



Australian Government

**Department of Climate Change, Energy,
the Environment and Water**

Submission to the inquiry into the transition to electric vehicles

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1 Purpose of this submission

The Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) is pleased to provide this submission for consideration by the House of Representatives Standing Committee on Climate Change, Energy, Environment and Water (Committee).

This submission provides information about Australia's transition to electric vehicles (EVs), focusing on policy and programs that fall within the responsibilities of DCCEEW and its portfolio agencies. The submission has been prepared with regard to the Committee's terms of reference, which includes:

- the establishment of resources, systems and infrastructure required to support transition to EVs
- the impact of moving from internal combustion engine vehicles, including fuel excise loss, existing auto industry component manufacturers and the environment
- the opportunities for fuel savings, such as by combining EVs with other consumer energy technologies and savings for outer suburban and regional motorists
- the impact on electricity consumption and demand
- the opportunities for expanding EV battery manufacturing, recycling, disposal and safety, and other opportunities for Australia in the automotive value chain to support the ongoing maintenance of EVs
- the impact of Australia's limited EV supply compared to peer countries, and
- any other relevant matters.

2 The role of DCCEEW

DCCEEW is responsible for leading Australia's response to climate change and sustainable energy use, and protecting our environment, heritage and water.

In terms of Australia's EV transition, DCCEEW is responsible for delivering the outcomes of the National Electric Vehicle Strategy, electricity-related measures to ensure the grid is ready for electrified transport, including the Rewiring the Nation Plan, and circular economy policy. DCCEEW is also responsible for preparing yearly greenhouse gas emissions projections (including contributions from individual sectors like transport), and international reporting against Australia's greenhouse gas emissions commitments.

Delivering initiatives under the **National Electric Vehicle Strategy** is a key priority for DCCEEW. This includes:

- Contributing to development of a **New Vehicle Efficiency Standard** for new, light vehicles (led by the Department of Infrastructure, Transport, Regional Development, Communication and the Arts (DITRDCA)).
- Roll-out of **EV charging infrastructure** through the Driving the Nation Fund.
- Delivering a **national mapping tool** to identify optimal locations for the installation of fast and ultra-fast EV charging infrastructure across Australia.
- Developing **training for emergency services workers** responding to EV incidents.
- Producing tools and guidance to help enable EV uptake for residents in **existing multi-residential buildings**.
- Research to inform EV and large format **battery recycling, reuse and stewardship**.
- Working with **states and territories** to coordinate efforts to decarbonise transport.

DCCEEW is also implementing the Government's **Powering Australia plan**, including the \$20 billion **Rewiring the Nation program** to rebuild and modernise the Australian electricity grid and ensure it can handle more renewable energy. This will see the portion of renewable energy in our national electricity market increase to 82 per cent by 2030.

DCCEEW supports the Government's engagement with energy market bodies and other jurisdictions on electricity network and transport decarbonisation related matters through ministerial forums such as the Energy and Climate Change Ministerial Council (ECMC) and its established interjurisdictional working groups. In November 2023, ECMC agreed to develop a **National Consumer Energy Resources (CER) Roadmap**, and to convene a CER Taskforce to deliver on priorities under the Roadmap. In March 2024, ECMC agreed to a Workplan for the CER Taskforce, which includes actions that will help manage the integration of EVs and ensure Australia is well prepared for future rollout of vehicle-to-grid technology.

In addition, the interjurisdictional **CER Working Group** has been established to support the integration of CER and flexible demand mechanisms into markets and electricity networks to benefit the system and provide increased value to consumers. This includes delivering packages of actions and priority reforms to ensure the electricity network is ready for rapid adoption of EVs, and help set the foundations for a future where the value of EVs is

maximised for consumers and industry while ensuring the energy system can continue to operate securely, reliably and efficiently.

In 2022, the Australian Government legislated Australia's greenhouse gas emissions reduction targets to reach net zero by 2050 and 43 per cent below 2005 levels by 2030. The Government has also committed to developing a **Net Zero Plan** that will be informed by six sectoral decarbonisation plans, covering all major sectors of the Australian economy: electricity and energy; transport and infrastructure; industry; agriculture and land; resources; and the built environment.

The **Transport Sector Plan**, known as the Transport and Infrastructure Net Zero Roadmap and Action Plan, is being developed by the DITRDCA in collaboration with DCCEEW. The Transport Sector Plan will examine the potential pathways to reduce emissions to net zero by 2050 across all transport modes and supporting transport infrastructure.

DCCEEW is also responsible for developing the **Electricity and Energy Sectoral Plan**. This plan will consider existing relevant initiatives including the National Energy Transformation Partnership and the Government's 82 per cent renewable target by 2030, and will be informed by stakeholder engagement with communities, states and territories, industry and peak bodies.

DCCEEW is responsible for policy relating to support for an EV **circular economy**, to help mitigate the environmental impacts of EV production and EV waste, and reduce the strain on battery supply chains by repurposing and recycling batteries, where possible. All of Australia's environment ministers have agreed to work with the private sector to design out waste and pollution, keep materials in use and foster markets to achieve a circular economy by 2030.

DCCEEW's Liquid Fuels Branch is leading the liquid fuels decarbonisation and security policy elements under the Electricity and Energy Sector Plan. This includes considering a policy framework to support the development of an Australian low carbon liquid fuel industry and support a fair, equitable and orderly transition for the **decarbonisation of liquid fuels**. As a first step to enable greater use of these fuels, we are developing a new fuel quality standard to enable renewable diesel supply in Australia.

2.1 Portfolio agencies

2.1.1 *The Australian Renewable Energy Agency (ARENA)*

The Australian Renewable Energy Agency (ARENA) was established in 2012 by the Australian Government. ARENA's function and objectives are set out in the *Australian Renewable Energy Agency Act 2011*. ARENA is supporting the global transition to net zero emissions by accelerating the pace of pre-commercial innovation. ARENA provides financial assistance to support innovation and the commercialisation of renewable energy and enabling technologies by helping to overcome technical and commercial barriers.

ARENA administers the Driving the Nation fund, which enables the demonstration and deployment of new zero emissions vehicle technologies and has supported projects such as the Realising Electric Vehicle-to-Grid Services bi-directional charging trial.

A key part of ARENA's role is to collect, store and disseminate knowledge gained from the projects and activities it supports for use by the wider industry and Australia's energy market institutions. To date, ARENA has committed \$98.37 million towards 27 projects directly

addressing EV uptake, grid integration, and innovation. ARENA's Board has decided that Decarbonising Transport is one of ARENA's four strategic priorities.

2.1.2 Clean Energy Finance Corporation

The Clean Energy Finance Corporation (CEFC) mobilises capital investment in renewable energy, low-emission technology and energy efficiency projects in Australia. The CEFC invests in measures to reduce transport-related emissions, including financing for fleet and residential EVs.

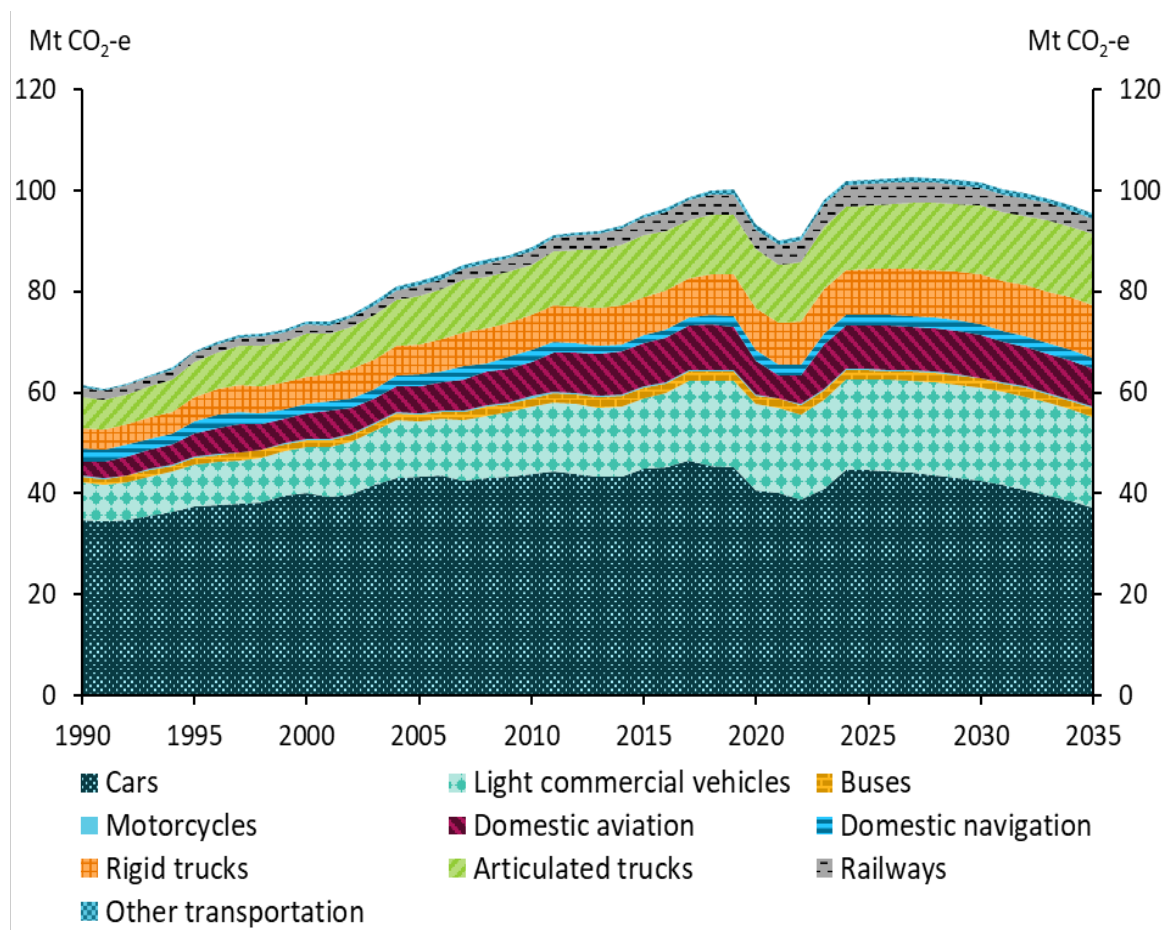
3 Background and key statistics

3.1 Transport emissions

In 2023, the transport sector was responsible for around a fifth (21 per cent) of Australia's total greenhouse gas emissions. Light vehicles account for almost 60 per cent of transport emissions and over 12 per cent of Australia's total emissions. Transport emissions have increased by 19 per cent since 2005, and without further action, are on track to be the largest source of greenhouse gas emissions in Australia by 2030 (DCCEEW 2023b). Emissions from cars have been relatively flat since 2005 despite population growth (Figure 1). Efficiency improvements in passenger cars are likely to have offset the increased number of cars on our roads over this time. In contrast, emissions from light commercial vehicles are up by nearly 61 per cent since 2005 (DCCEEW 2023b). This may be due to consumers' changing preferences for large SUVs and utes over smaller passenger vehicles, such as sedans.

Looking more broadly at the transport sector, emissions from railways, domestic aviation, articulated and rigid trucks, and buses have also increased significantly over this period (Figure 1).

Figure 1: Transport emissions, 1990 to 2035, Mt CO₂-e



Source: DCCEEW 2023c

Table 1 Transport emissions in the baseline scenario, 2005 and 2035, Mt CO₂-e

	2005	2030	Change (%)
Other transportation	1	1	17%
Railways	2	4	74%
Domestic navigation	2	2	-8%
Domestic aviation	5	8	58%
Motorcycles	0	0	25%
Articulated trucks	10	14	42%
Rigid trucks	6	10	61%
Buses	1	2	31%
Light commercial vehicles	11	18	68%
Cars	43	42	-2%
Total	82	102	24%

Source: DCCEE 2023b. Note: totals may not sum due to rounding. Baseline scenario projections for 2030.

Technology is available now to support the uptake of low and zero emissions vehicles, including the electrification of light vehicles, providing a key opportunity for reducing transport emissions. EVs are already producing lower emissions than internal combustion engine (ICE) vehicles across their lifespan. A 2022 Australian study of the full vehicle lifecycle greenhouse gas emissions by Transport Energy/Emission Research (TER) found that even with largely fossil fuel-based electricity generation, the lifecycle emissions of EVs are about 36 per cent lower than ICE vehicles (Smit and Kennedy 2022). Lifecycle emissions reductions were found to be up to 80 per cent with a greater share of renewable energy in the electricity grid.

In addition to greenhouse gas emissions, the burning of fuel by ICE vehicles also results in air pollution. Air pollution from transport emissions is estimated to have caused 1,715 deaths in Australia in 2015 (BITRE 2016), 42 per cent more than the road toll that year. More recent estimates by the University of Melbourne indicate mortality associated with vehicle emissions may have been underestimated, with researchers suggesting emissions may result in as many as 11,105 premature deaths in Australian adults each year (Walter and Say 2023).

Chronic exposure to air pollution, even at low levels, contributes to a range of acute and chronic health problems. This includes stroke, respiratory and heart disease, cancer, premature birth, low birth weight, neurodegenerative diseases, and reduced life expectancy.

3.2 EV uptake in Australia

Accelerating growth in EV sales is a global phenomenon. The uptake of EVs in Australia continues to gather momentum, transforming the options available to Australian consumers considering the purchase of a new light vehicle. Sales of EVs reached 8.4 per cent of new light vehicle sales in 2023, up from less than 1 per cent in 2020 (EVC 2023a; FCAI 2024a;

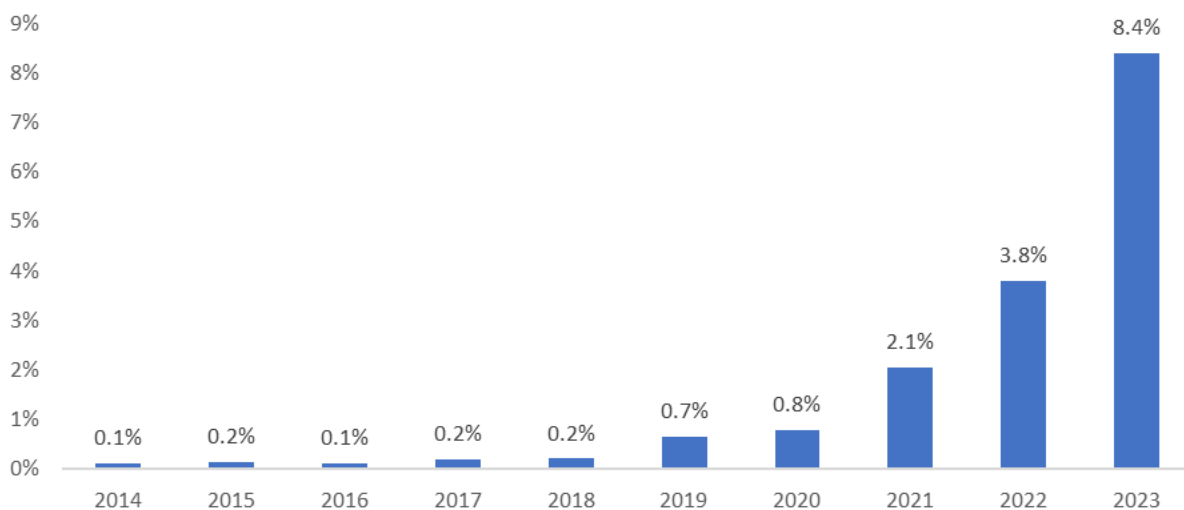
Figure 2). Sales of EVs comprised 9.1 per cent of new light vehicle sales in the first two months of 2024 (FCAI 2024b). The Electric Vehicle Council has estimated that the number of EVs on the road now exceeds 180,000 (EVC 2024).

Building on the strong consumer demand for EVs, manufacturers have continued to increase the supply of EV models to the Australian market. The total number of EV models available to Australian consumers increased from 70 in 2022 to 91 in 2023. The number of EV model variants¹ increased by 56 per cent to 148 in 2023 (compared to 2022). The number of battery electric vehicle (BEV) models increased from 38 to 59 between 2022 and 2023, while the number of plug-in hybrid electric vehicle (PHEV) models remained steady at 32 (EVC 2023a; 2023b).

In 2023, there were also 22 EV options available in the Australian market at a price of \$60,000 or less (EVC 2022; 2023b), with three BEVs having starting prices at under \$40,000—the MG4, the BYD Dolphin and the GWM Ora.

However, Australia does not currently have access to the same range of EVs that are available on the global market. The US has around 60 more models than Australia, while around 150 more models are available in Europe (BNEF 2024). A range of factors, including increased range of EV models, technological advancements, environmental awareness, the increased roll out of EV charging infrastructure and supportive government policies has contributed to the EV uptake trend, providing consumers with better opportunities to access EVs and helping reduce our transport emissions.

Figure 2 EV sales as a proportion of new light vehicle sales 2014 to 2023

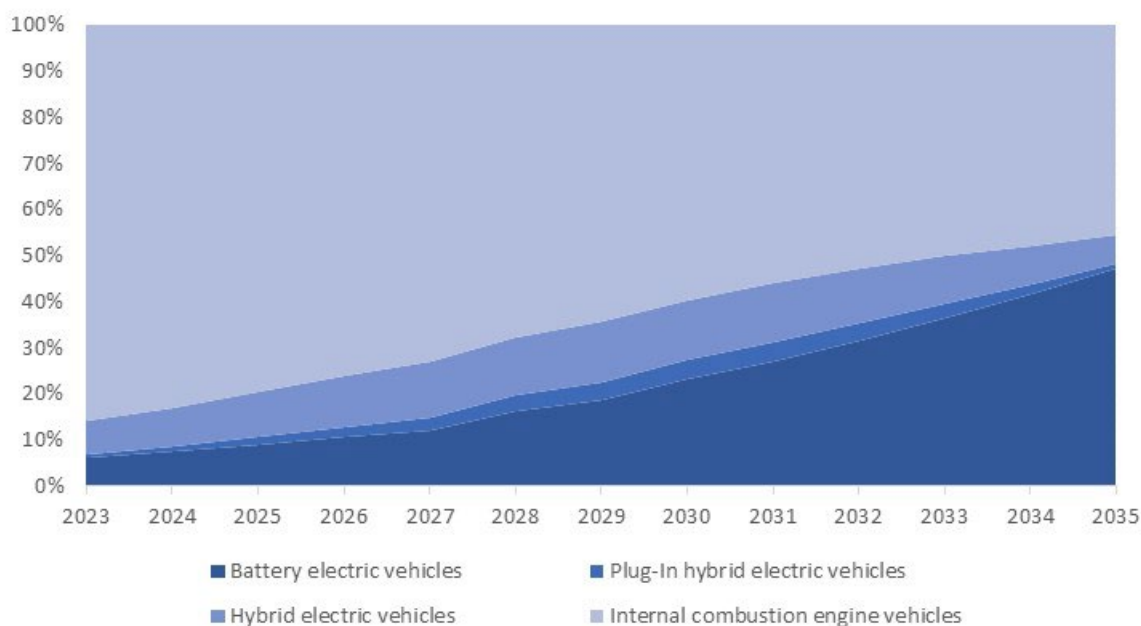


Source: EVC 2023a, FCAI 2023b (2023 data)

Australia's 2023 emissions projections indicate that, even without further policies to increase EV uptake, sales of EVs are anticipated to make up almost half (48 per cent) of new light duty vehicle sales by 2035 (Figure 3) (DCCEEW 2023c). This includes both BEVs and PHEVs.

¹ A particular model may have several variants, reflecting different qualities, inclusions and price points.

Figure 3 Projected new light duty vehicles sales (baseline scenario) 2023 to 2025



Source: DCCEEW 2023c

Light vehicles have a lifetime of about 15 to 20 years before they are retired from use, meaning turnover of Australia's light vehicle fleet can take decades. This highlights the importance of acting now to increase the uptake of low and zero-emission light vehicles, and improving the efficiency of ICE vehicles, to reduce transport sector emissions and help put Australia on a path to net zero by 2050. Rates of uptake and length of time that EVs remain in use will have flow-on implications for a circular economy for recycling and potential repurposing of EV batteries for second-life uses. Academic literature and industry reports indicate that cost-effective recycling and resource recovery operation are dependent on a high volume of available, healthy retired EV batteries.

3.3 Public EV charging infrastructure

While the vast majority of EV charging—as much as 80 per cent—occurs at home, and more developed EV markets indicate a consumer preference for charging at home (AEMO 2021), investment in public charging is a key element of supporting the take-up of EVs.

Public charging supports EV drivers to charge their vehicles during longer trips and upon reaching their destination. Ensuring a network of charging infrastructure is essential for ensuring that EV drivers can safely and reliably travel around Australia. A robust and reliable charging network supports demand for EVs by giving consumers confidence in their ability to travel longer distances and recharge during trips, as required.

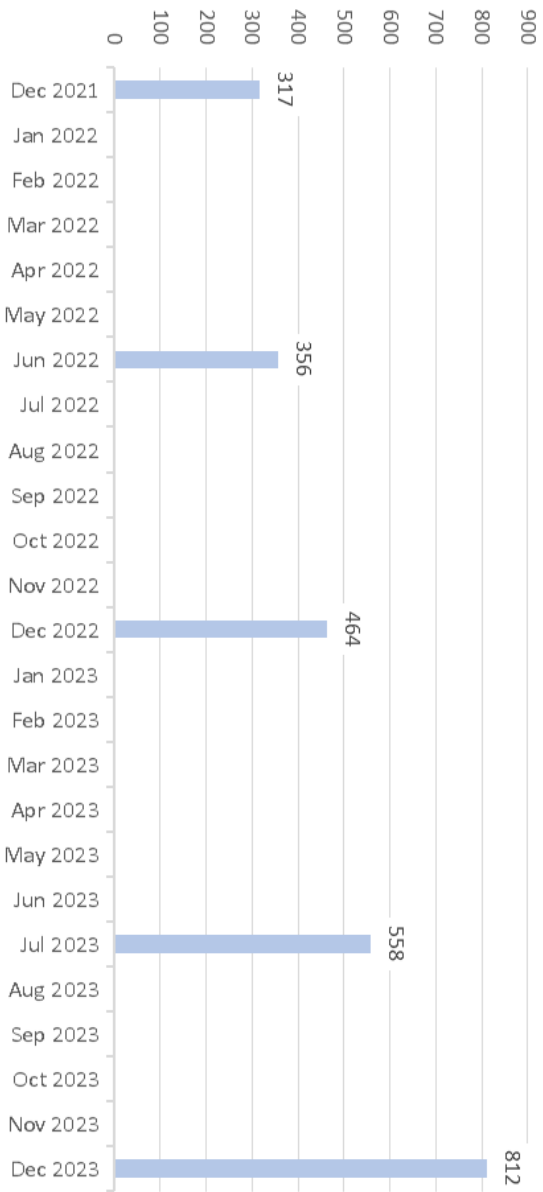
Australia is the sixth largest country in the world, with arterial and local roads spanning over 600,000 kms across rural Australia (DITRDCA 2022). It is important for Australians living in rural and regional areas to have access to adequate and reliable charging infrastructure that can enable an increase in EV uptake outside of highly populated areas.

Departmental analysis indicates that the total number of fast and ultra-fast (24kW+) public EV charging locations almost doubled from 464 locations in December 2022 to over 800 locations in December 2023 (Figure 4, Table 2). These charging locations support around 2000 fast and ultra-fast charging plugs.

DCCEEW estimates that there are approximately 100 EVs for every public fast and ultra-fast charger plug in Australia (as at the end of 2023).

The International Energy Agency (2023) Global EV Outlook noted that access to public charging is critical to support EV take-up. However, the optimal ratio of EVs per public charger varies depending on the characteristics of the country, local conditions and driver needs. Countries characterised by widespread availability of home charging may, in general, have a higher ratio of EVs to public charging points. For example, the IEA reported that the ratio of EVs per charger was 24 in the United States and 30 in Norway. The fast rate of uptake of EVs in Australia since that report was released complicates direct comparisons based upon the IEA's findings.

Figure 4 Number of fast and ultra-fast public charging locations in Australia



Source: DCCEEW analysis

Table 2 Number of fast and ultra-fast public charger locations available by jurisdiction

State / Territory	Fast (24kW – 99kW DC)		Ultrafast (≥100kW DC)		Total	
	DEC 2022	DEC 2023	DEC 2022	DEC 2023	DEC 2022	DEC 2023
ACT	6	8	3	4	9	12
NSW	112	164	37	65	149	229
NT	2	6	0	0	2	6
QLD	82	125	12	26	94	151
SA	36	42	9	43	45	85
TAS	23	38	6	5	29	43
VIC	72	160	25	47	97	207
WA	32	40	7	39	39	79
Total	365	583	99	229	464	812

Source: EVC 2023a; EVC 2024; DCCEEW Analysis

3.4 Benefits for EV owners

EVs offer substantially lower operating costs for households and reduce national and consumer exposure to volatile global fuel prices (DCCEEW 2023a). The Electric Vehicle Council (EVC) has estimated that the average cost to charge an EV travelling 12,000km a year would be around \$500. In comparison, the average Australian driving an ICE vehicle around 12,000km per year will spend about \$2,500 on petrol (EVC n.d.). Adopting an EV provides opportunities for fuel savings for all drivers across a range of locations. EV maintenance costs are also comparably low, given they have far fewer parts and much less mechanical complexity than conventional ICE vehicles.

EVs can turn electricity into drivetrain energy very efficiently, converting over 77 per cent of the electrical energy from the grid to mechanical power. They also use regenerative braking, which lowers energy costs (DCCEEW 2023a). In comparison, petrol and diesel vehicles only convert around a quarter of the energy from liquid fuels (U.S. Department of Energy n.d.). This means EVs use substantially less energy than an equivalent conventional vehicle.

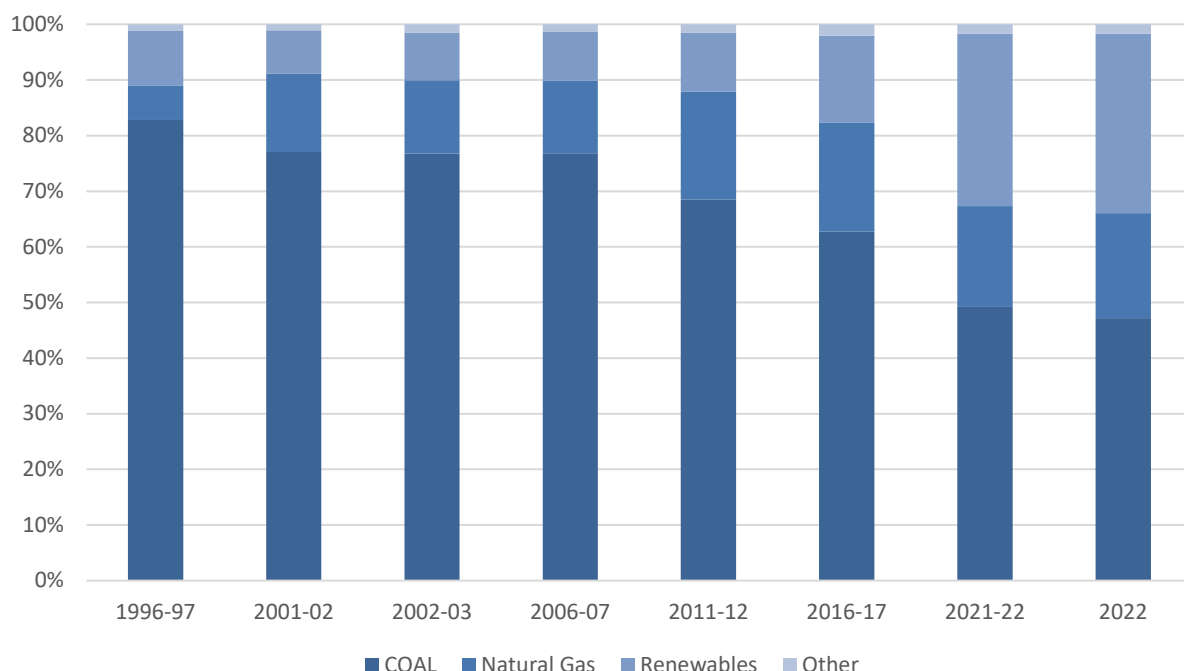
As well as using less energy, some EVs can provide energy storage for houses and the electricity grid. Innovation in bidirectional charging, which allows EVs to both receive and discharge energy, will enable more EV models to contribute electricity to power homes and the grid. EVs could also play a key role in storing and later dispatching excess power generated from solar photovoltaic (PV) and other renewable energy systems, and potentially assist in electricity grid management (AEMO 2022).

3.5 Australian electricity generation

Australia's energy transformation is already underway, with renewable sources making up just under a third of electricity generated in 2021–22 and calendar year 2022. Coal-fired generation dropped below 50 per cent of total generation in 2021–22 and continued to decline in calendar

year 2022 (DCCEEW 2023d). Since 2016, emissions from electricity generation have been falling, driven by renewable generation entering the market and displacing fossil fuel fired generation. Electricity emissions are estimated to be 152 Mt CO₂-e in 2023 and are projected to decrease by 46 per cent to 81 Mt CO₂-e in 2030 (DCCEEW 2023c).

Figure 5 Australian electricity generation



Source: DCCEEW (2023d), Australian Energy Statistics Table O, September 2023

4 National Electric Vehicle Strategy

The Government released the National EV Strategy in April 2023, with a vision to increase the uptake of EVs to reduce our emissions and improve the wellbeing of Australians. The Strategy is focused on supporting the electrification of light passenger and light commercial vehicles, which are the major source of road transport emissions (DCCEEW 2023a).

The National EV Strategy aims to help make Australia a globally competitive market for EVs, with better access to a broad range of affordable EV models, targeted infrastructure to enable EV use across the nation, and new industries and jobs along the EV supply chain.

Development of the National EV Strategy was informed by public consultation and insights from overseas experience.

At the core of the National EV Strategy are **three key objectives**:

1. increase supply of affordable and accessible EVs
2. encourage increase in EV demand
3. establish the resources, systems, and infrastructure to enable rapid EV uptake.

Alongside these objectives, the National EV Strategy details the **six policy outcomes** that it is seeking to achieve:

1. expand EV availability and choice
2. reduce road transport emissions
3. make it easy to charge an EV across Australia
4. increase local manufacturing and recycling
5. make EVs more affordable
6. reduce the cost to Australians of running their vehicles.

The Government will provide annual updates on initiatives identified in the National EV Strategy, with a major review to occur in 2026. The first update will be conducted in the first half of 2024.

4.1 National collaboration

The National EV Strategy is developed and delivered in collaboration with state and territory governments, industry, unions, business and community groups. Stakeholders emphasised the importance of the Australian Government taking a national, strategic leadership role in the transition to EVs and of national collaboration to plan and provide the systems and infrastructure needed to support it.

The National EV Strategy recognised that states and territories had already introduced a range of initiatives to support the uptake of EVs, and committed to work collaboratively to ensure a national approach in six key areas:

- national standards
- EV affordability
- remote and regional EV charging infrastructure
- data sharing
- fleet procurement
- education and awareness.

These areas for collaboration were identified by a **National Electric Vehicle Action Plan Implementation Group** (the Implementation Group), which includes members from all jurisdictions. Early collaboration has resulted in a set of national minimum operating standards for government-supported public EV charging infrastructure ([see 4.2.3](#) for further detail).

State and territory governments are also engaged in activities within their own jurisdiction to encourage the take-up of EVs by their local communities and businesses.

4.2 Resources, systems and infrastructure

The Australian Government, states and territories, and industry all play key roles in the roll-out of EV charging infrastructure.

The Australian Government has committed over \$500 million to support the deployment of charging infrastructure through the **Driving the Nation Fund**. State and territory governments are also making significant investments in charging infrastructure to support the uptake of EVs in their jurisdictions. This includes commitments to a significant pipeline of charging locations with 1,000 additional charging locations expected to come online in the next 12 to 36 months.

Box 1 Lessons from ARENA's public infrastructure projects

Data from public charging infrastructure projects funded by ARENA indicate direct current public charging stations can cost upwards of \$400,000. Given the substantial capital investment required, it is vital to approach the planning of public charging sites in a coordinated manner, considering strategic factors such as location, grid requirements, capacity, and accessibility. *Electric Highway Tasmania's Lesson Learnt Report #3* emphasises considerations such as public amenity, route popularity, security, cost, user wait times, and demand management in selecting public charging station sites.

National coordination of public charging infrastructure installation encourages greater uptake and ensures equitable and affordable access to EVs. While private businesses are increasingly attuned to factors such as accessibility and public amenity, there remains an opportunity for enhanced national coordination in the deployment of public EV charging stations. Coordinated efforts at the national level can streamline the planning process, optimise resource allocation, and ensure the widespread accessibility of EV charging infrastructure. As the EV landscape continues to evolve, a cohesive and strategic approach is essential to meet the growing infrastructure demands of both businesses and the public.

Source: ARENA. For the Electric Highways Tasmania report see Electric Highway Tasmania 2023.

Funding available through the Driving the Nation Fund was increased from \$250 million to \$500 million in the 2022–23 Budget. The additional \$250 million in funding supports three initiatives:

1. **National EV Charging Network** – \$39.3 million to the National Roads and Motorists' Association (NRMA), who contributed matched funding, to deliver 117 chargers on key national highway routes.
2. ARENA grants – \$125.5 million to co-fund initiatives that reduce transport emissions, delivered under the **Driving the Nation Program**.
3. **Hydrogen Highways** – up to \$80 million co-invested with state and territory governments to decarbonise heavy road freight transport.

4.2.1 National EV Fast Charging Network

DCCEEW is partnering with the NRMA to deliver 117 fast chargers on major highways across the country. This partnership will develop a 'backbone' of fast charging infrastructure, located on major highways at an average interval of 150 km, owned and operated by the NRMA.

The chargers will be interoperable with all EVs and accessible by all motorists. The grant agreement with NRMA currently stipulates that the minimum charging rate for each grid connected site will be at least 75kW even when four cars are charging simultaneously.

The first site at Mudgee has been delivered with 360kW of charging capacity across four charging bays (90kW when four cars are charging simultaneously).

The second site at Mittagong has been delivered with a battery-integrated solution with 300kW of charging capacity across four charging bays (75kW when four cars are charging simultaneously), using a standard 27kW connection to the grid, with the remaining power from battery banks.

An additional seven charging stations have been rolled out recently in locations along the national highway network in the Northern Territory (four), South Australia (three).

This network will make use of innovative off-site charging solutions for remote locations, ensuring EV drivers can recharge while travelling long distances along remote routes (Box 2).

NRMA EV chargers were free to use up until 27 September 2023. Payment has now been introduced across the network. All 117 locations are expected to be operational by March 2026. NRMA expects that over 30 sites will be operational by mid-2024.

Box 2 Off-grid charging prototypes for deployment in remote areas

The National EV Charging Network will target investment in regional and remote areas, focussing on known black spots. This is expected to include several off-grid sites that will require a standalone power supply.

NRMA has begun testing an Australian-first, self-contained hybrid off-grid EV fast charging prototype in preparation for deployment at sites along remote areas, such as the Stuart and Eyre Highways. For example, a prototype was deployed during the 2023 Bridgestone World Solar Challenge car race at Eridunda, about 200km south of Alice Springs (Schmidt 2023).

These units involved the deployment of a remote energy solution designed to power up to two chargers across four charging bays. For example, a hybrid power system combining solar panels (30kW) with an 80kW battery and 50kW generator set can support two 50kW charging units. Further refinement of this design may occur subject to field testing.

The anticipated cost for initial installation of a remote charging unit is expected to be in the order of \$650,000 to \$700,000.

The prototypes are designed to be substantially powered by solar, with battery banks and backup diesel generators for enhanced reliability.

Source: DCCEEW.

4.2.2 National mapping of EV charging infrastructure

DCCEEW is leading work to develop a national mapping tool to identify optimal locations for the installation of fast and ultra-fast EV charging infrastructure across Australia. This tool will help guide government and industry investment through the prioritisation of zones for regional charging infrastructure.

While most Australian states and territories are implementing similar initiatives at a local level, a national map will help facilitate infrastructure, energy and telecommunications planning around EV charging, cross border certainty for EV drivers, and inform future investment.

Collaboration with governments and industry is underway, with a proof-of-concept mapping tool expected to be complete by mid-2024.

4.2.3 Minimum operating standards for government-supported public EV charging infrastructure

Collaboration with jurisdictions through the state and territory Implementation Group has resulted in the development of national minimum operating standards for government-supported public EV charging infrastructure. The standards give consideration (but are not limited) to payment methods, customer service and availability (uptime) of public EV chargers.

The minimum operating standards were developed to help ensure EV drivers have access to a convenient, reliable, affordable, and equitable national, public charging network. The standards were developed in collaboration with all state and territory governments and are based on national and international guidance. The standards apply to all government EV charging funding programs beginning from 1 January 2024.

4.2.4 Enabling EV uptake for residents in existing multi-residential buildings

In October 2022 Commonwealth, state and territory building ministers agreed to update the National Construction Code to ensure that new buildings are designed, constructed and fitted-out to enable the installation of renewable energy and EV charging. However, this does not apply to existing buildings.

While many people will regularly charge their EVs at home, this can be challenging for those living in existing, multi-residential buildings. The National EV Strategy included funding to undertake research to inform and enable EV uptake for residents of existing multi-residential buildings—helping to ensure all Australians can access the benefits of EVs, regardless of where they live.

The study is expected to deliver public guidance and tools to help governments, building owners, owners' corporations and occupants understand EV charging energy demand and management, safety requirements, costs, and optimal and rational charging solutions.

Guidance for policy makers and stakeholders is expected to be delivered by mid-2024.

Box 3 Challenges in rolling out EV charging

Progress continues to be made in rolling out public EV charging. With a significant number of charging locations now available, it is possible to draw some broad lessons based on experience.

Rolling out charging infrastructure to particular locations may include costs for network upgrades and connections that are higher than originally anticipated. In some situations, factors around electricity network connections, capacity and cost can result in delivery partners deciding to change sites, adopting different engineering solutions or changing the scope of the project.

Practical considerations such as the timeframes for gaining approvals by Distributed Network Service Provider (DNSPs) for upgrades, or to negotiate commercial agreements with the landlords for charging site locations, can also result in delays to project completion.

Government initiatives underway to help tackle some of these challenges are presented in [section 5: Electricity Consumption and Demand](#).

4.2.5 EV safety

Lithium-ion batteries are safely used in EVs around the world. Evidence and experience from regulators overseas indicate that EVs and EV batteries are less likely to catch fire than ICE vehicles. The electrical and fire safety of battery storage installation and EV infrastructure are regulated under electrical safety legislation and overseen by electrical safety regulators in each jurisdiction.

We know that globally, there is limited research, data and emergency response procedures to inform responses to EV related incidents. International collaboration on EV safety for emergency responders is emerging as a priority.

Under the National EV Strategy, work is underway on the development of world-leading guidance, demonstrations, and training for emergency service workers about EVs. Consultation to inform the content, structure and outcomes needed for emergency service workers within the training design is in progress. This includes engagement with relevant state

and territory bodies, emergency services organisations, industry and academia. The work will also be informed by research to understand international practices and lessons learnt about responding to EV incidents.

In addition, the Australian Building Codes Board continues to work on behalf of the Australian, state and territory governments, with fire services, the fire prevention and protection industries, professional engineers and the EV industry to find the best ways to support the ease and safety of EV charging in buildings.

4.2.6 Broader impacts of the EV transition

The National EV Strategy noted that, over the longer term, increasing uptake of more fuel-efficient cars and EVs is expected to slow the growth in fuel excise receipts (DCCEEW 2023). Similarly, as modelled in the 2023 Intergenerational Report, fuel excise as a share of gross domestic product is expected to fall due to the impact of increased EV penetration (Australian Government 2023).

The Treasurer announced on 1 December 2023 that the Commonwealth, states and territories will work together on long-term options for zero emission vehicles user charging through the Council on Federal Financial Relations.

This work falls within the responsibilities of Treasury.

4.3 Increasing the supply of affordable and accessible EVs

Encouraging the supply of a wider range of affordable and accessible EVs is essential to help meet growing consumer demand for EVs and is an important plank in helping the country transition to a decarbonised transport sector.

4.3.1 New Vehicle Efficiency Standard

The Australian Government has committed to introduce a **New Vehicle Efficiency Standard** for new, light vehicles. Although some 85 per cent of new cars sold worldwide are required to meet an efficiency standard, Australia is one of the only advanced economies without a new vehicle efficiency standard (also known as a fuel efficiency standard).

A New Vehicle Efficiency Standard seeks to reduce Australia's road transport greenhouse emissions and incentivises manufacturers to supply more low and zero emissions vehicles. Over time, this is expected to improve the supply and variety of EVs into the Australian market.

DITRDCA is leading development of a New Vehicle Efficiency Standard in collaboration with DCCEEW. More information is provided in DITRDCA's submission to the Committee.

4.3.2 Government fleet procurement

Another way in which governments are encouraging the supply of EVs to the Australian market is by focusing on the choice of vehicles purchased for use in government fleets. Government fleet procurement programs can provide manufacturers with greater confidence to commit EVs to the Australian market and help speed the development of a second-hand EV market.

The **Net Zero Australian Public Service by 2030** commitment includes a target that 75 per cent of new passenger vehicles procured for the Commonwealth fleet will be low emissions vehicles by 2025. The Government also signed the Zero Emission Government

Fleet Declaration in September 2022. The Declaration commits Australia to procuring 100 per cent zero emission vehicles in all vehicle classes (light, medium and heavy-duty) for government fleets by no later than 2035. For example, COMCAR is transitioning its fleet to EV technology.²

4.4 EV batteries, manufacturing and supply chains

The National EV Strategy recognised that Australia has the capability and capacity to develop manufacturing opportunities to support EV supply, including in component parts and batteries.

4.4.1 *Circular economy and stewardship*

An expanding EV industry presents an opportunity to embed circular economy principles in design, manufacturing and end-of-life management of EVs, to better enable efficient and high-quality repair, reuse and recycling. This could include through potential product stewardship actions and adopting traceability principles.

DCCEEW is investing in research as a first step in developing an EV and other large format battery recycling, reuse and stewardship initiative in Australia. The research has commenced and will be used to help inform future policies in this area.

More broadly, DCCEEW has carriage of a range of work relating to achieving a circular economy. All of Australia's environment ministers have agreed to work with the private sector to design out waste and pollution, keep materials in use and foster markets to achieve a circular economy by 2030. This builds on work to improve and harmonise waste management and recycling activities across Australia, including under the National Waste Policy.³ The National Framework for Recycled Content Traceability supports the sharing of recycled content information in supply chains. Recognising the growing international demand for traceability, including for EV batteries, the framework is intended to be compatible with existing international requirements to support Australian businesses to access these markets.

4.4.2 *Related work across government*

The National EV Strategy complements other government commitments benefiting all Australians, including the \$15 billion **National Reconstruction Fund**, the **National Battery Strategy**, and the **Critical Minerals Strategy** to support regional development and national sovereign capability. This work is being undertaken within the Industry, Science and Resources (DISR) portfolio.

Australia has abundant battery minerals, strong environmental, social and governance (ESG) frameworks and renewable energy penetration, and is a source of continuous research and development improvement and innovation. To support downstream battery manufacturing, the Government is committed to delivering the **Australian Made Battery Plan** (AMBP) led by DISR. Under the AMBP, the Government will:

² COMCAR provides car-with-driver transport services for parliamentarians, the Governor-General, the federal judiciary and international guests of government.

³ State and territory governments have primary responsibility for regulating and administering waste, including planning for waste management and waste avoidance, minimisation and reuse, licensing and regulation of waste transport, storage, treatment, resource recovery and disposal, and managing the impacts of waste management activities.

- Publish Australia's first National Battery Strategy to guide government and industry towards a shared vision of a diverse and competitive battery manufacturing industry.
- Establish the Australian Made Battery Precinct in collaboration with the Queensland Government.
- Deliver the Powering Australia Industry Growth Centre to support businesses to locally manufacture renewable technologies and commercialise local ideas.

4.5 Encouraging and increasing EV demand

Increasing demand for EVs will be supported as EVs become more affordable and the range of models from which people can choose continues to grow.

Key Australian Government actions to support this objective include **Electric Car Discount** amendments to fringe benefit tax and import duty, and support for green car loans through the CEFC. Depending on the state or territory where a vehicle is registered, a consumer can be eligible for additional financial support provided by state and territory governments.

4.5.1 *Electric Car Discount*

The Electric Car Discount was introduced in 2022, providing a fringe benefits tax exemption for eligible cars made available for employees by employers, commonly through salary packaging. Indicative vehicle finance industry estimates suggest around 40 per cent of salary sacrificing arrangements were being used to purchase EVs at the end of 2023, up from around 2 per cent in early 2022.

The Electric Car Discount applies to only EVs priced below the Luxury Car Tax threshold for fuel efficient vehicles. For an electric car valued at about \$50,000, the exemption saves an employer up to \$9,000 a year or an individual using a salary sacrifice up to \$4,700 a year. Leasing an EV like a Nissan Leaf can now cost less month-to-month than leasing a similar petrol vehicle, like a Mazda 3.

The fringe benefits tax exemption is complemented by the removal of the five per cent import tariff, helping make EVs below the luxury car tax threshold more affordable.

The Electric Car Discount is administered by Treasury.

4.5.2 *Clean Energy Finance Corporation Green Car Loans*

In addition to the Electric Car Discount, the Australian Government, via the CEFC, is working across the economy to accelerate investment in finance for fleet and residential electric vehicles.

Since the launch of the National EV Strategy, the CEFC has helped finance more than 1,700 EVs for the period to 31 December 2023. This included offerings via a range of co-financing programs supporting EV uptake for both households and businesses, including a \$20 million commitment to support EV rideshare fleets, an \$80 million dollar commitment into a Clean Green Cars loan program and a \$20.5 million commitment to make green car loans cheaper.

5 Electricity consumption and demand

The Australian Energy Market Operator (AEMO) identifies electrification as a critical enabler for multiple domestic sectors—including transport—to reach net zero emissions. The Government is working to make the electricity system ready for significant electrification needed to achieve our emissions reduction targets of the transport sector. Decarbonising Australia's electricity grid will be the cornerstone of this transition. The Government's commitment to a national renewable energy target of 82 per cent by 2030 will help achieve its legislated emissions reduction target of 43 per cent by 2030 and set Australia on the path to net zero by 2050.

Central to this is the Government's Powering Australia Plan and Net Zero Plan.

5.1 Powering Australia Plan

The Powering Australia Plan is focused on creating jobs, reducing pressure on energy bills and lowering emissions by boosting renewable energy. The plan supports enabling requirements for increased electrification, including renewable energy generation, storage projects, and transmission infrastructure.

5.1.1 *Rewiring the Nation*

A centrepiece of this plan is **Rewiring the Nation**, a \$20 billion dollar program to make clean energy more accessible and affordable for Australian consumers. The program will modernise Australia's electricity grid by investing in new transmission lines to deliver affordable, reliable renewable energy to cities, towns and regional communities.

The program will see the Government partner with industry and provide low-cost finance to government and industry to support the upgrade of Australia's electricity grids, ensuring cheaper, more reliable electricity for homes and businesses. It will unlock critical transmission and Renewable Energy Zone projects; creating thousands of new energy jobs; and delivering energy that is more reliable, secure and affordable across the east coast of Australia.

5.1.2 *National Energy Transformation Partnership*

The **National Energy Transformation Partnership** (the Partnership) is a framework for state, territory and Commonwealth governments to work together on reforms to help transform Australia's energy system to achieve net zero by 2050. The Partnership works to identify opportunities for greater electrification and to address implications for energy networks, including meeting increased demand from electrification.

The Partnership signifies a common commitment by governments to achieve net zero and decarbonise Australia's energy sector during a time of unprecedented change and global challenges.

The Partnership provides additional certainty to support investment in renewables, storage and transmission. It also ensures the economic opportunities from the clean energy transformation are realised for Australian households, businesses and communities.

5.1.3 *First Nations Clean Energy Strategy*

In 2022, the Partnership committed to developing a First Nations Clean Energy Strategy as a priority. The purpose of a national First Nations Clean Energy Strategy is to recognise First

Nations people as essential partners in the clean energy transformation and ensure they can lead, participate in and benefit from a once-in-a-lifetime economic, social, technological and industrial transformation. Many First Nations communities are at the forefront of the impacts of climate change, as well as experiencing unreliable and unaffordable power.

Australian census data showed that most Aboriginal and Torres Strait Islander people resided outside of major cities (Australian Bureau of Statistics, 2022). There is a great deal of attention focused on urban communities and commuters and the benefits of electrification of the transport sector for those energy consumers. More research and planning are required to remove barriers for the adoption of EVs in regional and remote Australia to ensure a just and fair energy transition where no one is left behind. This need is even more pronounced in First Nations communities, who face additional barriers to energy equity.

5.1.4 Capacity Investment Scheme

The Capacity Investment Scheme (CIS) provides a national framework to support new investment in renewable capacity, such as wind and solar, as well as clean dispatchable capacity, such as battery storage.

The CIS involves a competitive tender for renewable capacity and clean dispatchable capacity projects. It aims to drive around \$67 billion in investment to deliver an additional 32 GW of capacity by 2030, fill expected reliability gaps as ageing coal power stations exit, and deliver the Australian Government's 82 per cent renewable electricity by 2030 target. The CIS will help ensure Australia has an ongoing supply of cheap affordable, renewable, domestically produced energy.

5.1 Integrating EVs into the Electricity Grid

As EV uptake progresses, additional electricity supply will be needed to charge these vehicles. AEMO's 2023 Electricity Statement of Opportunities (ESOO) projects the electrification of transport will lead to more than 80 TWh of additional demand in the National Electricity Market by 2050–51. This projected consumption of more than 80 TWh by EVs by 2050 is forecast to contribute 55–66 per cent of total electrification and equates to almost half of today's total operational consumption in the National Electricity Market.

Many EV charging infrastructure proponents have experienced network connection challenges to installing EV charging infrastructure. Work is underway across government and industry to improve how networks are monitored and managed, and to speed up new network connections.

In addition to decarbonising Australia's electricity grid, optimising use of electricity infrastructure and enabling demand flexibility are opportunities to support electrification of transport. If all EVs were to charge during peak usage periods, significant expansion of network infrastructure would be needed to meet charging demand. However, substantial savings from avoided network augmentation could be realised if the additional load from EV charging is better aligned with periods of low network utilisation. There is also opportunity for EVs to improve performance of the grid by using vehicles for grid support services.

To realise these opportunities, broad foundational reform is needed to support managed charging. Potential measures to encourage managed charging and mitigate the impacts of unmanaged charging could include data sharing arrangements, tariff and incentive design, device interoperability, and markets/platforms for decentralised power trading. In addition to the potential benefits of managed charging, further value for consumers and the grid can be

obtained by incentivising the smart-readiness of ecosystems through minimum communication and control requirements.

The Consumer Energy Resources (CER) Taskforce and interjurisdictional CER Working Group (CERWG), in collaboration with market bodies and industry, are progressing reforms to efficiently integrate EVs with Australia's electricity grid and avoid significant expenditure in network augmentation and new electricity generators.

5.1.5 National Consumer Energy Resources (CER) Roadmap

In November 2023, Energy Ministers agreed to develop a *National CER Roadmap – Powering Decarbonised Homes and Communities*. This includes establishment of a CER Taskforce to deliver priorities under the Roadmap and unlock consumer benefits for locally generated and stored power. The CER Taskforce will deliver national reforms for efficient and effective CER integration, deliver on emissions and renewable energy commitments, and drive positive outcomes for all consumers and the system.

The National CER Roadmap builds on the former Energy Security Board's CER Implementation Plan and incorporates the EV integration work plans. It will maximise the benefits and opportunities of increasing EV usage. The Commonwealth, state and territory governments are working with Market Bodies to progress these reforms through a dedicated CER Taskforce that will be supported by a stakeholder reference group. Energy and Climate Change Ministers will consider the National CER Roadmap and implementation plan for reforms at their July 2024 meeting.

5.1.6 Consumer Energy Resources Working Group (CERWG)

The CERWG is one of 14 working groups formed under the National Energy Transformation Partnership. Its role is to support the integration of CER, including EVs, into markets and electricity networks to benefit the system and provide increased value to consumers.

The expected growth of EV sales in Australia has implications for CER and demand flexibility. Treating EVs as energy resources—not just transport assets—may allow greater capacity to voluntarily coordinate charging and discharging of these vehicles. Through smart charging infrastructure and vehicle-to-grid (V2G) capabilities, the charging capacity of EVs can be dynamically adjusted to support the grid—charging at higher capacity when renewable generation is high and charging at lower capacity or even discharging to the grid during tight market conditions. This flexibility is expected to be important for managing peak electricity demand, reducing stress on the grid, and optimising energy consumption patterns. In turn, this will lower the cost impacts of EVs on all consumers' bills and may provide a source of income for EV owners participating in demand flexibility or V2G programs.

In December 2022, Commonwealth, state and territory Energy and Climate Change Ministers agreed to progress work in four priority areas for reform to ensure Australia's electricity system is ready for the rapid adoption of EVs. The work plans aim to:

- deliver nationally consistent and, where possible, internationally aligned standards and communications protocols for EV supply equipment (EVSE), cybersecurity, and smart functionality in Australia
- establish a common mechanism for EVSE data sharing
- nationally align Service and Installation Rules for charging infrastructure

- streamline network connection processes for consumer energy resources, including EVSE.

These areas of reform are foundational enablers to put Australia on a pathway to successfully achieve EV grid and market integration.

5.2 Establishing the foundations for future opportunities of the EV transition

Although transitioning to EVs will increase electricity demand, there are also considerable opportunities for consumers and the energy system due to EV battery storage capabilities. Accessing this battery capacity while vehicles are connected to the grid offers considerable flexibility. Taking advantage of this opportunity requires investment in communications and digital infrastructure as well as changes in market design and regulation.

Over time, EVs have the potential to provide valuable grid services and play an active role in the transformation of Australia's energy system. At the same time, they offer opportunities for consumers to directly share in the benefits of this transition.

The reforms being progressed under the CER Roadmap and CERWG are helping to put in place the foundations that will allow the grid to not only support the transition to EVs, but also to take advantage of opportunities they provide in terms of influencing demand on the grid and leveraging the potential of EVs to provide grid services.

The adoption of smart charging at home, for example, enables EV owners to set the timing of their charging. This can provide grid benefits in terms of scheduling charging to avoid peak periods, and consumer benefits in terms of taking advantage of lower cost off-peak tariffs. Learnings from ARENA smart charging projects highlight the potential for EV owner behaviour to benefit both consumers and the grid.

Box 4 Learnings from ARENA-funded projects on smart charging

Early findings from ARENA-funded projects demonstrate that once smart charging is installed, EV owners are willing to adopt smart charging behaviours. This includes shifting charging to off-peak periods and allowing for control of their charging, in response to tariffs or other incentives. In the Origin EV Smart Charging Trial, Origin implemented a fixed and variable reward mechanism to incentivise control. Origin found that participants responded strongly to the incentives. The positive response to these incentives underscores the potential for well-designed reward structures to drive meaningful changes in consumer behaviour.

Source: ARENA 2023d

There is also considerable potential for V2G to support the energy transition. AEMO's 2023 ESOO projects 10.7 GW of EV battery capacity will be participating in V2G arrangements by 2050–51. For comparison, AEMO reports that all existing, committed and anticipated grid-scale battery capacity in the NEM amounts to 6 GW.

Box 5 ARENA's V2X Study

ARENA's V2X.au study modelled and quantified the benefit of treating EVs as a CER, finding that Australia's EV fleet has the potential to be the lowest cost storage resource in our energy transition. Making use of V2G technology, that is, treating an EV as a storage resource to support the grid via bi-directional charging, will aid in stabilising Australia's changing energy grid. This is why EVs in this context are colloquially referred to as "batteries on wheels".

Beyond grid support, the implementation of V2G presents an avenue for EV owners to reduce total cost of ownership. Once established, V2G will allow consumers to significantly reduce electricity costs and participate in Frequency Control Ancillary Services (FCAS) markets. This provides EV owners and opportunity to generate revenue through grid stabilising services, contributing to support the grid in times of need, and lower costs for everyone (not just themselves).

Source: ARENA 2023c

5.2.1 *Broader links across government*

The transition to EVs presents a significant opportunity to develop new jobs and skills in Australia. Across the supply chain, from manufacturing through to maintenance, new skills will be needed to support the rollout of EVs.

For example, the New Energy Apprenticeships and New Energy Skills Program is being delivered by the Department of Employment and Workplace Relations. Around 10,000 people have been supported under the New Energy Apprenticeship Program (The Hon Brendan O'Connor MP 2023).

6 References

- Australian Bureau of Statistics (ABS) (2022). Aboriginal and Torres Strait Islander people: Census. Accessed March 13, 2024.
- Australian Energy Market Operator (AEMO) (2021) Distributed Energy Integration Program Electric Vehicles Grid Integration: Vehicle-Grid Integration Standards Taskforce – Key Findings, AEMO website, accessed 12 March 2023.
- Australian Energy Market Operator (AEMO) (2022) 2022 Integrated System Plan – June 2022, AEMO website, accessed 25 January 2023.
- Ausgrid (20 December 2022), Australia's first power pole mounted EV charger installed in Newcastle, Ausgrid, accessed 29 February 2024.
- Australian Automobile Association (AAA) Transport *Affordability index*, AAA website accessed 10 January 2024.
- Australian Government (2023) *Intergenerational Report 2023: Australia's future to 2063*, treasury.gov.au, accessed 6 March 2024. Australian Renewable Energy Agency (ARENA) (2023) ARENA targets better, more frequent EV charging stations, arena.gov.au, accessed 1 March 2024.
- Australian Renewable Energy Agency (ARENA) (2023) V2X.au Summary Report Opportunities and Challenges for Bidirectional Charger in Australia, arena.gov.au, accessed 29 February 2024.
- Australian Renewable Energy Agency (ARENA) (2023d) Origin Energy Electric Vehicles Smart Charging Trial, arena.gov.au, accessed 29 February 2024.
- Bieker G (2021) A global comparison of the life-cycle greenhouse gas emissions of combustion engine and electric passenger cars, theicct.org, accessed 29 February 2024.
- Bloomberg New Energy Finance (BNEF) (2024) database. Accessed via online subscription 14 March 2024.
- Bureau of Infrastructure, Transport and Regional Economics (BITRE)(2016), Road Trauma Australia: 2015 Statistical Summary, available from the BITRE website.
- Centre for Population (2023) Centre for Population Projections, population.gov.au, accessed 1 March 2024.
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023a) National Electric Vehicle Strategy, dcceew.gov.au, accessed 29 February 2024.
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023b) Australia's emissions projections 2023 [data set], dcceew.gov.au, accessed 29 February 2024.
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023c) Australia's emissions projections 2023, dcceew.gov.au, accessed 1 March 2024.
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023d), Australian Energy Statistics, September 2023. <https://www.energy.gov.au>, accessed 15 March 2024.
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) (2022) Australian Infrastructure and Transport Statistics Yearbook 2022, bitre.gov.au, accessed 5 March 2024.

- Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) (2024) *The Australian Government is introducing a New Vehicle Efficiency Standard for cleaner and cheaper-to-run cars*, infrastructure.gov.au, accessed 29 February 2024.
- Department of Finance (2023) *APS Net Zero Emissions by 2030*, finance.gov.au, accessed 29 February 2024.
- Electric Highway Tasmania P/L (2023) *Electric Highway Tasmania, Hobart EHT Fast Charger Network Project: Lessons Learnt 3*, report to the Australian Renewable Energy Agency, Electric Highway Tasmania, accessed 29 February 2024.
- Electric Vehicle Council (EVC) (n.d.), *Is there enough charging infrastructure to support electric vehicles in Australia?*, EVC, accessed 1 March 2024.
- Electric Vehicle Council (EVC) (n.d. b) *Will I save money by owning an electric vehicle in the long run?*, EVC accessed 12 March 2024.
- Electric Vehicle Council (EVC) (2022) *State of Electric Vehicles*, EVC, accessed 29 February 2024.
- Electric Vehicle Council (EVC) (2022b) *Insights into electric vehicle ownership: a survey of Tesla Owners Club Australia members in partnership with the Electric Vehicle Council*, EVC website, accessed 25 January 2023.
- Electric Vehicle Council (EVC) (2023a), *Australian Electric Vehicle Industry Recap 2022*, EVC, accessed 27 February 2024.
- Electric Vehicle Council (EVC) (2023b), *State of Electric Vehicles: July 2023*, EVC, accessed 27 February 2024.
- Electric Vehicle Council (EVC) (2024), *Australian Electric Vehicle Industry Recap 2023*, EVC, accessed 15 March 2024.
- Federal Chamber of Automotive Industries (FCAI) (2023a) 'VFACTS National Report: New Vehicle Sales', *June 2022*, NATJUN22, FCAI, accessed 1 March 2024.
- Federal Chamber of Automotive Industries (FCAI) (2023b) 'VFACTS National Report: New Vehicle Sales', *December 2022*, NATDEC22, FCAI, accessed 1 March 2024.
- Federal Chamber of Automotive Industries (FCAI) (2024a) 'VFACTS National Report: New Vehicle Sales', *December 2023*, NATDEC23, FCAI, accessed 1 March 2024.
- Federal Chamber of Automotive Industries (FCAI) (2024b) 'VFACTS National Report: New Vehicle Sales', *February 2023*, NATFEB24, FCAI, accessed 6 March 2024. Schmidt B (25 October 2023) *NRMA's prototype off-grid electric vehicle charger deployed during solar car race ahead of national network rollout*, mynrma.com.au, accessed 29 February 2024.
- Schofield R, Walter C, Silver J, Brear M, Rayner P and Bush M (2017), *Submission of the 'Better fuel for cleaner air' discussion paper*, National Environmental Science Programme, available from the Clean Air and Urban Landscapes Hub website accessed 14 March 2024
- Smit R and Kennedy D (2022) *'Greenhouse gas emissions performance of electric and fossil-fuelled passenger vehicles with uncertainty estimates using a probabilistic life-cycle assessment'*, *Sustainability*, 14(6): 3444. Accessed 14 March 2024.

The Hon Brendan O'Connor MP (20 February 2023) *New Energy Apprenticeships to power Australia's path to net zero* [media release], Australian Government, accessed 1 March 2024.

US Department of Energy (n.d.) *All-electric vehicles*, US Department of Energy website, accessed 25 January 2023.

Walter, C., and Say, K., (2023) *Expert Position Statement: Health impacts associated with traffic emissions in Australia*. Accessed 14 March 2024.