Submission No 88

INFRASTRUCTURE FOR ELECTRIC AND ALTERNATIVE ENERGY SOURCE VEHICLES IN NSW

Organisation: AECOM

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Legislative Assembly Committee on Transport and Infrastructure

Inquiry into Infrastructure for electric and alternative energy source vehicles in NSW - AECOM submission

Australia must embark on a purposeful, ongoing journey to deliver policy frameworks, regulations, and infrastructure necessary to fuel the next decade of rapid and consistent adoption of Electric Vehicles (EVs). By 2030, more than half of all new cars sold in New South Wales (NSW) will be electric; therefore, NSW needs a sustained effort to ensure the supporting infrastructure is in place.

A holistic approach to EV adoption will be crucial to achieving a swift and sustainable transition at scale. Priorities for consideration will be the effective implementation of commercial and residential charging infrastructure, supporting individual users and families as well as larger commercial or civic fleets, how to safely embed electric micro-mobility modes in the transport landscape, the transition to zero emission bus (ZEB) fleets, and how a low-carbon fuel sector will support electrification broadly.

AECOM is at the forefront of Electric Vehicle transition projects, programs and thought leadership in Australia and internationally, leveraging the skills and experience of an integrated team of tens of thousands of transport, energy, sustainability, engineering, natural and built environment specialists.

In Australia, AECOM has delivered projects supporting the Electric Vehicle transition in New South Wales, Victoria, Australian Capital Territory, Queensland, Western Australia, South Australia and Tasmania. We work extensively globally with government agencies and asset owners to support the transition to zero emission vehicle technologies, electric vehicle adoption and infrastructure delivery.

Our teams have delivered countless EV projects from individual charging sites to broad EV strategies, electric micro-mobility deployments and hydrogen vehicle feasibility studies. Our work is varied and has assessed impacts on transport networks, resources, waste, market dynamics and the power grid.

Our recommendations

Our submission sets out several key recommendations to accelerate the Electric Vehicle transition in New South Wales and to ensure that appropriate supporting infrastructure is in place.

Our recommendations are grouped into the following categories, with further details of each recommendation provided in our submission:

1. **Delivering the right infrastructure (5 recommendations)**
2. **Tackling Heavy Vehicles (7 recommendations)**
3. **Utilising existing infrastructure and ensuring market competition (4 recommendations)**
4. **Transition measures (3 recommendations)**

Our experience

Our team is focused on delivering Electric Vehicle transition planning advice, feasibility studies, infrastructure design and delivery support that goes beyond traditional Electric Vehicle horizons to consider the environmental impact of transition, circular economy and the role of low-carbon fuels in the electrification puzzle. We have a strong understanding of how best to navigate the intricate balance between risk and opportunity across technology, infrastructure and innovation.

Our recent project experience relevant to this inquiry includes:

- An electric vehicle infrastructure strategy for a major Australian airport
- A feasibility study for the transition of a heavy vehicle fleet in the Australian Capital Territory
- An EV charging infrastructure investment framework for the ACT region
- The business case for EV charging points at the Australian National Parliament House
- A National Road Freight Electrification Strategy for the Australian Renewable Energy Agency
- An electric vehicle infrastructure feasibility study for Hobart
- Technical Advice, Feasibility Studies, Design and Delivery support for ZEB depots in Sydney, Brisbane, Melbourne and globally
- Experience in 150+ Electric Vehicle Fleet conversions across North America alone.

Our response to this Inquiry has been informed by our work across the transportation, energy, environment and sustainability sectors, from private vehicle travel to transit to goods movement, and partnerships with cities, states, federal/ national governments, utilities, transit agencies, fleet and infrastructure owners. We have undertaken significant independent, objective research and analysis on electric vehicle charging infrastructure and fleet/ vehicle transitions in Australia and globally.

We are committed to supporting Australia's transition to Electric Vehicles and welcome further opportunities to discuss the recommendations and case studies in this submission.

Yours faithfully

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AECOM

INQUIRY INTO INFRASTRUCTURE FOR ELECTRIC AND ALTERNATIVE ENERGY SOURCE VEHICLES

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1 Current state of the market: the transition to electric vehicles

1.1 Moving past the hype

The Electric Vehicle (EV) transition in Australia began slowly in global terms. While globally, 20% of all new vehicles sales are EVs[1], in Australia, this figure was only 9.5%[2]. Despite this disparity, EV adoption in Australia has seen rapid growth. Amongst light vehicles, EV sales have nearly tripled year on year since 2022. Within this promising national trend are standout regional growth trends, for example, in the ACT, where 25% of new car sales in 2023 were electric vehicles, with NSW reporting a figure of just over 9%[3].

The nation's electric vehicle charging infrastructure is also being delivered at a faster pace than ever before. Nationally high-power public EV chargers increased 90% in the year up to June 2024[4]. Today, the total number of high-power public EV charging sites is now 558, and over 100 of these are 'ultra-fast'. Despite this, significant work must be done to accelerate adoption and uptake. For instance, Norway, which has one of the highest EV adoption rates worldwide, has over 6,700 publicly available fast chargers[5]. The Federal Government and all state and territory governments have adopted strategies that support more public EV charging sites across the country[6], so these numbers will continue to grow as EVs become more and more common. A summary of the State and Federal EV charging infrastructure programs is presented in Figure 1.

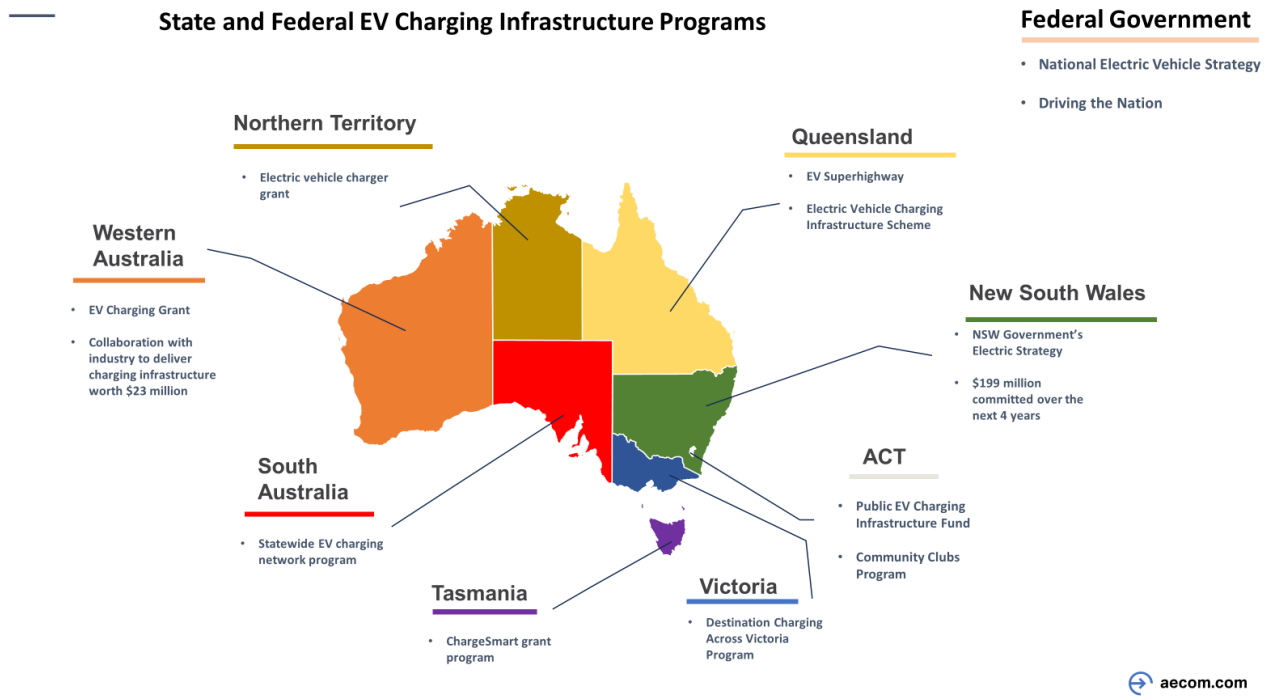


Figure 1 EV charging infrastructure programs

[1] *Global EV Outlook 2024, IEA, 2024 https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars*

[2] *Electric Vehicle Council. State of Electric Vehicles. July 2024.*

[3] *Electric Vehicle Council. State of Electric Vehicles. July 2024.*

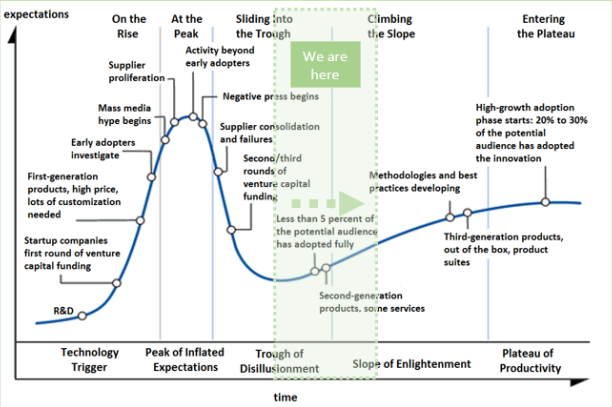
[4] *Electric Vehicle Council. State of Electric Vehicles. July 2024.*

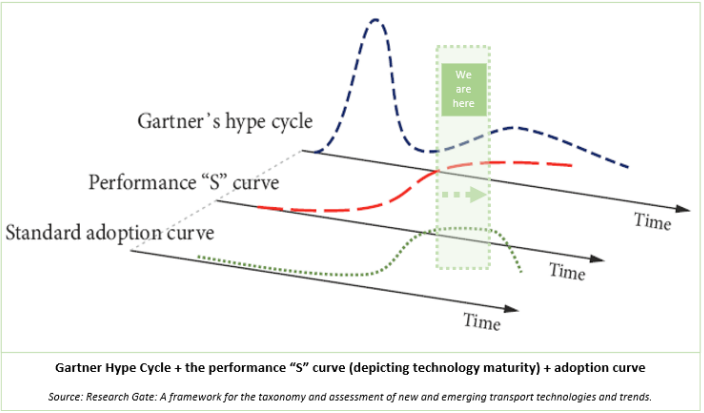
[5] *International Energy Agency - https://www.iea.org/reports/global-ev-outlook-2022/trends-in-charging-infrastructure*

[6] *Electric Vehicle Council. State of Electric Vehicles. July 2024.*

We can map the EV adoption and uptake to the Gartner Hype Cycle to illustrate how Australia has increasingly moved beyond the initial 'hype' phase of adopting EVs and has shifted to a more considered consistent phase of growth and adoption (Figure 2).

Electric Vehicles in ANZ: Market Maturity, Adoption and Performance





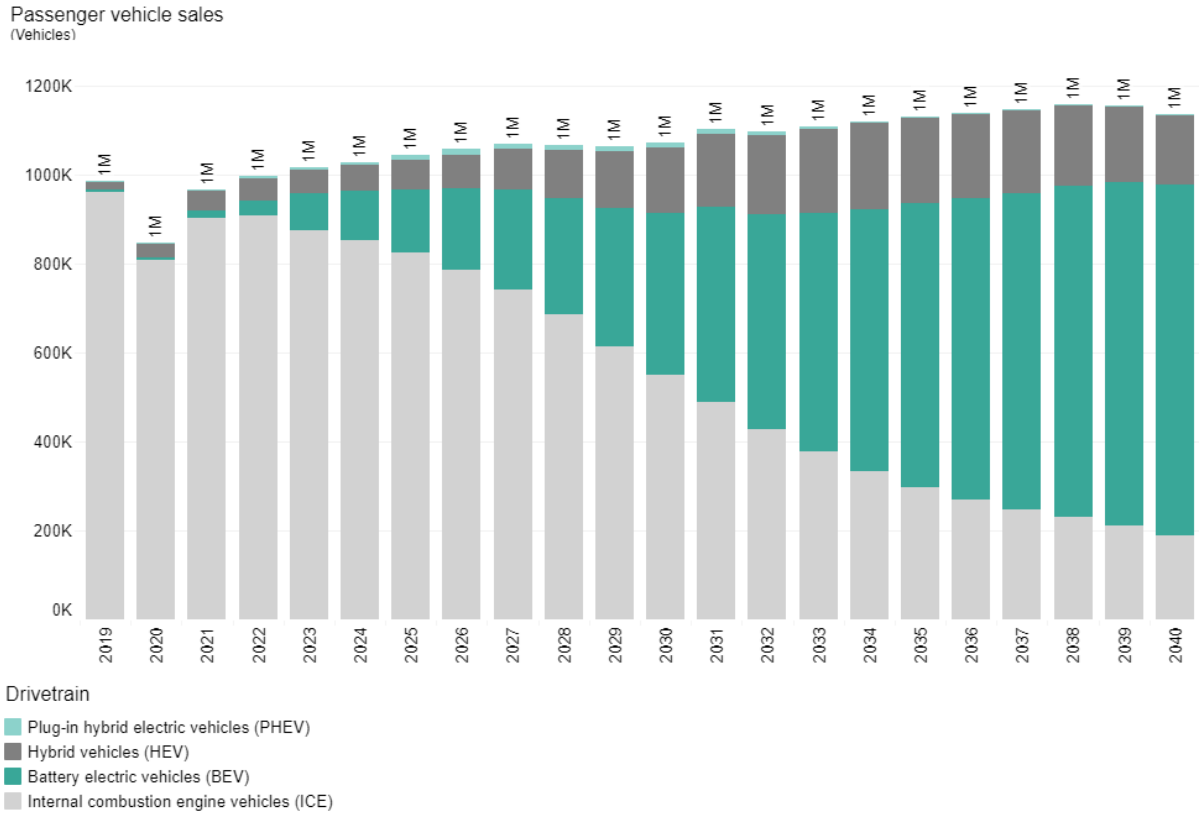
Gartner Hype Cycle + the performance "S" curve (depicting technology maturity) + adoption curve

Source: Research Gate: A framework for the taxonomy and assessment of new and emerging transport technologies and trends.

Figure 2 EV adoption in Australia on the Gartner Hype Cycle

Market data confirms this, indicating consistent growth in the sale of new EVs, with forecasts predicting EVs will overtake internal combustion engine (ICE) vehicles by the early to mid-2030s (Figure 3). However, as the sector and technology are still emerging, there is still a need to pull multiple levers (market supply, infrastructure, consumer confidence) to maintain further growth. Government can play a role in supporting these levers to facilitate stability in the ongoing growth and adoption of EVs, which in turn will help address broader issues of sustainability, climate change and the drive to net zero emissions.

Figure 3 Passenger EV sales forecasts for Australia (Based on current trends)



Source: Bloomberg NEF, June 2023

1.2 Addressing our Emissions

The Commonwealth Department of Climate Change, Energy, the Environment and Water released Australia's emissions projections in November 2024. Australia's transport sector, encompassing road, aviation, rail, shipping, and other activities, emitted an estimated 98 Mt CO_2-e in 2024. Road transport, including passenger vehicles (PVs), light commercial vehicles (LCVs), trucks, buses, and motorcycles, is the primary contributor, as illustrated in

Figure 4.

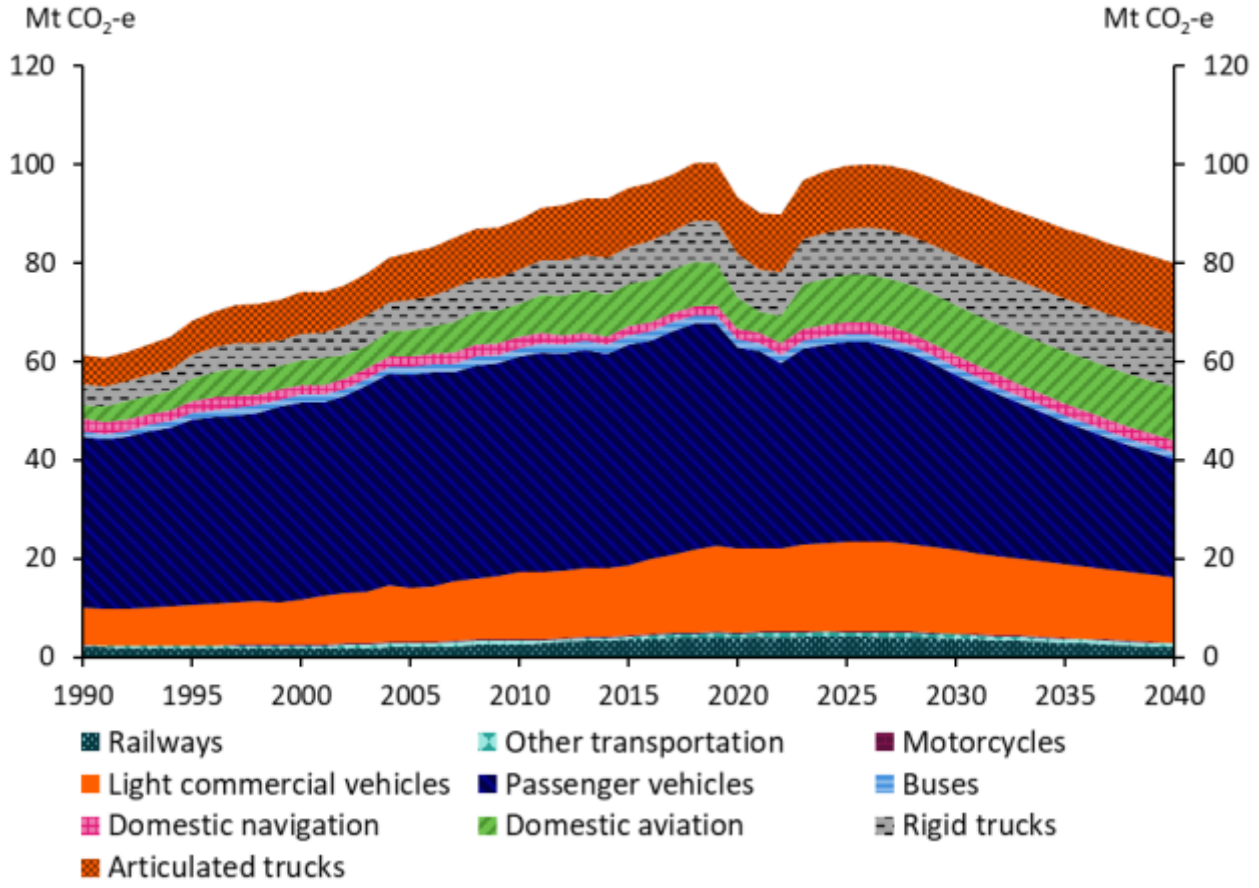


Figure 4 Transport emissions

Source: Australia's emissions projections, 2024

In 2024, Australia's transport sector emitted 98 Mt CO_2-e, with emissions projected to decline by 3% to 95 Mt CO_2-e by 2030 and by 19% to 80 Mt CO_2-e by 2040, remaining below pre-COVID-19 levels due to stabilised activity and entrenched post-COVID habits.

While the New Vehicle Efficiency Standard (NVES), legislated in May 2024, will drive significant emissions reductions in light vehicles from 2025, contributing most to the decline, rail emissions are also forecast to decrease by 2040 through efficiency gains and fuel switching. However, rising demand is expected to increase emissions from domestic aviation and heavy road vehicles, though low-emission fuels and efficiency improvements will mitigate the growth rate.

In this context, taking a targeted approach to Electric Vehicles has never been more needed. Recognising that while there will be more work to progress the transition of passenger vehicles, direct and focused effort is needed to transition a number of key sectors within the Transport industry.

1.3 Electric Vehicle use cases: far more than just private cars

When considering how best to support the adoption of EVs, it is important to adopt a holistic definition of EV use cases, as discussions often tend towards using EV as a synonym for private vehicles.

However, the role of EVs is broad, with many viable use cases, The EV market covers a range of vehicle types and modes: heavy and light goods vehicles, buses, fleet vehicles, emergency service vehicles, industrial/plant vehicles, motorcycles, scooters, and bicycles.

In terms of infrastructure, public EV charging facilities are primarily used to service private cars – with other types of electric vehicles requiring other infrastructure solutions. Either privately by their operators, or via specialised public infrastructure (such as heavy vehicle charging stations). Facilitating the full-scale transition to EVs requires a broad view of what EVs are and the infrastructure required to service and encourage their broader use.

The use cases can be grouped largely into four core vehicle typologies/user groups (Table 1). Each of these would benefit from ongoing NSW Government consideration. Each offers important and distinct opportunities to reduce carbon emissions from the transport sector and contribute valuable lessons inherent to the EV transition.

Table 1 EV focus areas

	Opportunities	Barriers
Government/ Corporate Fleets	• Ability to leverage buying power of large fleets to scale imports and shift market dynamics. • Shorter hold times allow for more rapid transfer of EVs to second-hand markets	• Infrastructure requirements for fleet depots can be challenging. • Operational and contractual requirements must be understood.
Personal EV's	• Ability to leverage public support and other levels of government to support on-street charging.	• Up to 35% of households do not have access to off-street parking. • Strata and apartment buildings are difficult to install charging infrastructure
Heavy vehicles	• Potential to address sub-sector responsible for 4% of national emissions[7] • Potential to reduce cost of transport for goods	• Current market supply highly limited • Require specialised assessments/ designs of supporting infrastructure
Public Transport Fleets	• Ability to leverage government procurement. • Potential to further develop local manufacturing. • User improvements for agencies (reliability/ maintenance) and end users (ride quality, noise)	• Additional investment is needed to improve manufacturing capability. • Fleet replacement requires significant capital investment. • Depot conversions can be technically challenging
Micro-Mobility ***(e.g. E-Bikes)***	• Highly scalable due to lower costs • Lowest production/operating emissions profile • Higher potential to locally manufacture. • Potential to exceed current bicycle usage rates. • Potential to grow local mobility industry/jobs via shared operators	• Limited oversight on battery quality • Limited support for adoption • Bicycle network infrastructure needed to support increased usage

[7] *Department of Climate Change, Energy, The Environment and Water - https://www.dcceew.gov.au/sites/default/files/documents/australias-emissions-projections-2022.pdf*

1.4 NSW leading the way

As with many facets of the Australian transport sector, NSW has already taken the lead in many of these areas, with important developments occurring in both the realm of policy, as well as delivering real world programs for change.

	Policy and Strategy Context	Programs of delivery
Government/ corporate fleets	• NSW Electric Vehicle Strategy	• NSW Government Fleet Transition Plan • Drive electric NSW EV fleets incentive
General EV charging	• NSW Electric Vehicle Strategy	• EV fast charging grants • EV kerbside charging program • Electric Vehicle ready buildings program
Heavy vehicles	• Towards Net Zero Emissions Freight Policy	• NSW zero emission heavy vehicle access trial
Public transport fleets	• Zero Emission Bus Transition Strategy	• 11 Greater Sydney bus depot conversions in delivery (stage 1) • ~10 Greater Sydney Bus depot conversions in Final Business Case Preparation (stage 2) • Regional Zero Emission Bus Trials
Micro-mobility	• NSW Active Transport Strategy	• E-micromobility Action Plan
Alternative Energy	• NSW Hydrogen Strategy	• NSW Renewable Fuel Scheme • Funding 3 hydrogen hubs and upskilling • Providing concessions for hydrogen producers

2 Delivering the right infrastructure

Term of Reference 1

Funding and location of electric vehicle chargers or infrastructure for other potential energy fuel sources

2.1 Systems and infrastructure to support the transition to EVs

Despite improvements to the wider EV ecosystem across Australia, infrastructure delivery remains a critical piece of the transition puzzle. Australia as a whole has struggled to develop at a pace to stay ahead of adoption and reduce barriers to users, both perceived and actual.

Without a considered and structured approach to supporting EV infrastructure nationally, our transition to an EV future will remain lagging behind others around the world. However, infrastructure provision can also be a key tool to growing and accelerating our EV transition through a considered and rigorous process that directs investment and decision-making towards a network developed to help unlock future growth.

2.2 Infrastructure ownership considerations

Key to delivering this infrastructure is the need to support and empower infrastructure owners to undertake the variety of work necessary to facilitate EV infrastructure. In doing so the NSW government should focus on three core use cases of charging provision. These being:

1. **Publicly accessible charging infrastructure**
2. **Privately accessible charging infrastructure**
3. **Infrastructure for Heavy Vehicles**

2.3 Publicly available charging infrastructure

As EV ownership grows, so does the need for comprehensive public charging networks. While at-home and workplace charging will play large roles in everyday charging patterns. The ability to charge on the go via publicly accessible sites is an important part of the equation, particularly to build greater confidence among the public.

While improvements are being made publicly available, charging infrastructure remains limited and presents an ongoing barrier to broad-based social acceptance of EVS. Upgrading public charging infrastructure along key routes/trip origins and destinations will:

- **Support a wide range of trips and users that find charging at home/destinations difficult** – including supporting about 35% of households without access to potential home-based charging due to lack of garaging, or inability to install infrastructure[8].
- **Improve awareness and build consumer confidence through increased visibility and availability**.

This second point is an often-underrepresented component of the EV transition. Consumers have high confidence in the ability to fuel ICE vehicles owing to the highly visible nature and well-understood network of petrol stations. EV charging networks are thus viewed in contrast to the status quo and will likely need to provide, at minimum, a comparable level of visibility to raise confidence in the minds of the Australian consumer.

The rollout of public charging infrastructure will most likely fall into two categories, being provided via both.

1. **Public destinations** – focused on large sites with high travel demand (at least initially).
2. **Public streets** – With priority for residential/ mixed-use precincts with limited off-street parking supply and/or in or near key centres and major trip origins and destinations.

Delivering this charging infrastructure will require direct engagement and support to key infrastructure owners. Stimulus funding can help state and territory governments, councils and utility operators, or major destinations to add chargers and charging infrastructure at or near publicly owned assets such as in parking stations, service stations, and at major origins and destinations such as town centres, shopping centres, hospitals and airports that can, in turn, serve as linchpins for new revenue streams for both public and private organisations.

However, while the benefits of providing EV infrastructure at these sites are clear, our experience working with such organisations has shown that there remains a range of risks and challenges that need to be overcome at each site before larger infrastructure investments can be made, as outlined in Table 2.

Table 2 Public EV infrastructure benefits, risks/challenges

	Infrastructure Owner	Possible sites	Benefits	Key risks/ challenges to installation
Destination charging	Public or private property owners	Airports, shopping centres, arenas	Improves wider visibility and service options to a broad audience	• Power availability • Cost of installation and maintenance • Interoperability of charging equipment • Determination of suitable charge rates
On-street charging	Local or State Government	Residential streets, high Streets	Improves visibility in local communities	• Road/footpath management • Potential footpath obstruction • Power availability • Enforcement limited. • Cost of installation and maintenance • Limited resources (funding/skills) • Interoperability of charging equipment

[8] *AECOM research*

Infrastructure owner case study

EV infrastructure strategy

Overview

AECOM recently supported a major aviation sector client in Australia to develop a purpose-built EV infrastructure strategy to support and guide the transition of their ground transport fleet, buses, taxis, and other private vehicles accessing the precinct.

We investigated the current market trends and technological advancements and identified the specific needs and requirements of the airport and its commercial partners.

We also explored various viable options for the implementation of the EV charging infrastructure, considering the identified needs, available technologies, and logistical and economic factors.

Lessons learned

- The need to prioritise competing stakeholder needs and balance the available electrical grid capacity.
- Setting up the infrastructure requires a significant upfront investment.
- Challenges with electric vehicle fires and how best to mitigate potential impacts to critical operations.
- Step change expected in EV uptake after the 2030s and how this is likely to impact the grid.
- The rapid pace of technological advancements in the EV sector means that infrastructure can quickly become outdated.

2.4 Privately accessible charging infrastructure

In contrast to public charging points, there remains significant work to be done to facilitate charging at private locations. While the provision of public funds to support private charging locations may seem counterintuitive in the face of the need to grow the broader availability of charging infrastructure. It is in truth a critical path towards wider electrification, particularly if done in a structured and effective manner so as to:

- Address key structural barriers to preventing private vehicles from electrifying.
- Facilitate the transition of large fleets to shift broader market dynamics.

2.4.1 Infrastructure for Privately Owned Vehicles

The growth in Electric Vehicles within the private vehicle market has advanced significantly in recent years, reflecting the growing momentum of Electric Vehicles as a viable and desirable commercial product. However, in our experience, despite this promising growth, there remain key structural barriers limiting adoption.

Of note are the ongoing challenges with the provision of charging infrastructure in apartment buildings and commercial buildings. This stems from a range of challenges as outlined in Table 3.

Table 3 Challenges in delivering private charging

Building types	Challenges
Apartment Buildings	• Strata committee approval processes • Cost/complexity of installation into existing car parks • Uncertainty regarding approval processes, or connection demands • Fears arising from potential fire risks.
Commercial Buildings	• Disconnects between tenants using car park and building/asset owners • Cost/complexity of installation into existing car parks • Lack of knowledge regarding installation viability • Fears arising from potential fire risk

While the NSW Government has made significant improvements in this space with the launch of the NSW EV Ready Building Program, additional investment in changes to strata rules, funding support, and improvements to access to knowledge is needed to scale this program further.

Additionally, greater emphasis needs to be placed on providing incentives to asset owners to install more EV charging facilities in commercial premises. This should move beyond the provision of small demonstration charging facilities within buildings, often used more as marketing features than viable charging solutions, to enabling tenants to have access to a surplus of EV charging points.

Lastly, the NSW Government must look to fund and finalise guidelines regarding fire requirements for buildings, considering EV charging, especially for the residents in strata schemes.

AECOM has undertaken extensive research and modelling to understand the nature of EV fires and potential measures to mitigate their impacts. In our experience, however, while EV fires are a serious matter when they do occur, the rate at which they occur is much less than that of petrol-based vehicles.

However, the current uncertainty regarding fire risk and building code has created a strong discouragement for the installation of EV charging stations amongst private buildings, particularly amongst commercial entities such as asset owners and property developers. As such, we believe the NSW Government must invest in working with stakeholders to develop clear guidelines that balance both the potential risk and impacts of EV fires, with the need to facilitate their adoption.

2.4.2 Infrastructure for fleet owners

Private vehicle fleets can often be one of the most critical parts of an organisation's operations, either to move customers, deliver products to market, or transport employees to their workplace. Fleet managers have a complex set of choices to balance as to how and when to electrify. AECOM is working with fleet owners locally and globally to help them understand the benefits of transitioning, develop strategies and roadmaps to adoption, and support organisations through the adoption stage with change management and implementation processes.

Leveraging the buying power of Government and corporate fleets to shift underlying EV market dynamics remains one of the most impactful and low-hanging fruits available. Doing so can further improve confidence in the market to invest in providing new vehicle models, providing infrastructure, and growing EV supporting services. Let alone the growth of a substantial second-hand market as fleet vehicles are cycled into the market.

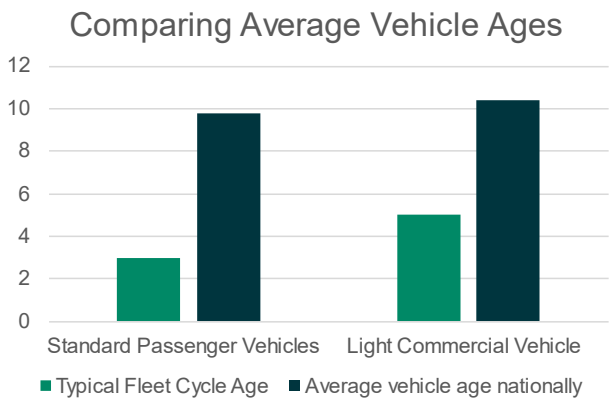


Figure 5 Fleet age comparison

Most large fleets adopt vehicle holding cycles of three to five years for standard passenger vehicles and light commercial vehicles[9]. This is significantly shorter than the national average vehicle age[10] (Figure 5).

These shorter ownership timelines should create a faster development of a strong second-hand EV market. This would allow for a more rapid movement of product into the hands of a consumer than would be achieved by simply targeting new private vehicle sales, while also providing Electric Vehicles to consumers at a lower cost.

Unlike private citizens who may or may not be driven by a desire to adopt more environmentally friendly transport, most large corporate and government agencies have underlying emissions and ESG goals that further align with the introduction of Electric Vehicles.

Electrification confers operational benefits too: local authorities can reduce the operating costs of transit and wider vehicle fleets – from police cars to refuse trucks – seeing substantial economic returns. Fuel costs for Electric Vehicles are typically 50 to 60% lower than ICE vehicles, and electric engines require less maintenance.

Transitioning from traditional fuels to electric charging can require a cultural change as staff grow accustomed to operating new equipment. Users must understand the benefits new vehicles offer in making it easier to do their jobs. This means the Electric Vehicles must work as well as, or better, than existing vehicles.

[9] *NRMA - https://www.mynrma.com.au/business/news/how-long-to-keep-your-fleet-vehicles#:~:text=Fleet%20vehicles%20usually%20travel%20around,km%20for%20light%20commercial%20vehicles.*

[10] *Australian Automobile Association - https://www.aaa.asn.au/wp-content/uploads/2018/03/AAA-ECON_Benefits-of-reducing-fleet-age-summary-report_Dec-2017.pdf*

Table 4 Barriers to fleet adoptions

Barriers	Description
Conversion costs	The cost of purchasing fleet, infrastructure, and charging equipment at scale can require sizeable investments – cost/benefits must be clearly understood, including the capital availability, or existing financial commitments.
Confused incentives	Organisations may have competing demands and incentives on fleet managers that obstruct adoption, such as the desire to achieve ESG goals, against existing contractual fleet arrangements.
Operational feasibility	Organisations need to be confident that EV charging requirements, connections, and timelines will have minimal to no impact on the ability to provide services/ conduct business.
Infrastructure requirements	Most organisations are unsure of the necessary infrastructure that will be required to upgrade their depots or yards to provide electrical supply and suitable types/numbers of chargers.
Storage / property	Perceived changes necessary to existing parking/ property to install infrastructure as well as navigate operational needs can limit ability to consider converting fleet.
Employee buy-in	Staff can remain hesitant to change and require further information and education on EV use, as well as retraining for some staff due to reduced maintenance requirements.
Heavy Vehicles	Use cases for heavy vehicles can range from standard trucks to plant and construction vehicles. Available models in the domestic market are limited, and there is a need to assess specialised use cases and infrastructure.

2.5 Recommendations

Based on our experience and understanding of the above, the NSW Government can further support the EV transition by adopting the following recommendations.

	Recommendation
2.1	Continue to deliver and expand on-street charging location rollouts, and work with more local councils to deploy charging equipment.
2.2	Maintain and expand current programs including the EV Ready Buildings Program to conduct infrastructure assessments for the suitability of EV installation. Consider expanding this program to encompass destination charging locations, in addition to residential buildings.
2.3	Expand the rollout of charging hub facilities within Greater Sydney to support mixed-use case charging.
2.4	Work directly with and consider funding support options for fleet owners and managers to develop EV transition strategies, in addition to existing vehicle acquisition grants.
2.5	Establish a knowledge resource hub for fleet managers and provide direct connection between fleet organisations and established EV transition support firms to reduce uncertainty in procuring help.

3 Tackling Heavy Vehicles

Term of Reference 2

The viability of alternative energy sources for freight, heavy vehicles and other licenced vehicles in regional communities

By far the most difficult ongoing issue in transitioning the transportation sector to electric vehicles remains heavy vehicles. With heavier weights requiring additional power, unique use cases that must be accommodated, commercial sensitivities of operators, regulatory requirements, and a smaller overall market – compared to private vehicles. The fundamentals for heavy vehicle electrification are uniquely challenging.

AECOM has worked with clients to provide strategic advice and infrastructure design to support heavy vehicle electrification. Based on this experience we have found that heavy vehicle electrification must respond to the specific use cases of each vehicle so that electrification is both operationally practical and commercially viable.

As heavy vehicles can have a plethora of possible uses cases - owing to their robustness – at this stage of the EV transition it can be useful to focus on two core use cases, which represent significant opportunities.

1. **Public Transport Vehicles**
2. **Freight carrying Vehicles**

3.1 Public Transportation

3.1.1 The transition to zero emission buses – fleets, depots and systems

The NSW Government and private industry has a significant opportunity to help society over the tipping point of transport electrification, through the push towards the electrification of public bus fleets.

As the operation of a public transport bus fleets is often more structured, predictable, and consistent compared to personal vehicle usage, the transition to a Zero Emission Bus (ZEB) fleet can in some ways be easier and less reliant on public charging networks. In addition, electrifying buses can yield a disproportionately large payoff for public health, the climate, and fleet running costs.

The scale of bus fleets provides an attractive opportunity for vehicle manufacturers and provides an incentive for new entrants to improve the total cost of ownership of EVs, so that electrification becomes more economical than operating a traditional internal combustion engine platform.

Additionally, bus fleets act as a highly visible real-world demonstration of the benefits of EVs that can influence the consumer market helping to accelerate electrification at scale. Their transition can also spur investment in supporting infrastructure, including grid modernisations, and accelerate the development new battery technology, and manufacturing capacity.

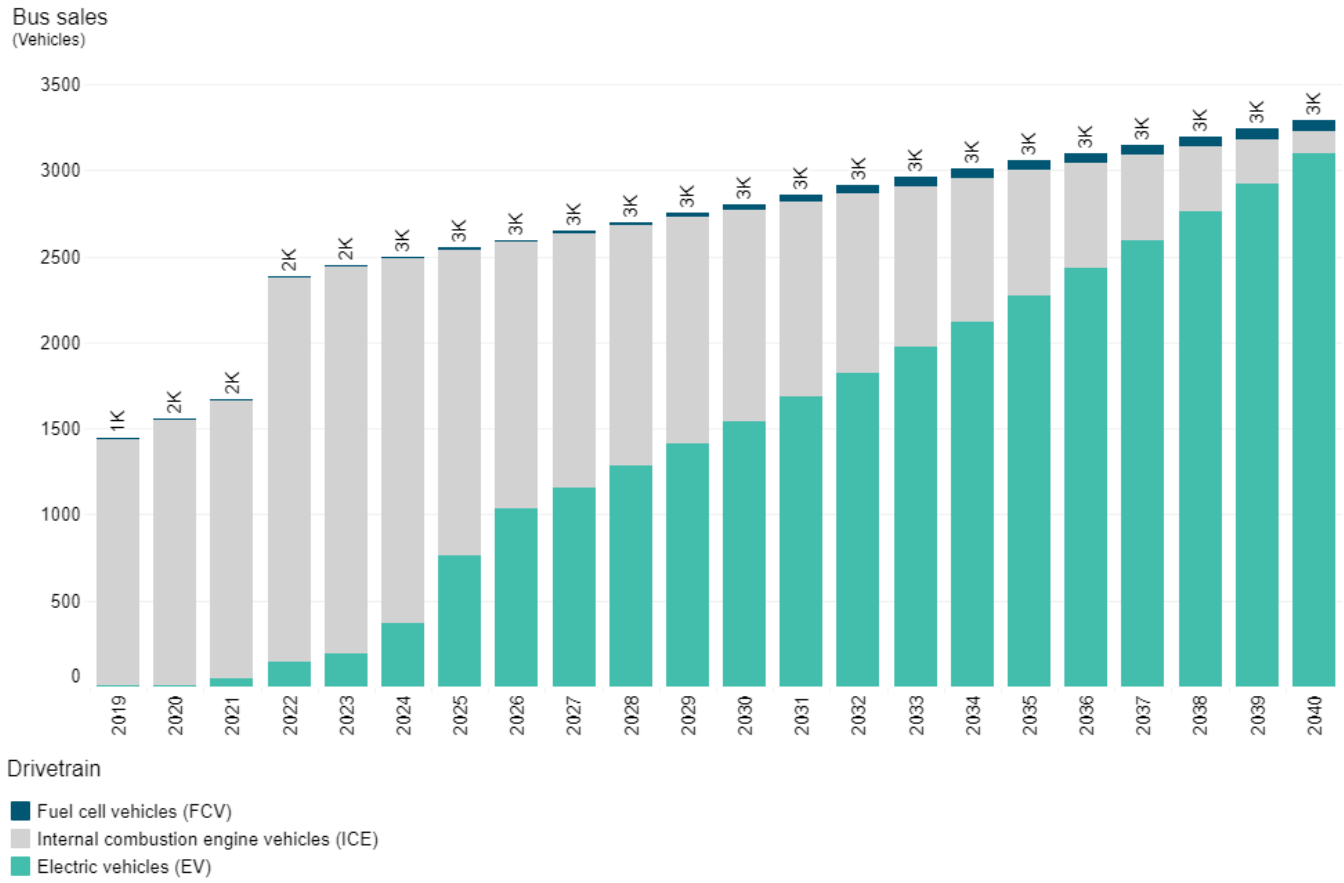
As such, governments across Australia are making efforts to adopt zero emission public transport fleets, with ZEBs being trialled, manufactured, and deployed in one way or another in all states/territories. With NSW already at the forefront of electrification as shown in Table 5.

Table 5 Current State and Territory ZEB commitments

States & Territories	Commitment/Plans
NSW	• 1700 ZEB buses by 2028 • Greater Sydney to be transitioned by 2035 • NSW fleet to be transitioned by 2047 • A new ZEB bus depot to be constructed in Macquarie Park
ACT	• 16 in operation, 90 to be delivered over the next 3 years • Public transport network to be zero emissions by 2040
QLD	• Procurement from 2025 to be 100% ZEB in South-East QLD • 100% ZEB procurement for Regional QLD between 2025-2030
VIC	• Procurement from 2025 to be 100% ZEBs
SA	• Hydrogen bus trials began last year • 100% ZEB fleet by 2050
WA	• $250 million program to deliver 130 locally built electric buses and charging infrastructure • 4 ZEB trials
TAS	• Running 2-year ZEB trials – aiming for 2030 net zero in public transport sector
NT	• EV Strategy and Implementation Plan suggests trialling ZEBs between 2021-26

Forecasts by BloombergNEF indicate that electric bus sales will overtake internal combustion engine buses by 2030 in Australia, as presented in Figure 6.

Figure 6 Forecast electric bus sales in Australia till 2040



Source: BloombergNEF, June 2023

However, while improvements are being made to the underlying market and policy dynamics driving adoption, infrastructure remains a prominent challenge in transitioning the existing bus fleets to ZEBs.

While at face value, operating rhythms suggest a simplified and targeted approach to infrastructure provision via routine charging at centralised depots, the complexities of depot sites, technical requirements, and operational needs create a complex set of challenges that must be addressed. AECOM has undertaken many depot conversion projects in Australia and overseas, which have provided valuable lessons learned in these challenges.

Australian public transport case study

Bus depot transition in Australia

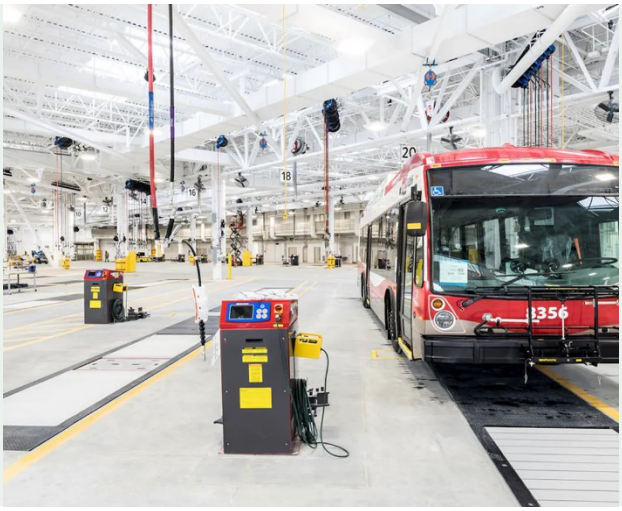
Overview

AECOM completed a detailed comparison assessment of battery electric charging infrastructure available for purchase within the Australian market.

This fed into the concept design options for depot configuration, taking into account capacity requirements, network operations, existing and required electrical supply, charging resilience, depot fire suppression, strategic cost estimates and delivery timeframes.

The transition to zero emission buses requires a staged approach to allow the fleet to transition gradually.

This allows for the development of the required infrastructure while still being able to service the existing bus routes and timetables with minimal disruption.



Lessons learned

- Leveraged our extensive global expertise in the planning and design of transit electrification projects to provide innovative and integrated approaches to overcome the complexities.
- Minimisation of contaminated material exposure and addressing environmental issues surrounding potential electric bus fires
- Minimising impacts on surrounding properties
- Improving charging resilience and minimising impacts to bus network operations and services.

Based on AECOM's work globally in supporting transit agencies and governments to transition the public transport bus fleet to zero emission buses, the following key challenges have been encountered.

Challenges	Description
Existing depots	A large proportion of existing depots are old. In bus depots that are mature, it is not uncommon for contamination of the site to have occurred.
Electrical Grid	Bus depots require substantial electricity which usually means uplifting the energy grid's capacity and optimising it so both the depot and surrounding buildings can effectively operate.
Subsurface Infrastructure	Utilities on site can provide a complicated working environment to navigate and ensure suitable connections are provided and they don't limit future installations or create re-work.
Staff	Staff can remain hesitant to change and require ongoing education in management processes, additional retraining and redeployment may also be necessary due to reduced maintenance and mechanical work required on EV drivetrains.
Fire Safety	Electric bus depots are prone to thermal events, and as such, specific design controls are required to ensure risks of fire are minimised.
Operational Needs	Service levels must be maintained through transition periods and once charging is provided, necessitating detailed staging plans, charging and accessibility assessments, and specialised infrastructure to allow charging in often confined environments.

International public transport case study

Bus depot transition in the US

Overview

AECOM led the design and engineering for a ZEB Master Plan and Phase 1 Implementation Plan of the Kearny Mesa Division (KMD) which encompasses a large component of the City of San Diego in the US state of California.

The existing facility operated 74 standard buses, 42 articulated buses, and two plug-in battery-electric buses for a total fleet size of 118 buses.

Our scope included facility design and engineering, electric charging infrastructure design and charger selection, resiliency and power redundancy design and coordination with key stakeholders.

Lessons learned

- Limit the loss of bus parking with the addition of new ZEB infrastructure and master plan around full site buildout to maximum bus capacity.
- Design to allow for phased construction without having to move any existing buses off-site.
- Limit impacts to on-site transportation activities during construction
- Design in compliance with local authority guidelines and to allow KMD to utilise local utility charging rates and funding programs

The infrastructure required to support the rollout of ZEBs often requires the installation of specialised equipment to service the new fleet – limiting the ability to use off-the-rack equipment. For example, overhead cabling or pantographs may be necessary to provide access to charge points, while enhanced operational requirements to ensure access and manoeuvrability within a depot while vehicles are charging is necessary.

The local market for effective ZEBs is limited, particularly as the Australian manufacturing market for this specialised equipment is still in development. Issues have been reported with the utility of available models and the market would benefit from additional resourcing and support, as without an increase in design and manufacturing capacity, the energy transition will be reliant on overseas markets. This limitation is having a direct impact on the timely transition to ZEBs.

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3.3 Alternative Energy

When it comes to the future of vehicles, two key energy solutions should be considered.

Battery Electric Vehicles

BEVs are the most immediately viable alternative energy source for most vehicle use cases, particularly for smaller urban and shorter regional journeys, due to several enabling factors:

- **Vehicle Availability**: Electric passenger vehicles, LCVs and rigid trucks are becoming more available in Australia, with multiple brands offering full BEV models. While larger electric articulated trucks and buses are less available. Ranges for vehicles have improved significantly and can largely meet most urban or short regional trips needs. Large EV truck ranges are currently achieving a top range of 600km creating barriers to long haul travel, this is expected to improve in the future.
- **Charging Infrastructure**: Smaller passenger vehicles and urban freight benefit from their ability to use slow overnight charging at homes/depots, utilizing off-peak electricity to minimize grid impact. Use cases that require more on-road charging such as Intrastate freight requires fast and ultra-fast charging at freight nodes and rest stops, but these are minimally provided currently. Battery recharge times continue to improve with infrastructure options such as Megawatt Charging Systems (MCS) - capable of delivering over 1 MW to charge rigid and articulated trucks quickly – increasingly emerging as options.
- **Energy Supply**: Overall energy supply will need to be increased to support wider societal electrification. However, this can be planned for in advance with investments in renewables and battery storage offering scalable opportunities. Transmission and Distribution networks however remain challenging to upgrade, particularly for high-energy demand locations.

Hydrogen

Hydrogen is a potential energy source for primarily for heavy vehicles, particularly articulated trucks used in interstate freight, but its viability is less advanced:

- **Vehicle Availability**: Hydrogen vehicle availability is underdeveloped, with no widespread models or operational trials in Australia, positioning hydrogen as a longer-term solution for high-energy, long-haul freight.
- **Infrastructure Gaps**: Hydrogen refuelling stations would require extensive development along key network, limiting immediate adoption for heavy vehicles, and would need extensive support systems in place to supply.
- **Energy Supply**: While Hydrogen is an abundant resource, it's transformation from raw resource to energy source at a societal level remains challenging, requiring significant investment in developing processes, transportation, and storage infrastructure and supply chains.

Challenges to viability for Heavy Vehicles

Several barriers affect the adoption of alternative energy sources for freight and heavy vehicles:

- **Cost and Availability**: High upfront costs pose challenges for operators, particularly small-medium freight enterprises. Limited model availability, especially for articulated trucks, restricts electrification, and the average freight vehicle age of 14 years indicates slow fleet turnover.
- **Infrastructure Needs**: Consistent, nationwide charging or supply chain infrastructure is essential to address range concerns and costs. Constructing charging hubs requires significant investment, particularly for high-capacity chargers needed for intrastate and interstate freight.
- **Operational Alignment**: Charging must align with operational models, such as back-to-base for urban freight or hub-to-hub for interstate routes, to maintain vehicle uptime. Misalignment could increase costs and reduce efficiency.
- **Grid Limitations**: While energy generation is sufficient, transmission and distribution networks face challenges, particularly for high-capacity charging required by intrastate and interstate freight, necessitating upgrades to support widespread electrification.

3.3.1 Establishing a hydrogen economy

Alongside developing core infrastructure for battery electric vehicles (BEV), the NSW Government may wish to also seek to ensure work and development in the hydrogen sector progresses. From our work in this sector it is clear that although many transport applications are well suited to electrification, there are applications for which electrification is not suitable and/or it may compromise operational performance.

Typically, applications where hydrogen may have an advantage over BEV have the following characteristics:

High time utilisation	Where charging time is costly to operations and fleet economics	*Highly utilised fleets (e.g. linehaul freight)*
High energy requirements	Where a large amount of energy is required and/or space is limited for fuel/battery storage.	*Linehaul freight, ferries, regional buses, municipal waste collection*
Long range requirements	Where range requirements exceed those achievable with current BEV technologies	*E.g. Linehaul freight*

Given these use cases encompass vehicles critical to economic activity, there is a need to also consider the transition to low-carbon fuels such as hydrogen for specific applications. This is further evidenced by the fact that there are now over 1100 hydrogen refuelling stations operating globally[11]. Locally, however, refuelling projects have been largely demonstration-scale and focused on passenger vehicle refuelling. Key considerations for establishing hydrogen refuelling infrastructure to support preferred use cases (i.e. heavy vehicle fleet) include:

- Establishment of hydrogen refuelling facilities suited for heavy vehicles. These require physically larger facilities compared to H2 passenger refuelling stations due to significantly larger fuel tank storage/ dispensing capacities and lower refuelling pressures.
- Preferred locations for H2 refuelling facilities for heavy vehicles are typically different (e.g. highway-based) from the location of existing H2 passenger vehicle refuelling facilities, which are currently suburban or co-located with industrial estates with proximal H2 production.
- Establishing hydrogen refuelling infrastructure, particularly to support linehaul freight, requires an integrated, national approach to establish infrastructure across key corridors to support the uptake of H2 heavy vehicles.
- Establishing a hydrogen fuel supply will require ongoing and additional support for projects to establish green hydrogen production at scale to support lower hydrogen supply costs.

Hydrogen fuelling case study

Queensland Hydrogen Highway

Overview

The Queensland Government is developing the requirements for future hydrogen-enabled highways across the State, our work involved:

- Conduct planning of the potential demand, market conditions and routes.
- Corridor identification based on key constraints and requirements relevant to H2 refuelling and heavy vehicle operating conditions.
- Site selection for potential refuelling sites, including reviewing footprint availability, utility availability, access and strategic need.
- Technology assessment of available refuelling and storage options, including concept development and cost estimation.

Lessons learned

An integrated approach to network planning for hydrogen refuelling infrastructure is required to ensure an initial "minimum viable network" is established to support commercial operations and route continuity requirements of heavy vehicle fleets. Government support is required to support the establishment of hydrogen refuelling and the commercial uptake of hydrogen vehicle fleets, relative to the total cost of ownership of incumbent diesel vehicles.

Further reading on this project available here

[11] *International Energy Agency - https://www.iea.org/reports/global-hydrogen-review-2023*

3.4 Other Energy Sources

In addition to Battery Electric, and Hydrogen, other fuel and energy sources are in development around the world, in various stages of development, and suitability. Recent work we have undertaken identified the below options.

Fuel	Description	Infrastructure	Pros	Cons
LNG	• LNG is produced from natural gas. • Mostly used for larger vehicles such as HGVs, as it provides a greater range which suits HV's that cover larger mileage	• Similar to petrol and diesel vehicles, a filling station is required. • LNG is stored in a tank and administered via a pipe to the vehicle.	• Some ICEs can be converted to run LNG, so no new vehicle needs to be purchased. • LNG is 30-40% cheaper than traditional fuels. • LNG cleaner than most fossil fuels (25% reduction in CO2, 90% reduction in NOx and 100% reduction in SO2).	• Still emits GHG, not a totally clean fuel. • LNG needs to be stored at -260ºF, special materials required for storage. • Non-renewable source so will eventually run out
CNG	• Similar to LNG, CNG produced from natural gas. • Can be used in cars, vans, light, medium and heavy-duty vehicles.	• Similar to petrol and diesel vehicles, a refuelling station with a pump required.	• Like LNG, Some ICE's can be converted to run CNG, so no new vehicle needs to be purchased. • CNG can be taken from gas mains, so no need to move gas by tanker. • CNG can reduce fuel costs by up to 40% • In HVs, CNG can reduce CO2 emissions by 15%.	• Still emits some GHG, not a totally clean fuel. • Non-renewable source so will eventually run out.
HVO	• Bio based liquid fuel originating from many kinds of vegetable oils (grapeseed, sunflower, and soybean) and animal fats. • Oils and fats are synthesized using hydrotreatment.	• HVO's refuelled the same way as petrol and diesel.	• Can be used in most petrol and diesel vehicles and can be mixed with diesel. • No additional vehicles or infrastructure required. • Compared to petrol and diesel significantly reduced NOx, particulate matter and CO2emissions.	• Much more expensive than petrol or diesel • Not a carbon free fuel so isn't a long-term solution to reach carbon targets.
Biodiesel	• Renewable biodegradable alternative fuel made from a mix of modified vegetable oil and diesel fuel. • Produced by esterifying a natural oil or fat with methanol to produce biodiesel and glycerol, the glycerol is then removed	• Additional storage equipment and management needed compared to standard diesel.	• High biodiesel blends can be used in standard diesel vehicles. • As a fuel, it is greener than petrol and diesel.	• Extra energy required for production. • Higher blends require vehicle retrofits by manufacturer. • Biodiesel starts to be affected if cooled to between 0 and 10 degrees, so heated tanks, lines, pumps are required. • More expensive than petrol or diesel • Reduced CO2 compared to ICE but emits more NOx

[redacted]

3.6 Recommendations

Based on our experience and understanding of the above, the NSW Government can further support the EV transition by adopting the recommendations below.

	Recommendation
3.1	The NSW Government should prioritise the transition of Urban Freight to electric vehicles by supporting depot electrifications, fleet transitions, and support for shared overnight charging locations.
3.2	Establish targeted support for small bus and freight operators to electrify fleets, including knowledge sharing, planning, and funding support.
3.3	Begin work on identifying key regional highways for charging infrastructure and undertake corridor protection efforts and enabling infrastructure in advance of future delivery.
3.4	Explore options to encourage freight customers to support freight electrification through including providing on-site charging points for freight vehicles at destinations.
3.5	Review existing freight regulations to understand and remove unintended barriers to EV adoption, and consider some regulatory easing a means to incentivise EV adoption
3.6	Ensure work on developing Hydrogen solutions is aligned with national efforts.
3.7	Establish a knowledge resource hub for bus and freight fleet managers and provide a direct connection between fleet organisations and established EV transition support firms to reduce uncertainty in procuring help.

4 Utilising existing infrastructure and ensuring market competition

Term of Reference 4

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

Our electric grid has been developed as a one-way system to meet the increasing power demand, and the grid has worked well for us for many years. But it has not kept pace with current needs. The electric grid we need now must be distributed with networked, intelligent, and advanced controls to meet our decarbonisation goals while improving reliability and eliminating redundancy. A plan accelerating grid modernisation will build community and economic resilience while serving environmental and social goals. Defining current system conditions and developing a roadmap forward will enable us to think bigger and bundle the local initiatives into scalable solutions. Incorporating technologies to track conditions and creating frameworks to measure success will ensure that infrastructure systems are resilient now and into the future.

Utility agencies are studying policies to expand energy generation and grid capacity as they work to meet the expected new surge of energy demand resulting from vehicle electrification. Generation increases are expected to come from renewables such as solar, so utilities are opening studies to determine how to optimise financial and performance success when connecting clean energy sources to battery storage. Careful planning is required to develop a grid that can move energy where and when needed.

AECOM works with states, utility agencies, regional planners and fleet operators globally, developing options to prioritise investments, tapping new financing strategies and targeting incentives to accelerate electric vehicle adoption to make electric vehicle charging infrastructure available and affordable.

4.1 Responding to Requirements

Increased electric vehicle adoption will place greater demands on electric grids. Studying and modelling electrification impacts on grid assets can help authorities, agencies, and other interested parties collaborate and make data-driven decisions on charging infrastructure and locations, capital improvements, and other future needs. The forecast electricity demand for vehicle charging in Australia is presented in

Figure 10.

Managing the energy grid wisely will be increasingly important as the number of electric vehicles grows. Utility agencies are adapting their policies to accelerate the adoption of electric vehicles by providing subsidies and, in some areas, specific rates for charging. They are also trying to balance those efforts with the demand on their grid and their ability to support demand However any in doing so there are costs and pressures placed on the provision of new infrastructure.

Transportation electrification will create a new baseline of increased electricity demand but also offers operators the potential to leverage the batteries, technology, and systems provided by EVs to better manage their networks (using Vehicle to Grid technology). Electric vehicles could help utility agencies manage their load better, within the existing infrastructure settings, particularly given the increase in wind and solar energy generation, where power supply can be irregular. We have already seen major investments that manage this in the form of batteries that can store energy for a few hours. This would require:

- A focus on ‘smart’ charging - particularly for residential charging - that facilitates charging at off-peak times, trickle charging, and coordination of EV charging in local areas to ensure they don’t all charge concurrently during the peak.
- Enabling Vehicle to Grid charging solutions to reduce pressure on local grids and improve overall resiliency.
- Fast charging technologies for public charging stations to make long-distance travel more competitive with fuel-based vehicles.

- Alternative methods of charging for public transport, such as flash charging on bus routes - these technologies will need to be reliable and flexible to accommodate various bus schedules.

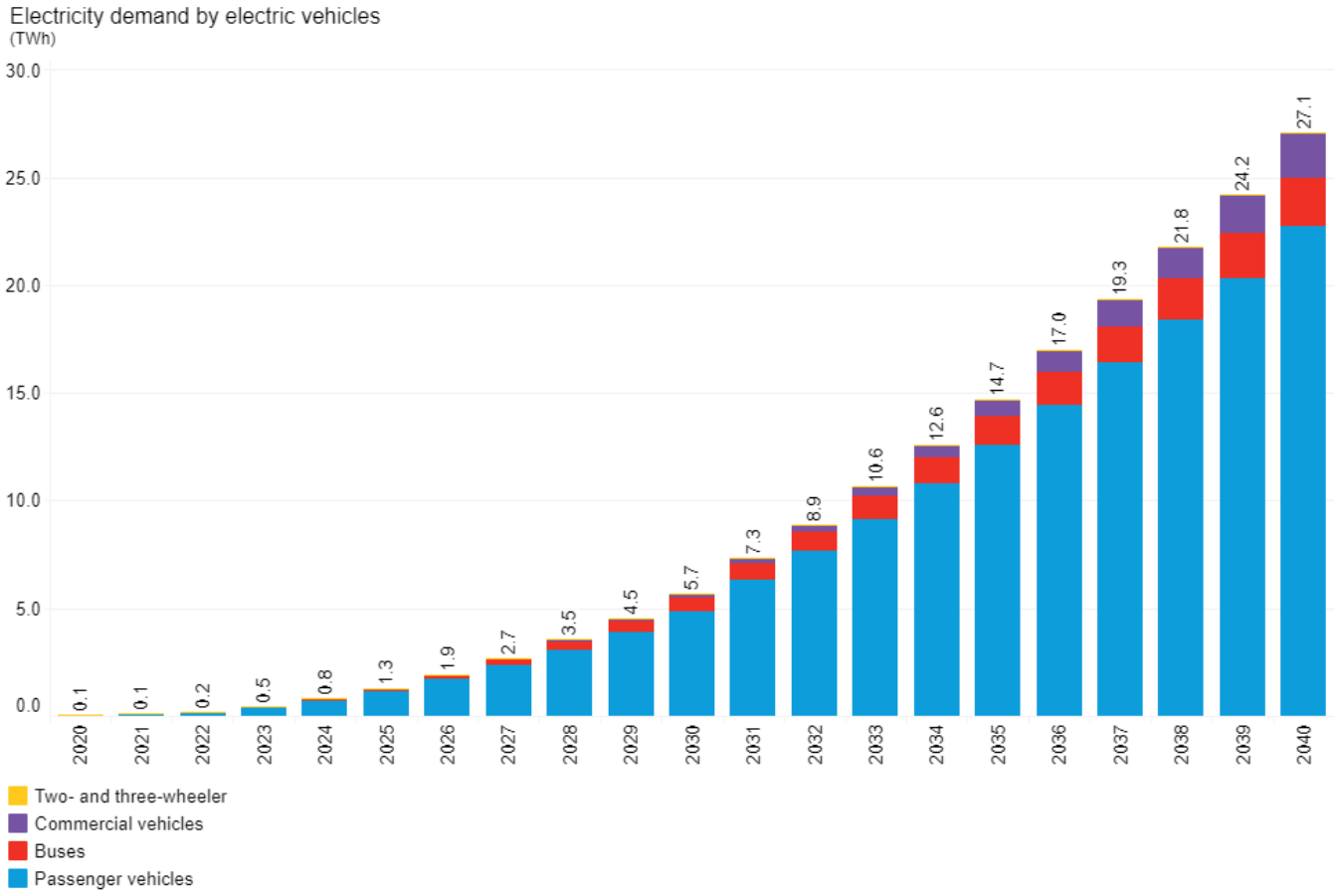


Figure 10 Forecast electricity demand for vehicle charging in Australia

Source: BloombergNEF, June 2023

4.2 Challenges and Opportunities using existing infrastructure

There are numerous opportunities to use not only existing infrastructure but also existing planning processes and technology adoption to enhance our ability to support the EV transition and support resilience. This can range from simply recognising that our existing energy grids can provide a core backbone for the charging infrastructure, through to adapting existing planning processes to ensure that long-term EV planning is integrated holistically.

Existing Infrastructure, technology or process	Opportunities	Challenges
Existing Energy Networks	Provides effective coverage for most urban and regional areas, allowing slow charging without any significant upgrades.	It will require targeted upgrades and modernisation efforts to support additional power draw at specific locations.
Local Energy Infrastructure	Our local energy infrastructure, i.e. light poles, is already being used for charging points, and can be further utilised.	Access to and use of existing poles may be restricted in some areas, potentially preferencing a small subset of operators.

Leveraging EV Batteries	By supporting Vehicle-to-Grid energy flows, we can potentially leverage a distributed network of EV batteries.	Requires policy and technical changes to facilitate.
Regional Renewable Projects	Large-scale renewable projects in regions could support highway and regional freight charging, but connections to charging hubs should be planned from the outset.	Requires alignment with regional charging plans and may add project costs
Urban Planning Assessment Frameworks	Current planning regimes consider the demand from new developments on local grids. To avoid future rework, these should be expanded to take a longer-term view of demands arising from broad-scale EV adoption.	Aligning state and local planning requirements can be challenging. Could add additional costs to development projects.
Existing Government Land and assets	Government land and assets could be used to provide larger-scale public charging solutions than are currently adopted. For example, commuter car parks could support significantly more EV charging points.	May require enabling greater public access to some sites than is currently facilitated. May change the operational nature of some sites.

4.3 Recommendations

Based on our experience and understanding of the above, the NSW Government can further support the EV transition by adopting the recommendations below.

	Recommendation
4.1	Continue to progress work to enable Vehicle-to-Grid solutions to build resilience in our grid.
4.2	Continue to support the transition of existing electrical infrastructure into EV charge points, while maintaining market fairness amongst charging providers.
4.3	Consider existing future planning processes and how they can be adapted to support or consider an EV future.
4.4	Undertake a broader review of current and future infrastructure and assets to identify opportunities to further support EV charging.

5 Transition measures

Term of Reference 4

Measures to ensure the transition of workers from affected industries and industry standards

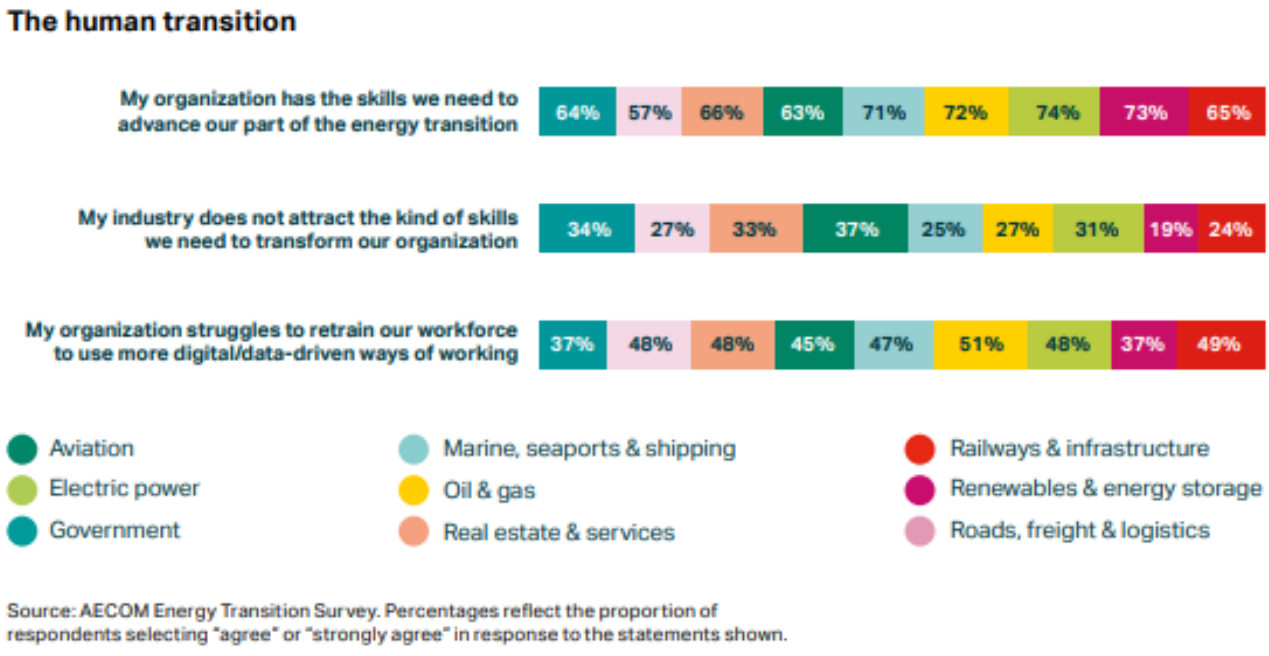
5.1 A people-centric transition

The delivery of the infrastructure items identified in Sections 2,3, and 4 above is dependent on supporting and educating people to facilitate the transition.

Our experience in this space, locally and globally, tells us that developing team members' skills, knowledge, and experience to assess, design, and deliver EV systems and infrastructure is one of the most important components of the EV transition. However, as Australia is still in the early days of its EV growth, critical skills and knowledge must be developed and grown today to future-proof tomorrow's industry leaders.

This will not be a simple task; the skills needed (both hard technical skills and soft people skills) across the energy transition/decarbonisation sector are already in high demand both locally and internationally. In 2020, there were over 12 million people working in the global renewable energy sector alone (up more than 60% since 2012)[12], and only 26,000 of those jobs were in Australia[13]. So, to undertake the full-scale transition to a cleaner economy, and deliver on net-zero goals, there is significant pressure to ensure a trained workforce is available to meet demand.

AECOM's own research has found that in the global transport sector, only 27% of industry respondents agreed that the industry attracts the right talent to support and transform their organisation. Given the nascent stage of Australia's EV transition and our own experience, we believe this trend holds in Australia and New South Wales.



[12] *AECOM - https://infrastructure.aecom.com/hubfs/FOI5/report/Lost-in-transition_AECOMS_Future-of-Infrastructure-report.pdf A*

[13] *ARENA - https://arena.gov.au/assets/2023/02/skilling-australian-industry-for-the-energy-transition-accenture-report-for-australian-industry-eti-phase-3.pdf*

AECOM has developed teams and skill sets to support the energy transition, especially EV projects. This has required a strategic approach and has leveraged support from overseas – where expertise has been developed due to market changes and adoptions that have outpaced Australia. Key components to build upon are:

- Those working in transport planning, engineering and design teams need to upskill and develop a blended understanding of both transport needs and energy fundamentals, while electrical engineers must have a baseline understanding of operational transport demands. There is a far greater need for crossover skills.
- Ensuring both depth and breadth of knowledge within an organisation, as EV projects require scope-specific knowledge depending on sites and vehicles from ZEBs to freight to private cars.
- There is limited specific technical training available in EV planning or design, so the industry must build knowledge firsthand through experience. It will be important moving forward that this knowledge is purposefully acquired by new entrants to the workforce.

5.3 Recommendations

Based on our experience and understanding of the above, the NSW Government can further support the EV transition by adopting the recommendations below.

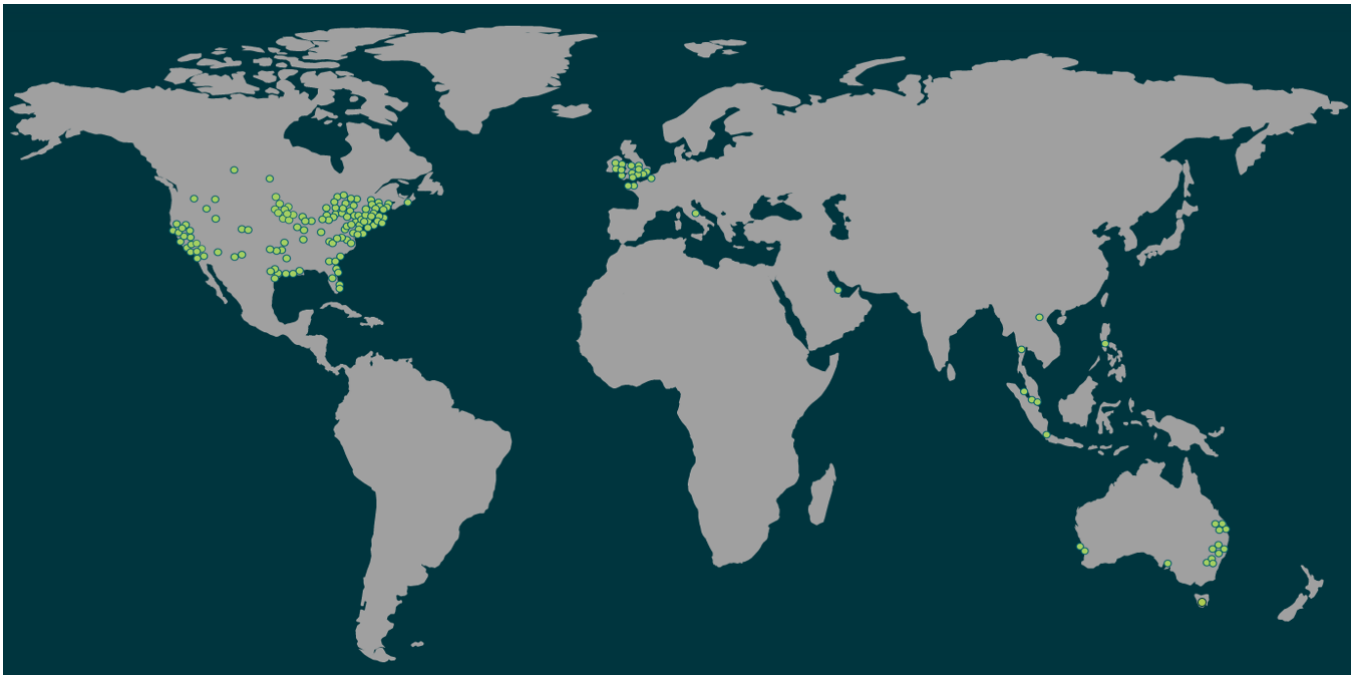
	Recommendation
5.1	Invest in EV-specific training across the full scope of EV support services both for young people/ new drivers and for experienced drivers, especially to support businesses seeking to upskill and improve staff knowledge
5.2	Work with freight operators to understand changes in driver demographics and consider effects on EV Transition planning.
5.3	Promote upskilling maintenance workers in the areas of Information Technology (IT) as EV technology evolves and incorporates digital systems.

6 About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy, and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivalled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities.

52K	7	$16.1B	#291
PEOPLE	CONTINENTS	FY'24 REVENUE	FORTUNE 500
Named one of ***Fortune magazine's*** **"World's Most Admired Companies"** for the tenth consecutive year	**Ranked #1** in water, transportation, general building, and international markets by **Engineering News-Record** in 2024	Named one of 2024 **World's Most Ethical Companies** for its commitment to integrity and making a positive impact by ***Ethisphere***	Received a perfect score seven years in a row on the **Human Rights Campaign Foundation's** ***Corporate Equality Index***

Guided by our Think and Act Global strategy, AECOM leverages international insights and proficiency in EV and ZEB transitions with Government and Private Industry clients from across Australia. In doing so, we work and engage with the wider transportation, energy, and sustainability industries to support the push for an EV/ZEB transition and broader efforts towards transport decarbonisation. Our local team is further supported by our highly experienced resources from North America and Europe, bringing mature experience in transport decarbonisation and EV/ZEB transition into the Australian context.



AECOM is committed to supporting the NSW Government as we strive towards a cleaner, more electric future.

AECOM is guided by our goal to leave behind a Sustainable Legacy

6.1 Our capabilities

As a fully integrated engineering and design firm, AECOM is proud to be able to support our clients across the full project lifecycle of the decarbonisation and electric vehicle transition. From initial planning and exploratory phases through detailed design, delivery and operations, our team have experience working across the entire ecosystem of project work. Our approach to delivery, as outlined in Figure 11, is based on our experience working directly with clients and reflects the core considerations needed to deliver effective, innovative, and impactful solutions.

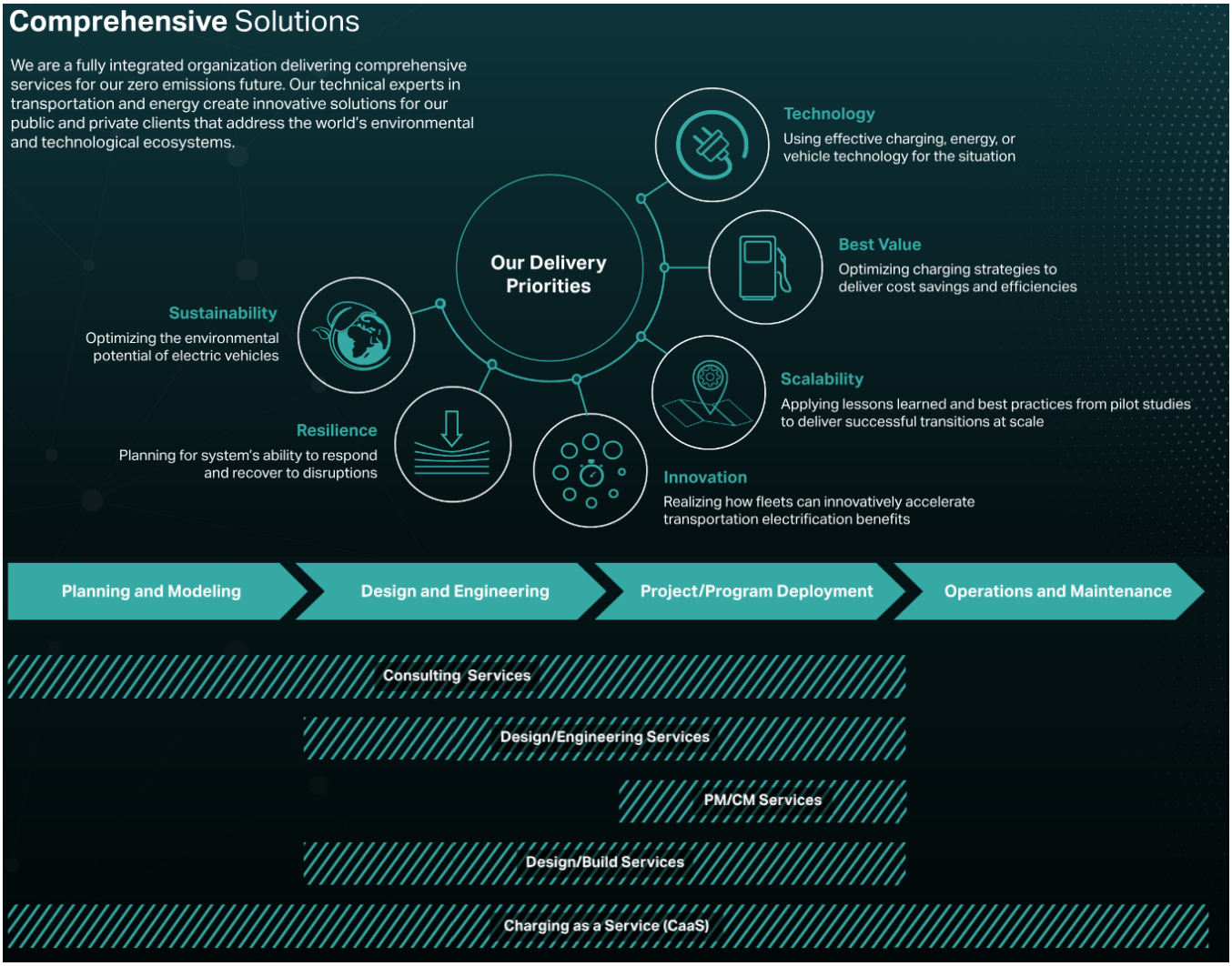


Figure 11 AECOM's approach and capability in decarbonisation

6.1.1 Electric vehicles

AECOM has an extensive history in Australia of working on some of the most impactful city/regional shaping projects in the country. We have turned that focus and approach towards the next big shift in transportation, with the transition to electric vehicles.

Our team is focused on delivering EV advisory, infrastructure design, and delivery support that goes beyond traditional EV horizons, recognising that to meet our climate targets and reduce the transport sector as a whole emissions profile, a holistic view of EVs must be adopted. Our team have worked across private EVs, heavy vehicles, and micro-mobility and has a strong understanding and appreciation of the intricacies of planning for and developing supporting infrastructure for EVs at all scales.

6.1.2 Zero Emission Buses (ZEBs)

In line with AECOM's corporate commitment to Environmental, Social and Governance (ESG) and the journey to net zero, we are committed to supporting transport agencies in Australia to transition services, fleets, and depots to ZEB operations. AECOM has conducted its own independent research through a comparative assessment of available battery electric bus charging infrastructure within the Australian market. This assessment has formed the basis for developing conceptual design alternatives for depot design configurations on recent projects in Australia. These alternatives consider factors such as capacity and demand, network operations, prevailing and required electrical network supply, charging system resilience, fire suppression systems, strategic cost estimates, and project development and delivery timelines.

With an extensive background in assisting transport agencies in their journey to transition services, fleets, and depots to ZEB operations both nationally and internationally, our team brings detailed, mature experience in the various aspects, risks, sensitivities, and opportunities for transitions to ZEB operations.

6.2 Our experience

AECOM is at the forefront of EV transition projects throughout Australia and leverages the skills and experience of our integrated team globally. It has led to success on the EV transition projects we have delivered across New South Wales, Victoria, Australian Capital Territory, Queensland, Western Australia, South Australia and Tasmania. Our recent project experience relevant to this inquiry includes:

- An electric vehicle infrastructure strategy for a major Australian airport
- A feasibility study for the transition of a heavy vehicle fleet in the Australian Capital Territory
- An EV charging infrastructure investment framework for the ACT region
- The business case for EV charging points at the Australian National Parliament House
- A National Road Freight Electrification Strategy for the Australian Renewable Energy Agency
- An electric vehicle infrastructure feasibility study for Hobart
- Technical Advice, Feasibility Studies, Design and Delivery support for ZEB depots in Sydney, Brisbane, Melbourne and globally
- Experience in 150+ Electric Vehicle Fleet conversions across North America alone.

We have extensive experience across the US supporting 50 transit agencies and fleet operators to transition to zero emission operations. These projects enable our team to understand the industry trends related to battery technology and capacities, charging technologies and load management systems, fleet types and availabilities. Industry trends are widely shared across teams globally to enable teams to make informed decisions on projects.

AECOM has also completed many studies across the United Kingdom, supporting multiple transport agencies and asset owners in transitioning to zero emission fleet operations. Some of the key projects are presented in the figure below. Using our extensive global experience in this area, we have developed an 8-step multi-year program for the UK to transition to zero emission fleets. The steps range from baseline studies and transition scenario development to trials, implementation, and annual review of progress.

We can draw upon our local and global transportation, energy, and environmental expertise to assist the NSW Government in creating comprehensive and innovative solutions focused on accelerating adoption and developing better system efficiency for users and utilities. Our response to this *Inquiry into the Transition to Electric Vehicles* has been informed through our work with all transportation sectors, from transit to goods movement, and partnering with cities, utilities, transit agencies, fleet, and infrastructure owners.

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of $14.4 billion in fiscal year 2023. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.

aecom.com