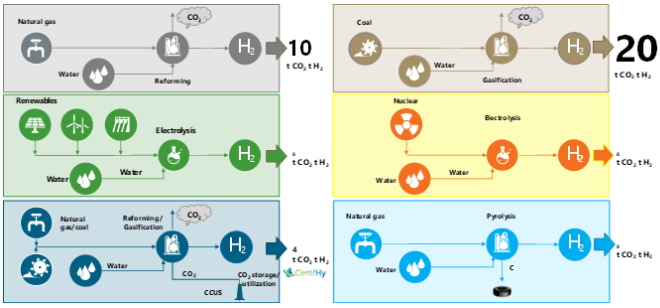
F6. Hydrogen Cost: Central vs. Local Production



Source: Australian Greenhouse Emissions Information System, Department of Industry, Science, Energy and Resources (Advisian Analysis)

Mr O'Neil explained that if hydrogen is to play a significant role, the way it is produced is key. It was noted that while 'tail pipe' emissions from hydrogen fuel cell vehicles were zero, this could be negated if fossil fuels were used to generate hydrogen. To help illustrate this scenario, **Mr O'Neil** explained six methods used to produce hydrogen (see Figure 7). He noted that methods such as those using natural gas (reforming, denoted as 'grey' hydrogen) and coal (gasification, denoted as 'brown' hydrogen) generated significant amounts of CO_2, with coal the most polluting, generating at least 20 tonnes of CO_2 per tonne of hydrogen. In contrast, hydrogen generated using renewables (electrolysis, denoted as 'green' hydrogen), produced no CO2, and hydrogen utilising carbon capture (denoted as 'blue hydrogen'), offer low emissions and are the preferred option for reducing transport emissions.

F7. The Hydrogen Rainbow

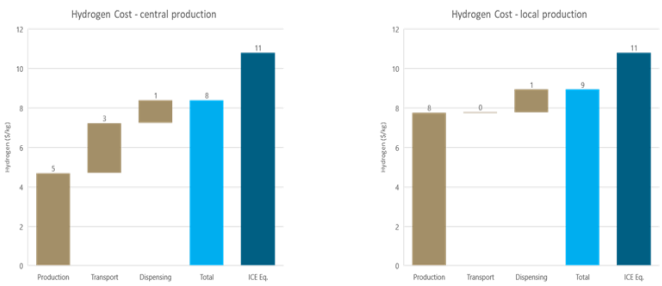


Source: Advisian

For hydrogen to be a viable alternative to other fuel sources within the transport sector, particularly for heavy transport vehicles, then consistent with earlier comments from other speakers, cost would play a crucial role. To illustrate this point, **Mr O'Neil** went on to explain the current costs of hydrogen production, contrasting central versus local production (see Figure 8). With central production, costs were currently at approximately $5 per kg, and it was estimated that it would cost a further $3 to transport to a refuelling station. Adding on a small amount for dispensing brought the cost in at approximately $8 per kg to deliver.

He noted that future transportation costs could be reduced to as little as $1 per kg if hydrogen could be moved via a network of pipelines, helping to bring delivery cost to around $6 per kilo. In contrast, local production resulted in a higher production cost of $8 per kg (driven by capital costs, electricity costs, and capacity factors), but only a relatively small difference in total cost at $9 per kg. It was noted that in both cases, it was reasonably cost-competitive when compared to a diesel option at $11 per kg.

F7. Hydrogen Cost: Central vs. Local Production



Source: Advisian

Mr O'Neil concluded by noting that prices were in fact dynamic, and other non-hydrogen options were also becoming cheaper and more effective, including battery-electric, so the jury was still out on the long-term cost competitiveness of hydrogen. He also pointed out that there were other factors impacting costs, such as fleet size and effectiveness, utilisation of infrastructure and supply chain challenges, which made the long-term outcome of hydrogen's role still somewhat uncertain.

It was noted however, that to the extent hydrogen production costs could be reduced to the target of $2 per kg as mentioned earlier, then the business case would become more compelling.

RECENT DEVELOPMENTS

In further developments, a recent article in The Age indicated that hydrogen industry hubs were being set up across the country by National Energy Resources Australia to capitalise on an emerging business opportunity.

Additionally, a recent article in the Australian Financial Review indicated that hydrogen-powered buses would be shipped to Australia in April and made in Australia from 2022 as manufacturers responded to state governments' calls for zero emissions vehicles.

EVENT OUTPUTS & NEXT STEPS

A snapshot of the event was promoted through Roads Australia's LinkedIn channel, with the presentations available on the RA website.

RA will continue its commitment to progressing policy discussions on the role of hydrogen, with further webinars and roundtable discussions being considered for later in 2021

Further details will be made available on the RA website.

APPENDIX	**NO. 3**
Document	**RA Policy Insights: Convergence in Transport** (March 2022)

POLICY WEBINAR

Convergence in Transport

Thursday 10 March 2022

Aneetha de Silva
RA Vice President

Mandi Mees
RA Policy Committee

Rory Butler
Infrastructure Australia

Natasha Santha
L.E.K Consulting

Geoffrey Rutledge
ACT Government

About Roads Australia

Roads Australia (RA) is the peak body for roads within an integrated transport system, representing an industry that contributes $236 billion annually to the economy and supports 1.4 million jobs.

RA brings industry, government, and communities together to lead the evolution of Australia's roads, integrated transport and mobility.

RA's members include all of Australia's transport agencies, road owners, major contractors and consultants, material suppliers, service and technology providers, and other relevant industry groups.

RA's policy focus extends across five activity streams: Safety; Capacity; Transport Reform; Customer Experience; and Sustainability. Diversity and Inclusion is a commitment across each stream.

Background

In the lead up to our 2022 Transport Summit, RA will explore the cross-sectoral policy objectives that must be advanced to support Australia's transition to low and Zero Emission Vehicles (ZEV).

Focusing on the themes of energy, fleets and holistic government policy goals, we will hear from experts working in these fields and analyse their interconnectedness as we work towards decarbonisation.

In this first webinar our panel discussed the trends, barriers and opportunities for Australia in the transition to Zero Emission Vehicles.

Event summary

The speakers for this webinar included:

- Rory Butler, Associate Director, Policy and Research, Infrastructure Australia;

- Natasha Santha, Partner, L.E.K Consulting;

- Geoffrey Rutledge, Deputy Director-General, Environment, Water and Emissions Reduction, ACT Government.

The webinar was hosted by Aneetha de Silva, RA's Vice President, Chair of the Transport Reform Policy Stream and Managing Director, Government Australia & New Zealand at Aurecon.

RA's Deputy Chair of the Transport Reform Policy Stream and Head of Program and Partnerships at the National Transport Commission, Mandi Mees, facilitated the event.

Our future transport challenge

The need to decarbonise the transport sector is obvious given the impacts of climate change. But how to achieve this in the timeframe and at the scale required is less obvious.

In 2020 Australian transport emissions were approximately 18% of total emissions, with light vehicles (cars and light commercial vehicles) making up the majority of that. Under current policy settings, transport emissions are projected to decrease slowly as gains from an increase in zero and lower emission vehicles are balanced by increased vehicle use.

The escalating severity and frequency of natural disasters are another major catalyst for change, given their impacts on people and property.

Repairing damage from recent floods in Queensland and New South Wales to the road network alone is expected to cost in excess of $1 billion.

Despite Australia not having a national incentive for purchasing a ZEV, demand is relatively high. Natasha Santha mentioned surveys showing that 30%-40% of people would consider an EV purchase for their next new vehicle.

But she went on to spotlight the supply side issues currently impacting the sector.

As Natasha pointed out, Australia is a small market which uses right hand drive and has unique safety standards as a part of our success in bringing down the road toll. In addition, the lack of an emission reduction target in Australia means many manufacturers prefer to sell the EVs they can produce in other markets where there is a greater profit incentive.

Issues, such as the slow vehicle turnover rate – just 5% per year – also mean it will take at least 20 years to turn over Australia's passenger car fleet, even if every new car sold was a ZEV.

"So change is required now if we're going to get close to our goal of net zero by 2050."

- **Natasha Santha, L.E.K. Partners**

Transport and energy's interdependency

A "spider's web of inter-dependencies" was how IA's Rory Butler described the challenge Australia faces to decarbonise by 2050 or earlier.

Dealing with the capital-intensive nature of the transition to EVs was one of the challenges put forward. This is best addressed by achieving the right level of collaboration among a diverse group. That includes not only energy infrastructure players. It must extend to the energy retail sector, those involved with renewables, and financiers who are needed to help alleviate the upfront capex challenges.

Currently the Australian Energy Market Operator estimates that electric vehicles will consume more than 2,200 GWh in 2030, with growth in consumption of approximately 1,000 GWh per year in the years following.

Making sure that the renewable energy capacity is there to meet the demand requirements from the fleet is an obvious concern, but meeting intermittent demand spikes from EV charging is a growing concern. Rory mentioned that distribution network upgrades, without appropriate user demand response controls, could be in the tens of billions of dollars.

"If done at the wrong scale and time, ZEVs are going to be a tidal wave and not a rising tide."

- **Rory Butler, Infrastructure Australia**

Vehicle charging infrastructure, public and private, is another key interdependency.

Geoffrey Rutledge from the ACT Government has been overseeing not only the ACT Government's fleet change over to hydrogen and battery electric vehicles, but also the development of a public recharging strategy for the ACT. These are some of the attributes that make the ACT arguably Australia's leading jurisdiction on ZEVs. This practical experience has taught him many lessons with a major one to be concerned more about buying chargers than buying vehicles.

"If I knew what I know now three years ago, I would have stopped worrying about buying cars and started worrying about buying chargers".

- **Geoffrey Rutledge, ACT Government**

Delivering an equitable transition is also important, with affordable energy distribution for all. Gaps could easily eventuate between urban centres and regional and remote areas or between those who will not have ready access to charge at home and will rely on charging at public facilities.

Building standards and land use planning

Geoffrey came to recognise that running a fleet day-to-day would also require retro-fitting buildings and upgrading switchboards. It revealed the value of smaller bus depots (with less need for power network augmentation).

Meanwhile the ACT has already installed 125 fast chargers – and this will grow to 350 by the end of June.

Geoffrey said his experience had reinforced the value of having standards, certifications, and good access to skilled engineers.

There is also growing realisation that land use planning considerations are important when seeking to accommodate charging infrastructure.

Workforce skills and capabilities

The need for such new skills is across many areas. One example is to craft new business models. Geoffrey described how the ACT is looking to develop new workforce skills that address the underlying commercial and legal processes needed to support the transition. As such skills grow, it helps the ACT adopt things such as four- year lease cycles. Geoffrey said the ability to negotiate such terms enable it to buy more expensive upfront EVs, with the maintenance and fuel costs offset over a longer period.

“Whether they're buying transport trucks or plant equipment, both Governments and corporations need to think about new business models," Rory said. Managers like Geoffrey have entered an era of new contracting, “because we're buying something quite different”.

New expertise will also be needed to ensure updated building codes capable of accommodating the greater electrical load can be handled effectively and safely.

There will also need to be new skills capable of tasks such as creating nationally consistent technical standards for ZEV buses.

Road pricing

To accompany such practical measures, Rory said IA also has a variety of reforms relating to road user pricing. The data these generate will help ensure the right sequence of infrastructure delivery measures and public transport initiatives.

Rory explained that tariffs will be a key driver of energy demand. They will influence when, where and how electric vehicle drivers will charge. The extent of the uptake of automation will also be a key factor.

Geoffrey said smart devices talking to each other will be another key part of the challenge. Measures will be needed to ensure motorists still feel they (rather than an energy retailer) are in control over things like bidirectional EV charging.

Rory called for conversations about distribution grid upgrade costs in urban and regional settings, and who would have to pay for them. The panel agreed that a fair approach must be taken.

It was noted that those with access to home charging are in a luckier position than those needing more expensive public charging facilities. IA's 2021 Infrastructure Plan underpins this by advocating adoption of the quadruple bottom line, introducing smart electricity tariffs that support EVs, and making

appropriate cost allocation for fair and equitable grid upgrades.

On the EV price tag itself, Natasha said a 15-20% reduction was needed to really move the needle on demand. However, levers such as stamp duty or various penalties could be used to bring down the EV price. And these could drive uptake and help achieve greater equity of access to EVs as well.

The panel also considered the challenge of finding financially sustainable measures that can be phased out as EV demand picks up.

They agreed different settings for each state and territory must be avoided. Those different settings could extend across areas such as the role of road user charging and how society will pay for the incentives to drive demand.

Rory observed national coordination was also needed between the Government's current policy patchwork and its technology approaches to reducing emissions such as in its Future Fuels and Vehicles Strategy.

Wholesale government policy

Against the backdrop of this need for national coordination, Natasha pointed to a number of other dilemmas for policy makers: Do we go down the same path as Norway and start disincentivizing the purchase of internal combustion engine vehicles? Do we consider ICE bans? And can we benefit from this transition from an economic development perspective?

As society debates such policy choices, there will need to be appropriate community engagement to ensure benefits are realised. Without that, it is possible that the community's generally falling levels of trust in institutions may lead to resistance to EV charging infrastructure being installed. As suggested by overseas experience, lack of trust can make consumers wary about aspects of their new role as electricity producers who feed energy back into the grid.

For the public to accept and take up such opportunities, the electricity operators will need to develop better grid integration tech through cross-industry collaboration. Government will need to regulate against assets becoming unduly gold-plated.

Parting thoughts:

Aneetha described the ACT as a “living laboratory for the nation” on EVs, one that beautifully combines policy and design debate with implementation tensions and opportunities. She concluded the webinar saying Australia is “running out of alibis” to not accelerate the transition to low emission vehicles.

Aneetha said Australia needs to “step up to the mark and start courageously looking at a national framework that will be an enabler”. And she said RA can additionally support some of the areas the Webinar had touched on in passing - such as the new skills and capabilities that would be needed for development of the necessary infrastructure, particularly for charging and evolving the Hydrogen economy.

In conclusion, Aneetha noted that analysing and drawing insights about the future of transport from such trends is the goal of this webinar series. “Bringing incredible insights, both at a policy and implementation level, was the aspiration for this kick-off,” Aneetha said. “It was getting our membership starting to think about future transport…in particular, the sort of pressures associated with the decarbonisation challenge.”

Event outputs & next steps

An overview of the Convergence in Transport event and the broad themes addressed by each speaker was circulated via RA’s LinkedIn feed.

This was the first in a series of webinars on the transition to Zero Emission Vehicles held by RA. Follow up webinars will focus on the issues in energy and fleet.

APPENDIX	**NO. 4**
Document	**RA Policy Insights: Convergence in Transport – Energy** (March 2022)

POLICY WEBINAR

Convergence in Transport - Energy

Tuesday 29 March 2022

Aneetha de Silva
RA Vice President

Mandi Mees
RA Policy Committee

Jonothan Clarke
Ausgrid

Carola Jonas
Everty

Sandra Lau
Viva Energy

Cameron O'Reilly
Marsden Jacobs Associates

About Roads Australia

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RA's policy focus extends across five activity streams: Safety; Capacity; Transport Reform; Customer Experience; and Sustainability. Diversity and Inclusion is a commitment across each stream.

Background

This RA Policy Insights is the second in a series of webinars on the convergence of transport, energy and technology supporting the transition to Zero Emission Vehicles (ZEVs).

Following our first webinar on the topic, this webinar has focussed on the energy sector.

In this webinar, panellists looked at what the transport and energy sectors need to do to successfully achieve transport's decarbonisation and meet Australia's net-zero goals?

Event summary

The speakers for this webinar included:

Jonothan Clarke, Customer Manager, Ausgrid

Carola Jonas, Chief Executive Officer, Everty

Sandra Lau, Alternative Fuels Manager, Viva Energy and Director, Australian Hydrogen Council

Cameron O'Reilly, Associate Director, Marsden Jacob Associates

The webinar was hosted by Aneetha de Silva, RA's Vice President, Chair of the Transport Reform Policy Stream and Managing Director, Government Australia & New Zealand at Aurecon.

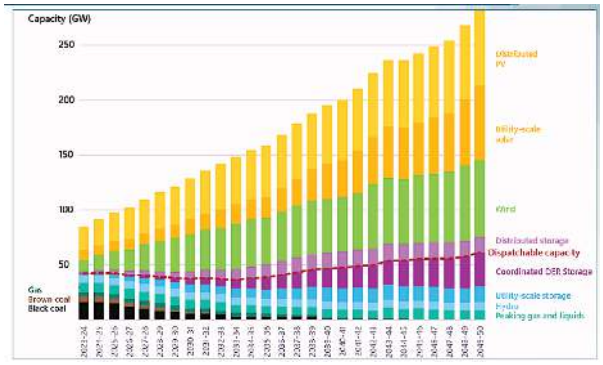
RA's Deputy Chair of the Transport Reform Policy Stream and Head of Program and Partnerships at the National Transport Commission, Mandi Mees, facilitated the event.

Future energy supply and demand

Jonothan Clarke commenced the discussion by detailing the deep change the energy industry is undergoing. There are shifts happening in how Australia's energy is sourced and supplies customer demands. Historically, energy has been provided through centralised power stations operating with relatively static and predictable supply demands. With the development and implementation of new technology and renewable energy, the generation mix is shifting towards intermittent and distributed energy sources with flexible supply demands.

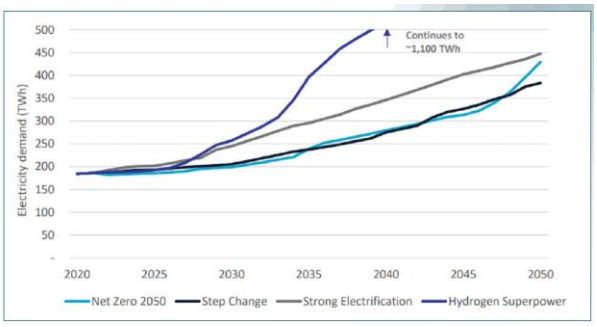
This is accompanied by increasing network demand, as more appliances are being electrified on the pathway to decarbonisation.

Cameron O'Reilly suggested that balancing the system will be far more challenging for market operators in future. Cameron referred to the supply side challenge for Australian electricity as being "unprecedented."



National Electricity Market Supply changes to 2050 – *Source: ISP Draft 2022*

Using information generated by the Australian Energy Market Operator for the 2022 Integrated System Plan Cameron discussed concerns including the reliability of generation and the dispatchable capacity as well as the increasing demand requirements, including the impact from transport electrification.



National Electricity Market demand changes to 2050 – *Source: CSIRO Multi Sector Modelling for AMEO 2021*

Carola Jonas reminded the audience that new technology needs infrastructure upgrades. Carola used a fitting example of the evolution of the internet. It was as recently as the 1990s that dial up internet was widespread and couldn't function at the same time as a landline. That was only 30 years ago and now we have the NBN and satellites for highspeed internet connections.

The transition we saw in internet could not have happened without effective infrastructure planning. Infrastructure plays a large part in people's everyday lives and the transition to EVs will not change that, so we need to plan accordingly.

Electricity from renewable sources will be a large portion of a decarbonised energy grid, but it is not the sole energy source in the grid of the future to expedite decarbonisation in the transport sector.

Sandra Lau talked through the benefits of hydrogen as a fuel in transport. Hydrogen as a more energy dense fuel results in freight vehicles being able to transport bigger payloads as compared to battery electric.

The business model for the use of many large trucks and other freight vehicles requires them to be on the road for many hours per day, necessitating short refuelling times to reduce downtime.

Hydrogen powered vehicles allow for similar refuelling patterns, still taking only 15-20 minutes to refuel.

Cameron agreed with the opportunities Australia has in the hydrogen economy. There is significant global investment in hydrogen and Australia is rich with resources for its production. Australia has the potential to become a large supplier.

Viva's recent announcement of undertaking Australia's most ambitious hydrogen project to date was highlighted by Sandra. This project aims to refuel commercial vehicles back to base with green hydrogen generated on site in a project in Geelong. This will also allow Viva to work with its partners to improve their understanding of how best to transition vehicle fleets.

A totally renewable energy system along with a strong hydrogen industry brings our transport and other fuel reliance completely onshore, reducing our vulnerability to movements in overseas markets and could create a significant new energy export market.

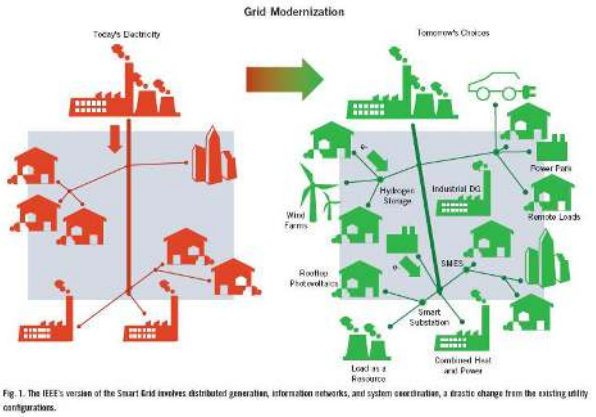


Fig. 1. The IEEE's version of the Smart Grid involves distributed generation, information networks, and system coordination, a drastic change from the existing utility configurations.

"There's been a lot of discussion over the years about a smart grid. But if ever, we needed a smart grid, it's now."

- **Cameron O'Reilly, Marsden Jacob**

Customer behaviour

Customers and their behaviour around charging will ultimately determine the transition of the energy grid to support EVs.

Jonothan gave an insightful overview of how much transport and energy affect average Australian household costs. Based on external research into households in NSW, Ausgrid stated that a typical household will spend $4,922 per year on their energy demands. That cost is 33% on electricity - while 60% of household energy spend is on petrol and diesel.

"So, when we look at it in terms of the total lifecycle cost of electric vehicles, they look quite promising now ".

- **Jonothan Clarke, Ausgrid**

Charging behaviour can have a large impact on the ultimate design of the energy grid. Private vehicles are on average stationary for 95% of the day giving ample opportunities for EV owners to make the most out of slow charging at home or work.

Research from the Boston Consulting Group outlined by Carola forecasts that of the public charging infrastructure expected in Europe, 90% will be at homes and businesses and more than 70% of public chargers will be slow charge at destinations where cars are parked for multiple hours.

Influencing and aiding customers to make choices that benefit themselves and the grid could help reduce the infrastructure investments required to the energy grid. Emerging technology is already investigating this through an increased use of smart charging.

Internationally the Netherlands is targeting 70% smart chargers and the UK has mandated that new building chargers must be capable of enabling new kinds of smart charging models.

Bi-directional charging using smart chargers would allow the energy stored in a vehicle (bought by EV owners at times of low cost) to support the grid (or their homes) at peak periods when energy costs are higher.

Carola also supplied a thought experiment using the energy demands of the Sydney Opera House as how this could also work away from the home.

Of the 1200 parking spots under the Opera House, the energy demands for a performance can be met using energy supplied by just one quarter of these vehicles using bi-directional charging. Those who are part of a smart charging scheme could potentially charge their battery during the day when energy prices were at their lowest and be paid to supply a portion of that charge to allow them to attend an event at the Opera House.

Trialling different customer behaviour incentives is already underway in Australia.

Jonothan discussed Ausgrid's *"Dynamic Connections and Pricing Innovation"* that will allow new capabilities to help manage increasingly two-way energy flows. An example is sending signals to shape EV charging, dialling up or down usage where there is network capacity available or capacity shortfall. An indirect benefit from this is that it does not necessarily require expansion of the amount of network infrastructure.

Ausgrid is also conducting community battery trials. These place an energy storage facility on the network close to customers so they can deposit and withdraw energy from this shared battery solution. Ausgrid also partners with Jolt to offer electric vehicle recharging facilities. The first seven kilowatt hours - about 45 kilometres of range - are free and sourced from green energy.

"A key change in Ausgrid's new approach is to be more customer focused, working more in collaboration with customers and partners."

- **Jonothan Clarke, Ausgrid**

Collaboration and partnership, with private and corporate customers and across sectors, is essential to the transition. Sandra explained that successful energy partnering requires a different approach with more transparency, equal risk appetite and acknowledgement of what everyone is trying to achieve to ensure aligned goals.

Such principles enable the required new partnerships and experimentations that can accelerate Australia's target electrification, using viable underlying models that are sufficiently sensitive to marketplace pricing signals.

This transparent approach is also required as there is an upfront cost of shifting away from mature industries with markets that have evolved over decades. Being aware of this and understanding the goal is important from the start.

"On a commercial basis, I think the transport sector has to recognise that new technologies do cost a bit more...and that there could also be an operational risk element there as well."

- **Sandra Lau, Viva Energy**

Harmonisation

The decarbonisation of energy and transport sectors is a complex challenge and needs to occur simultaneously in order to gain the best outcomes.

A harmonised, national approach will allow for the creation of overarching regulations and will ease the challenges caused by the transition.

Carola pointed out the fuel excise, and the way that states are considering the implementation of electric vehicle road user charging, as an example of an inefficient policy which should be transformed to a broad, nationally harmonised road user charging system.

"Fuel excise is a federal tax and now individual states (VIC) introduce state-based road user charges where you pay tax to a state regardless of where in the country you drive your car: that approach makes no sense to me."

- Carola Jonas, Everty

A further consideration for the transition is ensuring no one is left behind. There is a role for government to make sure it is an equitable transition. If left solely to the private market, the more heavily trafficked metropolitan areas will be prioritised for new infrastructure, neglecting regional and rural Australians and strongly demonstrating that decarbonisation is also a matter of equity.

The panel agreed governments need to recognise that the EV charging infrastructure and bringing EVs into that charging system should really be their priority, but that more work could be undertaken to incentivise the supply of cleaner cars, such as emission standards.

Parting Thoughts

Moving away from the mature and complex energy system currently in place will require collaboration of effort to reduce the costs and the risks of unexpected negative outcomes.

The decarbonisation of the transport industry is an unprecedented challenge that interconnects with the energy sector – with the challenge being how to achieve both simultaneously.

This challenge also comes with enormous opportunity. The creation and maintenance of partnerships between industries will allow these opportunities to be taken advantage of so we can all continue the journey towards net-zero together.

"I loved how there was a lot of discussion around those opportunities, with both reflection on the need for different business models, as well as new approaches that are national, transparent and collaborative.

"These are words that we at Roads Australia use a lot in our own world. It's heartening to see that when you bring energy and transport together, the same principles and behaviours are what is going to lead us to success, or something less than that."

Aneetha de Silva, Vice President, RA

Event outputs & next steps

An overview of the Convergence in Transport event and the broad themes addressed by each speaker was circulated via RA's LinkedIn feed.

This was the second in a series of four webinars on the transition to Zero Emission Vehicles held by RA in the lead up to the 2022 Transport Summit in Melbourne on 19-20 May.

APPENDIX	**NO. 5**
Document	**RA Policy Insights: Convergence in Transport – Fleet** (April 2022)

POLICY WEBINAR

Convergence in Transport - Fleet

Tuesday 19 April 2022

Mandi Mees
RA Policy Committee

Natalie Hanna
Acciona

John Edgley
Hyzon Motors

Adam Begg
Kinetic

Geoffrey Rutledge
ACT Government

About Roads Australia

Roads Australia (RA) is the peak body for roads within an integrated transport system, representing an industry that contributes $236 billion annually to the economy and supports 1.4 million jobs.

RA brings industry, government, and communities together to lead the evolution of Australia's roads, integrated transport and mobility.

Roads Australia's members include all of Australia's transport agencies, road owners, major contractors and consultants, material suppliers, service and technology providers, and other relevant industry groups.

RA's policy focus extends across five activity streams: Safety; Capacity; Transport Reform; Customer Experience; and Sustainability. Diversity and Inclusion is a commitment across each stream.

Background

This RA Policy Insight is the third from a series of webinars on the convergence of transport, energy and technology supporting the transition to Zero Emission Vehicles (ZEVs).

The two previous webinars looked at the overarching issues and opportunities and the simultaneous efforts required from the energy and transport sector in order to meet Australia's net-zero goals.

This webinar included panellists discussing the issues in the supply, purchase and use of zero emission fleet vehicles, light and heavy.

Event summary

The speakers at this webinar were:

Natalie Hanna – Senior Advisor Business Development, Acciona

John Edgley – Managing Director ANZ, Hyzon Motors

Adam Begg – co-CEO, Kinetic; and

Geoffrey Rutledge – Deputy Director General, Environment, Water and Emissions Reduction at the ACT Government

The webinar was hosted by RA's CEO, Michael Kilgariff, and RA's Deputy Chair of the Transport Reform Policy Stream and Head of Program and Partnerships at the National Transport Commission, Mandi Mees, facilitated the event.

Why fleets?

Fleet buyers have a very large impact on the ZEV market and on Australia's transport emissions.

According to the Australian Bureau of Statistics, more than half the kilometres travelled by vehicles in Australia are for business purposes or to travel to and from work. Government, rental and business fleets also make up almost half of all new vehicles purchased in Australia.

With ZEVs nearing, and in some cases equalling or surpassing, the total cost of ownership of fossil fuel powered vehicles, companies seeking to achieve their ESG goals are also looking for lower carbon options for their fleets.

With the scale of their purchasing, and with light vehicles generally rolled over after 3 to 4 years, fleet purchasing of ZEVs also boosts inventory for the future second hand market.

The ACT Government has assembled a passenger fleet of 78 BEVs, 82 Plug-In Hybrids, 161 Hybrids and 29 hydrogen Fuel Cell vehicles. **Geoffrey Rutledge** said the ACT's passenger fleet changeover to zero emission fuels shows leadership, helps get charging infrastructure built, reduces petrol costs and reduces emissions.

"We're showing our community that an electric future is actually electric reality."

Geoffrey Rutledge, ACT Government

Large fleet purchases can also change the type of mobility options to meet modern needs. **Natalie Hanna** outlined Acciona's global efforts to introduce 12,000 e-scooters in Spain and Italy and the development of relatively more affordable 2-seater "Silence" EVs.

Making the transition to electric is also seen to be the right thing to do for the world's climate and for its communities.

"We recognise that achieving about 80% of the UN Sustainable Development Goals ...can be [done] through good infrastructure...that is people and planet positive. And that's what we mean by sustainable infrastructure."

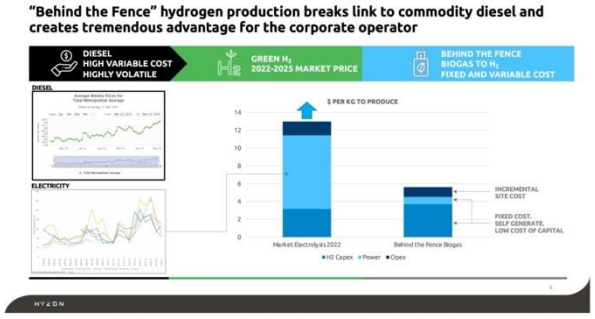
- Natalie Hanna, Acciona

Adam Begg from Kinetic explained that is the key reason why Kinetic will not submit a tender price without a zero emission option, even if one is not requested.

At the same time, Kinetic is also aware of an underlying logic justifying transition to EVs. Up to 70% of its routes can be serviced by the range available from its battery electric buses today.

For heavy vehicle fleet operators, recent instability on fuel prices and necessary additive products like AdBlue, used to reduce emissions from diesel powered vehicles, brings out the case for self-control of their energy supply, such as hydrogen.

John Edgley outlined the business case for back-to-base logistics operations supported by behind the fence hydrogen generation.



John noted some early adopters of hydrogen have made the transition based on their own firm belief that hydrogen is the future for zero emissions for heavy duty applications.

There is also a strong underlying logic to this decision with benefits becoming particularly clear at the scale of 10-20 vehicles.

Hyzon is showing operators a pathway to a decarbonised fleet. This happens as they move towards using more green power to produce hydrogen sourced from large scale renewables being developed and/or through local solar at their premises.

Knowing your fleet needs

Improved data collection could reveal paths to greater efficiency and overcome perceived fleet problems. Natalie said data insights are helping Acciona realise where 4x4s, which are currently difficult to obtain in a zero emission format, were not actually essential and where a smaller Toyota RAV4 hybrid could be substituted.

With modern vehicles becoming moving computers, John pointed out how vehicle telematics can further help complete a picture of user needs.

Data flows are already helping operators with diagnostics, insurance underwriting and driver comfort. But he said with hydrogen vehicles in particular, telematics can contribute to fuelling infrastructure decisions.

"...whether it's EV battery electric vehicle charging, whether it's hydrogen and that generation, power strategy is absolutely key to being able to make sure that you can develop and function on sites for large scale fleets."

- **John Edgley, Hyzon Motors**

For instance, data collected for regular runs – such as between Sydney and Melbourne – have shown the need for only two large refuelling stations, each about 250 kilometres inland from Sydney and Melbourne. That not only provides a repeatable and secure pattern for hydrogen prime movers delivering goods between Australia's two largest cities, but it also means that it can be achieved with minimal capital expenditure and without the complexity of building hydrogen refuelling stations everywhere along the Hume Highway.

Geoffrey also pointed to how a small change in the economic case in fleet vehicles has underpinned the ACT's transition. By shifting their lease cycle from three to four years, the lower fuel and maintenance costs of ZEVs means that they achieve total cost parity with existing fossil fuel powered vehicles.

Geoffrey said the ACT had learned about the magnitude of power draw from its testing of various kinds of electric vehicles. Its fleet includes tipper and garbage trucks.

Understanding how fleet vehicles use available energy has been important. In the case of the ACT, their new plug-in hybrid fire truck uses batteries for propulsion, but still needs fossil fuels to provide energy for other functions on the vehicle.

Hydrogen powered vehicles being developed by Hyzon, such as their new garbage trucks, also need to consider the total energy needs for the vehicle to still fulfill its role.

Realising how much energy the air conditioners in buses needed has meant that Kinetic has installed solar shades to keep vehicles cool at their depots and reduce their energy demands when leaving.

Preparing for unknown unknowns

The panellists agreed that moving away from a mature fossil fuel system had presented a variety of unexpected challenges.

On the hydrogen front, Adam pointed out that servicing hydrogen assets required a specialised facility that takes into account hydrogen's dangers as a volatile commodity. For example, he said it may be necessary to decide whether a separate workshop is needed that is separated from diesel-based workshops where sparks are a risk.

Asking users of fleet cars to charge them at home raises similar payment and tax questions to those related to working from home.

Sharing information gathered through the ACT Government's fleet journey is a way to help others cope with many of the unexpected challenges that arise.

To assist others on their journey to reduce their own transport emissions, Geoffrey is passionate about sharing the lessons the ACT Government has encountered and overcome.

"We think by offering this level of expertise and fleet advice, we might be able to help them be more focused on their service delivery, with less need for focus on back end functions,"

- **Geoffrey Rutledge, ACT Government**

The panellists also agreed that new fleets engendered a pressing need to find staff with new skills and training.

Natalie said Acciona was very aware of the need to transition skills amongst its diesel mechanics, and that this needed to be managed in a coordinated and sensitive way.

Within a period of a year, Kinetic has needed to review the contracts it uses to attract mechanics including a significant increase in remuneration.

Adam said he hoped Kinetic's reputation as a leader in moving to zero emissions would attract mechanics to the business, along with its investment in upskilling its people.

"Kinetic faces a huge labour supply challenge. It's not far off being a crisis."

- **Adam Begg, Kinetic**

Vehicle energy demands: infrastructure

As an owner of an EV, Natalie explained her experience in charging her vehicle. Using an app on her phone, Natalie can program charging for off-peak times at home, which is not only providing sufficient energy for her daily use but does so at the lowest possible cost.

For the ACT's EV fleet, Geoffrey found that even merely knowing the electrical capacity of each of its buildings was a challenge. In supporting the ACT's fleet, they have had to install large amounts of extra capacity, working with both the building owner/landlord and the energy network operators.

Shared premises can be a particular problem requiring the additional need to deal with individual metering (similar to the challenge faced by people living in apartments).

Meanwhile Kinetic has grappled with the challenge of getting power companies to come along on their transition journey. Kinetic had found it took 12 to 18 months to get power connections upgraded to its immediate requirements. That has proved a much greater challenge than the supply of zero emission buses.

Adam said depot upgrades for 10 buses cost about three quarters of a million dollars even before adding additional infrastructure.

Adam also raised the possibility of dual-direction charging at bus depots as an additional community benefit.

The large amount of energy that can be stored in the battery banks of zero emission buses could act as an additional source to supply neighbourhoods in times of need.

"What we've learnt through the early days of transition to zero emission buses, is we just don't see it as a revolution."

- Adam Begg, Kinetic

Geoffrey said finding an Australian standards-compliant, vehicle-to-grid charger had been particularly difficult. But he said the ACT is now replacing its single direction chargers with dual chargers.

John discussed the development of hydrogen communities as a means to help make the transition to a hydrogen economy.

Biogas, an environmentally damaging by-product from many landfill sites, is now a cost-effective way to produce hydrogen. Clustering operators together around a facility based on using biogas for hydrogen production could help the transition to a hydrogen economy.

Parting Thoughts

Mandi concluded the event, noting the value of hearing about actual experience of panellists from such organisations.

Hearing from people who are actively and successfully working in the transition can only lead to more people and companies joining in and helping to accelerate the transition.

Event outputs & next steps

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