Submission No 22

INFRASTRUCTURE FOR ELECTRIC AND ALTERNATIVE ENERGY SOURCE VEHICLES IN NSW

Organisation: RACE for 2030 CRC

Date Received: 30 April 2025

30th April 2024

Committee Manager
Legislative Assembly Committee on Transport and Infrastructure
6 Macquarie St
Sydney NSW 2000

transportinfrastructure@parliament.nsw.gov.au

Dear Committee Manager,

The Reliable Affordable Clean Energy (RACE) for 2030 Cooperative Research Centre submits the following document to the Legislative Assembly Committee on Transport and Infrastructure's inquiry into existing and future infrastructure needed to support electric and alternative energy source vehicles across New South Wales.

The Cooperative Research Centres (CRC) Program is an Australian Government initiative established to fund industry-led collaborations between industry, researchers and end users. RACE is a cooperative research centre for the energy and carbon transformation and is an industry-led research collaborative established in 2020 to drive energy innovation across the supply chain to deliver improved, lower cost and lower emission energy services for energy customers. Projects with RACE leverage industry funding to develop innovative research alongside the best researchers in Australia.

RACE represents a $68.5M investment by government and will deploy $350M of resources into research innovation by 2030. RACE has developed numerous research projects on the transition to electric vehicles since its formation in 2020. Relevant recommendations from project reports against the terms of reference provided by the Committee on Transport and Infrastructure have been outlined and a further summary of these completed projects related to the inquiry's terms of reference is provided in Appendix A.

The transition to electric vehicles is fundamental to achieving national and global emissions reduction goals. This transition has the potential to create a wide range of benefits for Australia if managed well, navigating the associated challenges and risks while optimising the benefits requires ongoing cooperation and collaboration between industry, research and end users. The RACE for 2030 CRC thanks the Committee on Transport and Infrastructure for the invitation to this inquiry and welcomes the opportunity to provide a submission to this inquiry into infrastructure for electric and alternative energy source vehicles in NSW.

Best regards,
Oliver Hill
Program Leader, RACE for Electric Vehicles (EVs)
[redacted]

Reliable Affordable Clean Energy for 2030 CRC
C/- Institute of Sustainable Futures, UTS
Level 10, Building 10, 235 Jones Street ULTIMO NSW 2007

Australian Government
Department of Industry, Science, Energy and Resources
AusIndustry
Cooperative Research Centres Program

The RACE for 2030 CRC submits the following response to Legislative Assembly Committee on Transport and Infrastructure's inquiry into existing and future infrastructure needed to support electric and alternative energy source vehicles across New South Wales.

This response is separated into two sections. The first is intended as a plain language executive summary of technical recommendations that have been sourced from RACE funded research projects relevant to the inquiry's terms of reference. The summary outlines seven key findings from each subject matter area and provides a perspective on the policy implications of this research. The second section is more technical in nature and provides direct excerpts from RACE projects. Where appropriate, background information and context has been provided to explain relevance to the inquiries subject matter without changing the intent or nature of research project recommendations.

Links to all RACE for 2030 CRC projects referenced are provided in Appendix A.

SECTION 1: EXECUTIVE SUMMARY OF RACE FUNDED RESEARCH PROJECTS RELEVANT TO THE INQUIRY INTO INFRASTRUCTURE FOR ELECTRIC AND ALTERNATIVE ENERGY SOURCE VEHICLES IN NSW.

1. Bidirectional Charging Has Clear Economic Benefits
Vehicle-to-grid (V2G) technology could reduce energy system costs by billions of dollars, especially when powered by home or onsite solar. However, upfront hardware costs and limited vehicle options are current barriers.

Policy implication: NSW should incentivise early adoption of EVs and V2G, while ensuring planning rules allow for and/or encourage both home and commercial V2G installations.

2. Better Infrastructure Planning Requires Better Data Visibility
A national approach is needed to map, plan, and monitor EV charging infrastructure. Without this, planners risk misallocating investment and developing an inefficient charging network

Policy implication: NSW should support and contribute to the development of state based and national tools that can guide an equitable and efficient charging rollout for all stakeholders.

3. Smarter Use of the Existing Grid Can Delay Expensive Upgrades
Research shows that by better understanding how low voltage electrical transformers heat up during short bursts of EV fast charging, more chargers could be safely connected without costly network upgrades.

Background context: A distribution transformer steps down the high voltage from a transmission line to a lower, safer voltage suitable for homes, businesses, and other end-users. It's a critical part of the electrical power distribution system, converting the high-voltage electricity into the lower-voltage electricity needed for daily use.

Policy implication: NSW should support further demonstration of this research to establish reference sites for performance over longer timeframes and explore how early findings could inform updated technical operating procedures for networks.

4. Bi-directional Charging for Trucks is Promising but Needs Demonstration
Heavy vehicles, especially buses and rigid trucks, are well-suited to V2G. Demonstration projects can help confirm benefits and make the business case clearer for procurement and fleet managers.

Policy implication: NSW should fund pilots for commercial fleets to explore high-value V2G applications and inform future freight decarbonisation policy.

5. Workforce Planning is Critical and Currently Lacking
There's a growing need for electricians and related trades for EV charger installation and maintenance, especially for fast chargers. Skills shortages could delay rollout.

Policy implication: NSW should invest in workforce planning and training tailored to the EV infrastructure sector, particularly outside metropolitan areas.

6. Hosting Capacity of the Grid is a Bottleneck
As more EVs connect existing electricity networks may become overloaded. Advanced smart charging management and flexible services arrangements can help, but they need demonstration and investment to minimise risk to providers. There are also issues of trust among consumers towards dynamic connection agreements.

Policy implication: NSW should work with networks to build trust in demonstration of dynamic connection agreements and smart charging management. Where there is future predicted growth, but capacity is yet to hit full constraint, novel network capacity management solutions could be explored without putting users at risk.

7. Equity Needs to Be Front and Centre
People in remote areas, renters, and lower-income households face more barriers to EV adoption. Without action, the benefits of the transition may be unevenly distributed.

Policy implication: NSW should design programs and incentives that ensure all communities—especially those historically underserved—can access EV infrastructure. Existing and new policies could be designed with underserved demographics to ensure applicability and encourage uptake.

SECTION 2: RACE TECHNICAL FINDINGS RELEVANT TO THE INQUIRY INTO INFRASTRUCTURE FOR ELECTRIC AND ALTERNATIVE ENERGY SOURCE VEHICLES IN NSW.

Inquiry item a) funding and location of electric vehicle chargers or infrastructure for other potential energy fuel sources

RACE Project: Maximising electric vehicle fast charging by improved thermal management of distribution transformers - 2025

This project led by the University of NSW and Essential Energy investigated the potential for greater numbers of fast EV charging infrastructure to be connected to the existing distribution network without transformer capacity upgrades or replacements being required.

The uptake of electric vehicles and fast charging facilities across Australia will present challenges and benefits to the distribution network. This requires significant investment in upgrading or installing electrical transformers to supply the growing demand of EV chargers.

One way of deferring some of the necessary investments in new network capacity is to unlock existing under-utilised capacity. A complex challenge is understanding the impact on transformer performance, particularly understanding the impacts on the thermal envelope that transformer windings will need to tolerate.

The first part of this study demonstrates through numerical modelling, informed by practical experimental heat run tests, the potential to use thermal transformer capacity when considering short duration EV charging profiles that consist of highly peaked loads.

The planned outcome of the second part of this project is the demonstration and verification of an anticipated increase in transformer capacity by correlating the thermal models with thermal measurements when delivering the peak loads required by fast EV charging. Such evidence will permit more EV chargers to connect to Essential Energy's network, and similarly for other Distribution Network Service Providers (DNSPs) whose distribution network characteristics are comparable, before assets are replaced or new assets installed. The business benefit is reduced expenditure on new plant and upgrades.

This report goes some way to demonstrating the additional capacity available. A caveat is that many of the simulated scenarios in this report are specific and numerical hence the outcomes cannot be generalised. The location, the local network and the predicted charging profiles (the charger and the customer requirements) all have an impact on the additional capacity.

These numerical methods of determining improvements in particular scenarios provide confidence that significant overloading of the windings can take place. This report also presents a control strategy to regulate the interaction between the electric vehicle, the charger, and the transformer hotspot temperature. The range of potential instrumentation options are also articulated where each option provides improved control over the hot-spot temperature at the cost of embedding more sensors in the oil tank.

These options nevertheless provide an opportunity to consider the balance customer expectations of fast charging with operational loading on transformers if the economic benefit of the improved control is positive when accounting for the cost of instrumentation.

RACE Project: National Roadmap for Bidirectional EV Charging in Australia – 2025

This project has findings relevant to decision making when considering investment in either DC and/or AC bidirectional charging infrastructure (DC – direct current, AC – alternative current)

Automakers and Consumer Energy Resource (CER) installers consider the high cost of DC bidirectional Electric Vehicle Supply Equipment (EVSE) will present a barrier to mainstream uptake in the near-term as markets for these products do not yet support scale production. While

residential DC EVSE products may currently (where available) cost in the order of A$8,000 to A$12,000 initially (installed), the consensus among stakeholders was that this could drop to below A$5,000 by 2030 reflecting a target Bill of Materials (BoM) cost of approximately USD$500-550. The cost is less if you consider the A$1500 to A$2500 cost of installing a unidirectional wall box charger as the baseline (the cost of bidirectional charging can be considered an incremental increase). In addition to creating opportunities to consolidate revenue, the relatively high installed cost of DC EVSE is understood to be part of the reason why Renault and Nissan are planning mainstream products based on AC V2G configurations.

One of the key advantages of AC bidirectional charging is the ability to leverage vehicle scale-production to drive down unit costs. Installation costs and complexity are also reduced to achieve those similar to a conventional AC wall box. It is stressed that some unique technical challenges exist in developing suitable, scale-production of bidirectional on-board chargers (OBC). For example, volumetric and thermal performance envelopes are more stringent than for outboard (external to vehicle) power conversion and product life is expected to be consistent with engineered vehicle life (e.g., 20 years). Whilst these challenges exceed those of typical DC V2G solutions, it is noted that vehicle Original Equipment Manufacturers (OEMs) may leverage cost savings in other vehicle systems to present consumers with a net marginal cost that is more favourable than for DC V2G.

There is also a strong engineering design case for combining power conversion from solar, stationary batteries and DC charging in a single unit and this would greatly reduce the marginal cost of bidirectional charging for many customers. This may be most relevant to 'greenfield' installations or for customers looking to replace existing inverter technologies at their premises. DC bidirectional charging can be more efficient when recharging from a local DC power source such as solar PV. This can reduce power conversion losses by 20% (e.g. a fifth of 8% losses currently seen in DC to AC conversion) or more as the electricity does not need to be converted to AC then back to DC again before it reached the vehicle's battery

When considering infrastructure investment, it is also critical to ask what the long-term national economic value of enabling bidirectional charging to Australia is.

enX and Endgame Economics modelled the potential long-term value of V2G in the National Electricity Market (NEM) under a range of scenarios. Results from this analysis are reported in a separate report that was provided to codesign workshop participants: National V2G Roadmap Market Modelling Report (see Appendix A). The modelling assumptions were intended to strike a balance of potentially optimistic and conservative biases to produce credible results, with an overall conservative bias. For example, in the most optimistic case, the rate of V2G uptake is less than half that already achieved for rooftop solar by Australian households to date. We also only modelled residential uptake and so other transport sectors may add significant upside benefits (for instance it is well acknowledged that charging for trucks is promising but needs demonstration). Correcting for these conservative assumptions could more than double the estimated benefits.

The key findings of this analysis include:

- In a future high renewable penetration world, V2G can reduce firming needs from grid connected generation and storage assets. This will provide a wholesale market benefit by reducing the associated investment and operation costs.

- The rate of V2G uptake has a large impact on the V2G benefit. The wholesale market benefit is between $0.7bn to $1.2bn in the slow uptake scenario and is between $1.7bn to $2.7bn in the fast uptake scenario.

- V2G operating according to market signals provide greater wholesale benefit than batteries with ToU tariff-responsive behaviour. This benefit could be further increased by enabling more daylight-hour charging.

- V2G operation can also contribute to reduced distribution network costs by reducing local peak demand. We estimate the associated cost savings are between $0.6bn and $2.4bn with fast uptake and between $0.3bn and $1bn with slow uptake.

- A NEM-wide aggregate installation cost premium was calculated at $1.25 billion and $580 million for the fast uptake and slow uptake scenarios, respectively. This analysis produces a positive total system NPV across scenarios ranging from $2.96 billion to $740 million.

- In all scenarios, V2G produced positive net benefits. In economic terms, this analysis indicates that supporting a faster uptake of bidirectional charging is likely to be a no regrets activity, and there is a total net benefits pool of up to $2.96 billion that could be used to incentivise uptake (through electricity pricing or complementary incentives).

RACE Project: My V2X EV: Informing strategic electric vehicle integration – 2023

These projects findings are relevant to wow bidirectional/V2G charging infrastructure may impact distribution network hosting capacity.

There is a lack of V2G-capable charging infrastructure. Potential V2G services such as frequency regulation require sufficient numbers of charging stations and EVSE equipped with bi-directional chargers. Enough charging hardware is essential for engaging active players. Currently, only a limited number of EVs in the Australian market can provide bi-directional power flow between vehicles and charging stations. A recent survey of consumer attitudes found that the lack of access to, and perceived inconvenience of, charging stations are key barriers to the adoption of EVs. To alleviate the concerns of consumers and facilitate V2G uptake, Australia needs significant investment in EV-charging infrastructure—especially in the bi-directional chargers—in the coming years.

There is insufficient hosting capacity for V2G services across some of Australia's existing distribution networks. Existing network infrastructure was not initially designed to embrace high penetrations of EVs and absorb the impacts of charging and discharging of these technologies. The hosting capacity of each distribution network to embrace higher penetrations of EVs differ across different states and distribution network service providers.

The coordinated management of EVs may also impact the network hosting capacity in the short term. Meeting future EV-charging requirements will depend on the modernisation of parts of Australia's energy grid through solutions such as; advanced data-driven algorithms for planning and operation, facilitating the integration of the distribution grid and the Frequency Control Ancillary Services (FCAS) market, and developing non-wire alternative solutions to reduce upgrade costs.

While the demands of EVs will eventually necessitate upgrades of electricity infrastructure, a V2G scheme could substantially mitigate these new electricity infrastructure costs. International electricity distributors, such as distributors in California 64, have already started to implement a 'non-wire alternatives' concept in the distribution grid. The predominant objective is to smartly manage energy generation and storage capacity in active distribution grids to minimise infrastructure upgrades.

RACE Project: National Charge Link – 2022

These project findings are important to understand when considering the national planning of electric vehicle charging infrastructure.

This project identified that it would be critical to create a national capability and governance framework for electric vehicle charging infrastructure. The objective of the National Charge Link platform is to enable faster-planning capability for national strategies and platforms to ensure the optimisation of deployment and use of charging infrastructure. The project recommended developing a standing database of public and private charging infrastructure and a data

aggregation, and a collection layer for private charging data. These assets would then be developed into a national charging infrastructure master planning resource.

Since completion of this project the Australian Government Department of Climate Change, Energy, the Environment and Water has provided initial funding for the development of a national charging infrastructure master planning resource. It is acknowledged that as the transition to EVs continues, there may be other market entrants who deliver tools and web platforms to manage charging infrastructure planning and operation. The benefit of investing in an open-source national resource is that there is an avenue to the continued funding and development of tools and platforms for decision making by customers who may not have resources to access commercially developed products. Developing basic decision-making tools for the benefit of the Australian public supports an equitable and inclusive transition to EVs.

Inquiry item b) the viability of alternative energy sources for freight, heavy vehicles and other licenced vehicles in regional communities

RACE Project: National Roadmap for Bidirectional EV Charging in Australia – 2025

This section relates to findings relevant to the planning of bidirectional charging for heavy vehicles.

The Megawatt Charging System (MCS) is derivative of Combined Charging Systems (CCS). It is DC-only and natively supports bidi up to 3.75 MW DC for heavy road, rail and vehicles and water vessels. MCS underwent initial testing in 2020 with a v1.0 specification whitepaper released in 2022. MCS' bidirectional capabilities are expected to have vehicles in this class contribute readily to ancillary services markets given that power magnitudes from individual vehicles can exceed frequency market bidding increments (e.g. 1 MW in Australia).

Heavy vehicles are an important area for future growth (for bidirectional charging and vehicle-to-grid opportunities). Rigid trucks and buses were considered most favourably due to often shorter runs and duty cycles which typically allow for longer overnight recharging periods. Vehicle availability was seen a critical constraint ahead of 2030 during which time targeted demonstrations could be explored to firm up the commercial case for fleet operators. Articulated trucks with high utilisation and longer haulages were not seen as an opportunity in the near term, in an Australia context outside of niche applications (e.g., primary frequency control service delivery). Several stakeholders noted the benefits of further studies to identify specific opportunities for bidi across commercial fleets and heavy vehicles.

Inquiry item c) use of existing infrastructure and measures to ensure a competitive market, including 'ring fencing' policies

RACE has yet to conduct research specific to this topic and therefore does not have a formal response to this matter. RACE does note that through discussions with industry and research partners we have observed a general support for Australian Energy Regulator (AER) sandboxing to test alternative before committing to solutions such as 'ring fencing' policies

Inquiry item d) measures to ensure the transition of workers from affected industries and industry standards

RACE Project: Developing the future energy workforce – 2021

This workforce planning projects has findings relevant to the planning of future workforce needs in the EV and EV charging sector.

Evidence based workforce planning is essential to manage the complex changes that are occurring as a result of our national energy transition. Research to date, funded by RACE, on the transitioning electricity sector workforce has provided insights on critical points between now and 2050 where workforce constraints may create critical risks for infrastructure development.

Research on the demand side workforce, which includes electrification, energy efficiency and EV charging infrastructure, is not well explored to date. The evidence base for sectoral specific workforce planning is needed to provide the necessary insights for holistic workforce planning across all aspects of the energy transition.

Several explorations have laid the foundation for national demand side workforce projections, with EV specific developments outlined here:

- Surveys in 2024 explored the EV charger workforce, which covered development/installation and operations and maintenance activities. Surveys identified the labour intensity for level 3 chargers is considerably higher than level 2 chargers. This is a factor when looking at whole of system planning for EV charging infrastructure and the energy system in that it can affect both the cost but more importantly the ability to meet the demand.

- The operations and maintenance workforce comprises 70% of workforce intensity for EV chargers, predominantly electricians with support from logistical and trade support.

- Electricians and electrical support workers such as electrical engineers, electrical trades assistants and related roles are critical and in high demand across all areas of the energy transition. Electricians are already listed on the Occupational Shortage List by Jobs and Skills Australia.

- The 'Developing the future energy workforce' opportunity assessment identified a need to engage with the transport sector to explore appropriate methods to represent workforce characteristics. Broader engagement with the transport sector is still in development beyond charging infrastructure.

Sectoral investment in research activities is critical to advancing an exploration into the complex characteristics of the demand side workforce, including interdependences and competition for workers between sectors.

Inquiry item e) any other related matters.

<u>RACE Project: Accelerating EV adoption through commercial radio – ongoing (to be completed 2026)</u>

This project has and will generate further findings related to consumer trust and misinformation in relation to EVs and EV charging infrastructure.

Trust and misinformation are key influencers in the adoption of EVs and use of EV charging infrastructure. The aim of this ongoing project is to identify and analyse commercial radio's role in Australia's response to issues such as EV misinformation, climate change and net zero targets.

Researchers are working with radio content directors to develop content that resonates with commercial radio audiences and people who are vulnerable to misinformation and resistant to the renewables roll out and shift to EVs. The efficacy and impact of the content is being evaluated through a rigorous research program using content analysis, surveys, focus groups and interviews with audience members, producers and presenters.

The following are some of the early findings from focus group interviews. To date the project has found focus groups participants

- Believe the messenger is important, like to hear lived experiences and experts, and trust what radio hosts have to say

- Express a desire to increase their knowledge on climate and energy topics and seek education about actions they can take

- Express a desire to bring climate/energy into everyday conversation and increase public engagement with these topics

- Want local voices to represent their community

These findings are relevant to the terms of the inquiry as consumer trust in EV and EV charging product is key to its effective use and integration within communities

RACE Project: Australian Consumers at the Heart of the EV Transition – ongoing (to be completed 2026)

This project has and will generate further findings related to EV adoption across different customer demographics

This study is exploring the issues and challenges that will face all Australian consumers during the EV transition by understanding their lived experience. In-person, qualitative ethnographic interviews with consumers are being conducted alongside quantitative survey research to go beyond existing consumer sentiment surveys to tell us not only the what, but also the how and why concerning EV consumer behaviours in Australia. Outputs, including research insights, policy recommendations, and support in the crafting of customer messaging will be co-designed with consumers and industry to put end users at the heart of the process.

Some of the early findings from interviews have found that there is a clear separation of attitudes towards EVs across demographics which will be further defined into potential customer cohorts. It has been seen that interviewees on lower incomes typically face greater barriers in adopting new technologies such as EVs. International research has also found EV charging infrastructure is typically placed in higher income areas, leading to increased perceptions of range anxiety in lower income neighbourhoods.

RACE Project: Strategic Electric Vehicle Integration – ongoing (to be completed 2026)

This project has and will generate further findings related to EV charging infrastructure needs in holiday parks/regional tourism destination areas

The Strategic EV Integration (SEVI) project is a three-year, industry-led research initiative focused on exploring promising use cases for the integration of electric vehicles (EVs), associated technologies, and business models across Australia. Research has focused on select demonstration projects in New South Wales, Western Australia and South Australia.

The South Australian research focus has centred on the context of Holiday parks, particularly those in regional areas of destination tourism. Preliminary research has included an investigation into the EV related market landscape and baseline for Holiday Parks in the South Australian region. From review of the literature and consultation with stakeholders on this topic, researchers have considered the drivers for EV infrastructure installation in parks and their approaches to EVs and identified early movers of EV infrastructure installations. Preliminary research to date has suggested.

- EVs are increasing in popularity and holiday parks will naturally be a point of charging as people park their vehicles for periods of time.

- EV charging in holiday parks could also help plug a gap in the EV charging infrastructure network in regional areas, while offering an opportunity to support the electricity network in weaker, less resilient parts of the grid.

- Unmanaged charging could exacerbate network issues in regional and remote areas with large swings in seasonal demand. It could also add to the operating costs of many tourism businesses which are already experiencing increasing electricity costs due to the growing energy demands of holiday makers

RACE Project: Electric vehicles and the grid: Opportunity Assessment – 2021

This project had findings relevant to customer equity in the transition to EVs

Customer equity is an important consideration which has been raised by multiple stakeholders during research projects and partner engagement. While still nascent, it is vital to understand the potential equity issues that can arise as networks reach hosting capacity limits and access to network resources is limited. When transitioning to an electrified future, it is critical that all consumers can participate and benefit from Australia's transition to EVs – this is particularly an issue for First Nations and low-income Australians those living in regional and remote areas, apartment dwellers, renters, and those who don't and can't drive.

APPENDIX A: RACE FOR 2030 CRC PROJECTS RELEVANT TO THE INQUIRY'S TERMS OF REFERENCE

Electric vehicles and the grid: Opportunity Assessment – 2021

This project was compiled with the expertise of multiple experts across a broad range of disciplines relating to EVs, including vehicle and charging infrastructure, distribution and transmission networks, as well as social science areas of human interactions with technology and urban planning and design. It provides a comprehensive literature review on the subject matter of EVs and the grid, a detailed barrier analysis, and list of research opportunities and recommendations.

Available at: https://www.racefor2030.com.au/content/uploads/N1-EV-Opportunity-Assessement-Report-FINAL_05112021.pdf

E3: Developing the future energy workforce – 2021

This project, Developing the future energy workforce, addresses several fundamental questions about Australia's energy sector, including how to measure the workforce, how training and skills can be fit for the future, and how to strengthen Australia's innovation pathways. The work is separated into three work packages addressing: 1. Market size, workforce and employment; 2. New skills development; and 3. Innovation pathways.

The project describes a pathway to understanding the present and future energy workforce in Australia. Developing the workforce is crucial to enabling the clean energy transition and realising the RACE for 2030 vision of a customer-centred clean energy system, and to the successful translation of RACE for 2030 research outcomes to industry impact.

Available at: https://www.racefor2030.com.au/content/uploads/RACE-E3-Opportunity-Assessment-FINAL-REPORT-October-2021.pdf

National Charge Link – 2022

The National Charge Link (NCL) platform emerged from work funded by both the Australian Renewable Energy Agency and NSW Government related to electric vehicle charging infrastructure. This work recognised that it would be critical to create a national capability and governance framework for electric vehicle charging infrastructure. The objective of the NCL platform was to enable faster-planning capability for national strategies and platforms to ensure the optimisation of deployment and use of charging infrastructure. This project centred on the design of this platform with the aim of firming the project's design, exploring funding and governance opportunities, and considering how to incorporate input from new and emerging datasets.

Available at: https://www.racefor2030.com.au/content/uploads/National-Charge-Link.pdf

My V2X EV: Informing strategic electric vehicle integration – 2023

This project aimed at identifying the barriers and opportunities for vehicle-to-everything technologies (V2X) and developing a path to technology implementation through technical solutions and research partnerships with industry. The project identified the costs, benefits and potential value streams for vehicle-to-grid (V2G) services, regulatory and policy considerations

related to V2G, the technical challenges and standards required for V2G implementation and undertook a national consultation with industry to identify opportunities for future research.

Available at: https://www.racefor2030.com.au/content/uploads/V2X-Stage_1_Final-Report.pdf

National Roadmap for Bidirectional EV Charging in Australia – 2025

This project was commissioned by the Australian Renewable Energy Agency (ARENA) and RACE for 2030 (RACE) to identify the critical path to achieving commercial adoption of bidirectional EV charging in Australia. The roadmap is also intended to provide guidance to industry and government who will have a key role in developing policy settings and strategy initiatives to realise the benefits of bidirectional charging for the Australian community. It outlines 18 actions under five action areas, that are recommended for inclusion in a national strategy for bidirectional EV charging to be developed by Australian governments.

Available at: https://77980725.flowpaper.com/BidirectionalBidiROADMAP20250115/

Maximising electric vehicle fast charging by improved thermal management of distribution transformers - 2025

This project focuses on an area of emerging stress that is very likely to become a huge issue for the electrical grid. It seeks to investigate whether transformers can be momentarily loaded higher than their initial nameplate rating to allow for greater EV charging without substantially increasing transformer temperature. It was hypothesised through this research that this could allow for greater deployment of electric vehicles at existing transformers, which would indicate large potential cost savings in infrastructure deployment and reduction in embodied emissions through achieving much more throughput of EVs charging using the same original product. This coupled with dynamic connection agreements holds the potential to release significant capacity from existing infrastructure. The projects final report goes some way to demonstrating the additional capacity available. A caveat is that many of the simulated scenarios in this report are specific and numerical hence the outcomes cannot be generalised. Further work is under development to test and verify outcomes from the first part of this project.

Available at: https://www.racefor2030.com.au/content/uploads/Final-report-0571-FINAL-FINAL.pdf

Australian consumers at the heart of the EV transition – ongoing (to be completed 2026)

This project aims to explore the issues and challenges that will face all Australian consumers during the EV transition by understanding their lived experience. Research will focus on all consumer behavioural aspects of EVs – including but not limited to purchase, charging, servicing, service use, battery management, energy management technologies, driving and use patterns, and energy consumption. In-person, qualitative ethnographic interviews with consumers will be conducted alongside quantitative survey research to go beyond existing consumer sentiment surveys to tell us not only the what, but also the how and why concerning EV consumer behaviours in Australia. Outputs, including research insights, policy recommendations, and support in the crafting of customer messaging will be co-designed with consumers and industry to put end users at the heart of the process.

Project page and updates will be published at:
https://www.racefor2030.com.au/project/australian-consumers-at-the-heart-of-the-ev-transition/

Accelerating EV adoption through commercial radio – ongoing (to be completed 2026)

This project will identify and analyse commercial radio's role in Australia's response to climate change and its net zero targets. Working with content directors, producers and presenters across states and regional areas, we will develop content that resonates with commercial radio audiences and with people who are vulnerable to misinformation and resistant to the renewables roll out and shift to EVs. The efficacy and impact of the content will be evaluated through a rigorous research program using content analysis, surveys, focus groups and interviews with audience members, producers and presenters.

Project page and updates will be published at:
https://www.racefor2030.com.au/project/accelerating-ev-adoption-through-commercial-radio/

Strategic Electric Vehicle Integration (SEVI) – ongoing (to be completed 2026)

The Strategic EV Integration (SEVI) project is a three-year, industry-led research initiative focused on exploring promising use cases for the integration of electric vehicles (EVs), associated technologies, and business models across Australia. Central to this project is the emphasis on co-design and collaborative implementation with partners and stakeholders, guided by research plans co-designed with industry. These plans lay the groundwork for the implementation and assessment of research within select demonstration projects in New South Wales, Western Australia and South Australia.

Project page and updates will be published at:
https://www.racefor2030.com.au/project/strategic-electric-vehicle-integration/