Australasian Health Infrastructure Alliance (AHIA)

Key Sustainability Guidance

Electric Vehicle Infrastructure Guide

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Australasian Health Facility Guidelines

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The Australasian Health Facility Guidelines (AusHFG) are developed in collaboration with stakeholders across Australia and Aotearoa, New Zealand.

Acknowledgement of Country

We acknowledge the Aboriginal people as the traditional owners and continuing custodians of the land throughout Australia and the Torres Strait Islander people as the traditional owners and continuing custodians of the land throughout the Torres Strait Islands.

We acknowledge their connection to land, sea and community and pay respects to Elders past, present and emerging.

Acknowledgement of Te Tiriti o Waitangi

We acknowledge Māori as tangata whenua in Aotearoa New Zealand.

Te Tiriti o Waitangi obligations have been considered in developing these resources.

Contents

Abbreviations

The following abbreviations are used throughout this guide to assist with understanding the specific technical and regulatory language related to electric vehicle infrastructure.

ABBREVIATION	DEFINITION
ABCB	Australian Building Codes Board
AC	alternating current
AS/NZS	Australian/New Zealand Standards
BCA	Building Code of Australia
BEV	battery electric vehicle
CCS	Combined Charging System 2
CCTV	closed-circuit television
CPO	charge point operator
DC	direct current
EMSP	electric mobility service provider
EPC	engineering, procurement and construction
EV	electric vehicle
EV infrastructure	infrastructure required to charge an electric vehicle, including dedicated EV parking bays, charging equipment, associated electric cabling, and any other specialist infrastructure
ICE	internal combustion engine
km	kilometre
km/h	kilometres per hour
kW	kilowatt
LMS	load management system
NABERS	National Australian Built Environment Rating System
NCC	National Construction Code
NZBC	New Zealand Building Code
RF	radio frequency
RFID	Radio-Frequency Identification
SoC	state of charge
SOCI	security of critical infrastructure
ZEV	zero emissions vehicle

1 Introduction

1.1 Purpose

This electric vehicle (EV) infrastructure guide is designed specifically for fleet vehicles used in public health facilities across Australia and New Zealand. It aims to give stakeholders involved in the full asset lifecycle of health infrastructure a comprehensive understanding of EV infrastructure and its role in both mitigating and adapting to anticipated climate changes. The guide offers practical steps for integrating EV infrastructure throughout the key stages of the asset lifecycle. Many of the requirements in this guide could also apply to public and staff EV charging facilities, as well as private health facilities.

The document includes a series of minimum compliance requirements, deliverables and consultation processes that are essential for meeting the expectations of stakeholders. It outlines a consultation process that includes identifying key stakeholders, engaging with them to refine and define requirements, and obtaining necessary approvals.

Also, the guide offers insights into technology options, planning and risk management. Fact sheets and case studies serve as references to help implement and operate EV charging facilities specifically tailored to the needs of fleet vehicles in the healthcare sector.

There will be other tasks associated with transitioning vehicle fleets to EVs such as choosing fit-for-purpose vehicles, driver training, EV policies and using EV infrastructure for non-fleet vehicles. This guidance focuses on implementing EV charging infrastructure for fleet vehicles so does not offer detailed guidance on these topics. Some of these tasks may need to progress concurrently with any tasks to install EV charging infrastructure. This guidance does not cover e-scooters or other forms of personalised electric mobility aids.

1.2 Audience

This guide targets various stakeholder groups engaged throughout the entire project lifecycle of health infrastructure capital projects, from project inception, planning and design to post-occupancy evaluation.

For existing health facilities, the guide is directed at facility managers and asset management teams. It is relevant also for fleet managers who require access to EV infrastructure.

1.3 Guide to navigation

This navigation guide is designed to help you easily find relevant sections of the EV charging guide, presenting tasks and activities in an ordered way. It's set up to streamline the process, showing what needs to be done at every stage of planning, design and risk management. For clarity, tasks specific to new and existing facilities are presented in the same section and differentiated using tables. This ensures the guide is user-friendly for any infrastructure scenario.

Figure 1 Guide Navigation Aid

Guide/stage	Task	Required activities
2. Planning	Scoping and project context	❑ Needs assessment ❑ Identify key stakeholders for engagement ❑ Develop the brief for EV charging infrastructure
2. Planning	Infrastructure constraints	❑ Identify constraints and opportunities ❑ Assess electrical infrastructure ❑ Understand cost implications
2. Planning	EV education	❑ Develop an understanding of EV charging basics ❑ Understand different procurement models ❑ Be across the meaning of EV readiness
3. Design	Regulations	❑ Understand the minimum jurisdictional requirements
3. Design	Design process	❑ Develop a design process through all stages
3. Design	Detailed requirements	❑ Determine the number of chargers ❑ Understand demand management ❑ Fire, security and essential power needs
4. Risk	Risk identification and mitigation	❑ Identify existing and future risks ❑ Develop risk mitigation strategies
4. Risk	Resilience planning	❑ Plan for resilience

2 Planning

2.1 Planning process

To align the process of planning EV infrastructure installations with the existing framework for new and existing hospitals, the following steps can be incorporated:

1. **EV charging needs assessment:** Determine the current and projected EV charging demand at the master planning stage. Review the EV transition plan if available.
2. **EV requirements** should be embedded into an overall site-wide infrastructure plan that considers future development and building electrification. This high-level electrical infrastructure plan should identify load requirements and the electrical supply strategy. It should also include a cost analysis to ensure the charging infrastructure can be expanded in a financially sustainable manner.
3. **EV charging brief:** Capture high-level EV charging requirements including the number of fleet EV charging parking spaces, preferred locations, types and quantities of chargers.
4. **Stakeholder consultation:** Involve key groups in planning, including hospital managers, clinicians and facility staff. Gather input on preferred locations, charging times and accessibility concerns.
5. **Business case formulation:** Develop a comprehensive business case for the EV transition, showcasing the value-for-money and sustainability benefits. Include a cost-benefit analysis, projected usage, environmental impact, and alignment with government policy and facility sustainability goals.
6. **Implementation in existing facilities:** For existing facilities, conduct a comprehensive site assessment to understand current electrical capacity and infrastructure limitations. Develop a phased implementation plan that prioritises critical areas and addresses infrastructure upgrades as needed. Ensure minimal disruption to hospital operations by scheduling installations during off-peak times and clearly communicating with staff about changes.
7. **Integration into capital works planning:** Ensure the EV charging project is incorporated into health capital works projects. Seek endorsement of the business case from relevant authorities and include it in the broader budget and funding allocations.
8. **Reporting:** Understand the jurisdictional reporting requirements and capture the impact of these in the design process.

The planning process for integrating EV infrastructure into new and existing facilities necessitates distinct approaches. Detailed planning considerations are shown in Table 1.

Table 1: Detailed planning considerations

CONSIDERATION	NEW BUILD FACILITIES	EXISTING FACILITIES
Electrical infrastructure	Designed to accommodate EV needs from the start, including future scalability. It is important to understand the implications for future widespread adoption of EV charging and how the health facility will respond to this. To avoid future disruptions, add spare ducts for the future electrical and communication cabling in the ground during initial construction. This measure significantly reduces costs compared with later excavation and disruptions.	May require significant upgrades to existing electrical systems to support EV charging. When significant upgrades are planned, it is important to understand the implications for future widespread adoption of EV charging and how the health facility will respond to this. To avoid future disruptions, add spare ducts for the future electrical and communication cabling in the ground during initial construction. This measure significantly reduces costs compared with later excavation and disruptions.
Physical space	Space for EV chargers can be planned and allocated in initial designs.	Space constraints may require reconfiguration of existing parking or other facilities.

CONSIDERATION	NEW BUILD FACILITIES	EXISTING FACILITIES
Operational placement	Chargers are positioned to optimise new logistical layouts without disrupting operations.	Placement should consider existing traffic flow and operational areas, potentially complicating integration.
Fire safety	Fire safety measures integrated into the overall safety plan from the beginning.	Existing safety protocols may need adjustments to include EV charging safety requirements.
Security and safety	Security measures for EV infrastructure designed as part of the overall security framework.	Extra security measures may be needed to adapt to current setups and to protect new assets.
Budgeting	Costs for EV infrastructure incorporated into the overall capital budget for new construction.	Separate budgeting needed, potentially requiring reallocation of funds or finding new financial resources.
Smart charging technology	New systems equipped with the latest smart charging capabilities integrated into building management systems.	New systems equipped with the latest smart charging capabilities integrated into building management systems.
Future scalability	Infrastructure designed to be easily scalable for future expansion and technology updates.	Scaling up may be more constrained by existing layouts and systems, requiring more extensive planning.
User education	Educational programs on EV charging can be implemented as part of new operational training sessions.	Embed EV training into existing driver training and induction processes.
Monitoring and maintenance	New systems include integrated monitoring tools for ongoing maintenance.	New systems include integrated monitoring tools for ongoing maintenance.
Funding and incentives	Potential for funding integration into initial financial planning for construction. Potential for lower operating costs to balance out higher initial expenses.	Seeking funding for retrofit projects may compete with other maintenance and upgrade needs. Potential for lower operating costs to balance out higher initial expenses.
Impact on services	EV charging areas planned to avoid disruption to hospital services.	Installation must be carefully managed to minimise the impact on ongoing hospital operations and services.

Royal Melbourne Hospital Electric Vehicle Project

The Royal Melbourne Hospital aims for 99% of its fleet to be EVs by 2026. Leveraging the Department of Transport and Planning's Zero Emissions Vehicle Program, RMH optimised charging infrastructure by considering parking space, electrical capacity and usage patterns. Staff education was crucial for managing fleet and trip needs, with plans including advanced support like home charging.

Challenges included balancing EV charging with infrastructure and fire safety requirements for basement chargers. Successes were positive staff reception and cost savings through grants. Key lessons were the need for futureproofing, ongoing management and adjusting leasing contracts to speed up adoption. For more information, refer to the case studies in the Appendix.

2.2 Benefits of moving to electric vehicles

The primary motivations for integrating EV charging infrastructure include the following:

- **National government policy:** Jurisdictional governments have set individual targets for electrifying their government passenger vehicle fleets. Health facilities across the country may therefore need to install the necessary EV charging infrastructure for this transition.
- **Achieving decarbonisation goals:** Transitioning to EVs aligns with broader decarbonisation objectives by significantly reducing greenhouse gas emissions from transportation. Unlike vehicles powered by fossil fuels, EVs can operate on clean electricity, especially as the grid shifts towards renewable energy sources. This transition not only helps healthcare organisations meet their sustainability targets but also contributes to improving air quality and public health outcomes.
- **Cost efficiency:** Incorporating EV infrastructure early in asset development can prevent costly future upgrades. Also, as fuel prices climb, the operational expenses of conventional engine fleets may surge. Implementing EV charging stations will move the transition away from traditional combustion engine vehicles in health infrastructure fleets.
- **Health and wellbeing:** EVs produce zero tail-pipe emissions and offer quieter operation. This will have positive impacts on the health and wellbeing of patients, staff and the surrounding community.
- **Corporate social responsibility and public image:** Hospitals often strive to be seen as leaders in community health and innovation. Moving to an EV fleet can enhance their public image as environmentally conscious organisations. This shift can attract patients, partnerships and staff who value sustainability.
- **Diversify fleet option:** Australia is increasingly relying on foreign fuel imports. EVs help mitigate the risk of service disruption by introducing a diverse mix for operational fleets.

2.3 Constraints

Healthcare facilities each have their own set of distinct constraints and opportunities that need to be carefully weighed when integrating EV infrastructure. These challenges vary across facilities and may include, but are not limited to, those listed in Table 2.

Table 2: Healthcare facility constraints

CONSTRAINT	NEW-BUILD HOSPITALS	EXISTING HOSPITALS
Space allocation	Integrated into the design with dedicated areas for EV charging.	Limited by existing structures, potentially requiring reorganisation of parking or other spaces.
Electrical infrastructure	Electrical capacity planned with EV charging needs in mind.	May require upgrades to existing electrical systems to accommodate extra load.
Construction costs	Costs are bundled into overall construction budget.	Retrofitting costs can be significant and may require separate funding.
Regulations and land use	New builds can consider local council development controls and land use requirements.	Less flexibility to comply and may require specialist planning advice.
Operational workflow	Charging stations can be strategically placed to align with hospital workflow.	Installation must adapt to established operational patterns, with minimal disruption.
Technology implementation	Can plan for and install the latest EV charging technology.	Limited to selecting technology that is compatible with existing infrastructure unless significant upgrades are planned.
Sustainability goals	EVs can help deliver decarbonisation goals.	EVs can help deliver decarbonisation goals.
Patient and staff disruption	EVs are typically not the key concern when it comes to disruption for a new capital project.	Installation must be carefully scheduled to avoid disrupting patients and staff.
Spatial requirements	Charger space implications to be considered.	Installing EVs in existing car parks is not always feasible because of the extra space needed for the charger and protective bollards.
Cybersecurity	Can incorporate robust cybersecurity measures from the start.	May need to upgrade existing systems to ensure cybersecurity, especially for systems requiring comms integration and/or third-party operators.

2.4 Jurisdictional considerations

Integrating EV infrastructure involves navigating distinct jurisdictional considerations. These vary significantly between new constructions and existing buildings, influenced by local and national regulations, environmental policies and specific compliance standards. Table 3 compares these key factors.

Table 3: Jurisdictional considerations

JURISDICTIONAL CONSIDERATION	NEW-BUILD HOSPITALS	EXISTING HOSPITALS
Development approval	New builds require development consent, which includes considering EV infrastructure under the relevant local council's planning requirements.	Existing facilities may need to navigate approvals or modifications to existing consents, which can be complex and time-consuming.
Building codes	Construction must comply with the Building Code of Australia (BCA) or the New Zealand Building Code (NZBC), integrating EV charger installation into the design from the outset.	Retrofitting must also comply with the BCA or NZBC but may face other hurdles to bring noncompliant electrical infrastructure up to current standards.
Environmental policies	Projects should align with the environmental sustainability goals outlined in state and territory planning policies in Australia or the Resource Management Act in New Zealand, considering the impact of EV chargers.	Projects should align with the environmental sustainability goals outlined in state and territory planning policies in Australia or the Resource Management Act in New Zealand, considering the impact of EV chargers.
Parking standards	Must comply with Australian Standards for parking facilities (AS/NZS 2890), which can influence the planning of EV charger allocation and layout.	Any changes to parking layouts for charger installation need to comply with current AS/NZS 2890 standards, potentially affecting the number and placement of chargers.
Energy regulations	Compliance with the National Electricity Rules in Australia or the Electricity Industry Act in New Zealand to ensure safe and reliable integration of EV charging infrastructure.	Upgrades to existing electrical infrastructure must meet current energy regulations and may involve significant alterations to comply.
Accessibility requirements	Design must ensure EV charging stations are accessible, following the Disability (Access to Premises – Buildings) Standards in Australia or the New Zealand Building Act.	Existing facilities need to consider accessibility upgrades, which may involve significant alterations to parking and charger locations.
Jurisdictional whole-of-government contracts	The implications of existing whole-of-government contracts will need to be considered.	The implications of existing whole-of-government contracts will need to be considered.

2.5 Stakeholder engagement

By engaging with stakeholders and gathering their feedback on EV infrastructure requirements, the healthcare facilities can ensure the infrastructure meets the needs of its fleet vehicles and is optimised for efficient and effective charging.

The stakeholder engagement process to confirm fleet vehicle requirements for EV infrastructure should involve the following steps:

1. Identify the stakeholders who will be affected by the EV charging infrastructure.
2. Schedule meetings with the identified stakeholders to discuss their EV fleet requirements and any specific needs or concerns.
3. Conduct the stakeholder meetings and gather feedback.

4. Review and finalise the extent of electric fleet vehicle charging infrastructure requirements based on the stakeholder feedback and any regulatory requirements.
5. Obtain stakeholder approval for the final electric fleet vehicle charging infrastructure requirements and ensure any concerns have been addressed.

The EV charging strategy should be reviewed and approved by relevant stakeholders and working groups at each stage of the planning, design and delivery process. The following stakeholders should be consulted as part of this process:

- health entity fleet manager, asset manager, corporate management, sustainability manager
- sustainability working group or health entity sustainability personnel
- health capital works authority project director
- BCA consultant
- design team
- normal project governance.

To determine how many and what type of electric chargers are needed at a health facility, the following questions should be considered during stakeholder consultations:

Fleet size and location

1. Where will the fleet vehicles be garaged overnight?
2. If basement parking, will extra fire suppression be needed?
3. How many fleet vehicles does the facility have or plan to buy that will need electric charging, at each of the identified garaging locations?
4. What is the expected future change in fleet and how will that affect the charging infrastructure needed? Does the health entity have an EV strategy?
5. Are any EV chargers being considered for non-fleet vehicles and, if so, can they be installed and operated by a third party?
6. What type of EV chargers are needed for non-fleet vehicles?

Charging requirements

1. What is the expected usage pattern of these fleet vehicles (for example, daily, occasional)?
2. What types of fleet vehicles require electric charging?
3. What is the maximum distance these fleet vehicles will travel in a single day, and what charging needs will be needed to support this distance?
4. What are the charging requirements for each type of fleet vehicle and potential sources (for example, voltage, amperage, plug type)?
5. What are the peak usage times for the fleet vehicles, and how many chargers will be needed at the same time? Will fleet vehicles be charged during the day or overnight?
6. Are there any special requirements for charging EVs such as specific locations or charging schedules?
7. What is the role of smart charging in managing electrical demand, and how can it optimise energy usage and cost-efficiency for the fleet?

Metro North Health Zero Emissions Vehicle Transition

Metro North Health's *Green Metro North sustainability strategy 2021–2026* aims to transition 100% of eligible passenger vehicles to zero emissions vehicles (ZEVs) by 2026, aligning with *Queensland's zero emission vehicle strategy*. By May 2024, they achieved 56% ZEV adoption and installed 118 EV charging points across 16 locations.

Key challenges included funding alignment, user education, policy updates and managing higher-than-expected initial costs. Successes involved significant ZEV adoption, a dedicated fleet operations manager and more than 60% transition for equipment vehicles. Effective stakeholder engagement and understanding that ZEVs do not need daily recharging were crucial lessons learned. For more information, refer to the case studies in the Appendix.

2.6 Electrical services planning

Integrating EV infrastructure requires careful planning of the electrical services. This section outlines strategic steps and considerations for effectively incorporating EV charging capabilities into new and existing buildings.

Infrastructure capacity evaluation: Review the existing electrical setup, including switchboards and switchgear, to ensure they can accommodate the increased demand and physical footprint of EV charging stations. New buildings should be designed to incorporate these extra electrical loads and spatial requirements.

Charger quantity and type assessment: Calculate the number of charging stations needed by considering various vehicle types and their respective charging habits. This helps in catering to specific needs such as rapid charging or trickle charging options.

Maximum demand and future-proofing: Analyse the incoming utility supply point and existing electrical infrastructure to gauge the overall electrical capacity of the site, ensuring it can support the added demand from EV charging stations. Project future needs for EV charging and include this in maximum demand calculations.

Load management system: Allow for a load management system (LMS) to optimise the distribution of the available electrical capacity. This system should include prioritisation capabilities. Also, consider the communications capacity needed for the LMS. Car parks often have limited communications infrastructure, and EV chargers significantly increase the communications requirements, in terms of both amount and distance from comms rooms to endpoints. This needs to be included in planning because wireless systems are often not robust enough for controlling potentially significant electrical loads. Also, daisy-chaining chargers are often disallowed under government cybersecurity requirements since multiple ingress protections and media access controls per port are generally prohibited.

Designing new infrastructure: For new constructions, include dedicated electrical distribution systems designed specifically for EV charging. This includes installing new distribution boards, protective devices and robust cabling to handle expected loads.

Existing infrastructure assessment: For renovations, thoroughly assess the current electrical infrastructure. This includes examining historical energy usage patterns and existing capacity to identify potential upgrades or enhancements needed to support EV charging.

2.7 Cost considerations

Generally, the expense of charging stations escalates with their power capacity, size and charging speed. Extra chargers might mean potential upgrades and modifications to the site's existing electrical infrastructure. An estimated cost range for EV charging systems and their setup is presented in Table 4, along with an approximation of ongoing operational expenses for government-operated charging stations in * Excludes peak demand charges.

Table 5.

Installation costs will be different for each site but can be reduced through strategic placement of charging bays that reduces the length of electrical cabling required and through shared use of chargers between adjacent bays. Installation costs also include other supporting infrastructure depending on the type of charging installation including:

- switchboards breaker (switchboard upgrades not included in the cost ranges below)
- EV charger distribution board with load management
- cable trays, trenching and submain wiring
- software, ethernet and data cables for remote monitoring.

Note that these costs are to give a comparison between the options and should not be used for budgeting due to the significant variation across the judications and individual projects.

Table 4: EV charging infrastructure costs

	UP TO 3.7 KW (LEVEL 1)	7–22 KW (LEVEL 2)		25–50 KW (LEVEL 3)
				
Typical forms	General power outlet or wall-mounted EV charger	Wall-mounted EV charger	Dual or single port charging stand	Rapid DC dual port stand
Range (km) added per hour*	10–20 km	Up to 80 km	40 km per plug or 80 km if 1 plug in use	Up to 290 km
Estimated hardware cost	$500–$1,000	$2,000–$5,000	$5,000–$10,000	$30,000–$50,000

* Excludes peak demand charges.

Table 5: Estimated operational costs (for government-owned charging infrastructure)

ITEM	UNIT	ESTIMATED COST ($)	ASSUMPTIONS
Maintenance	Per port	$315	Electrician service call for 4.5 hours, assuming an hourly rate of $70 per hour (annually)

ITEM	UNIT	ESTIMATED COST ($)	ASSUMPTIONS
Software and connectivity	Per year	$300	Based on the cost for a 12-month data package from a third-party software provider**
Energy cost (1 × single port 7 kW charger) *	Per year	$2,100	Used 250 days a year, for 6 hours a day @ 7 kW and 20 kWh

* Excludes peak demand charges.

** Assumes comms rooms are already available for connection to. There will be other site specific costs not included.

2.8 Procurement models

There are typically 3 procurement models for providing EV charging infrastructure, with different benefits and responsibility for upfront costs, maintenance costs and revenue to varying stakeholders.

A comparison between the 3 common procurement models is provided in Table 6 and summarised in more detail below. These include:

- government-owned
- third party–owned*
- energy utility–owned.

To understand these procurement models, 4 key components of any charging installation should be understood:

- land host – owner of the location where the charger is installed
- engineering, procurement and construction services – responsible for the design, equipment procurement, construction and installation of the charger
- charge point operator – responsible for the management, maintenance and day-to-day operation of the charger, as well as interaction with grid operators to manage the energy supply
- electric mobility service provider – responsible for the customer experience (access to payment, user subscription and software platforms).

Table 6: Procurement models

ELEMENT	GOVERNMENT-OWNED	THIRD PARTY–OWNED	ENERGY UTILITY–OWNED
Land host	Health authority	Health authority	Health authority
Engineering, procurement, construction	Health authority selects contractor	Third party	Energy utility
Charge point operator	Health authority or contractor	Third party (for example, ChargeFox, Evie Networks, Jolt, EVX, Tesla)	Energy utility
Electric mobility service provider	Health authority uses software package provided by contractor for a fee	Third party	Energy utility

Allowing third party–operated electrical loads in hospital infrastructure introduces several risks. There is a potential for significant impacts on demand and capacity charges paid by the hospital, while third parties may impose extra costs per kilowatt. It’s crucial to have override and isolation capabilities to manage the campus’s electrical load during grid failures or when switching to generator mode. Also, curbing strategies should be in place to protect upstream infrastructure and reserve capacity. Cybersecurity risks also need to be considered because car chargers could be vulnerable to attacks that rapidly cycle the charging state, potentially destabilising the hospital‘s electrical infrastructure. These concerns are critical for complying with security of critical infrastructure (SOCI) requirements and ensuring the reliability of health service delivery.

2.9 Electric vehicle charging basics

As healthcare facilities increasingly focus on sustainability, transitioning to EVs for fleet operations presents a significant opportunity. This section provides hospital facility managers and decision-makers with fundamental knowledge about EVs and their charging requirements, ensuring a well-rounded understanding before delving into more complex installation and management details.

EVs need to be charged via electrical power, which is stored in their batteries for later use. This process involves either alternating current (AC) from standard electrical outlets or direct current (DC) from specialised charging stations. Understanding this process is key to effectively planning and managing EV charging infrastructure.

Charging levels explained

Level 1 chargers **(1.4–3.7 kW, single phase)** are typically used for overnight charging. This charging method adds 12–20 km of range per hour, making it ideal for fleet charging or long-term parking without urgent use.

Level 2 **(7–22 kW, typically 3 phase)** or level 3 **(25–50 kW typically 3 phase)** chargers should only be considered where there is a strong business need. These provide 40–290 km of range to the battery per hour and may be appropriate for cars that drive more than 100 km per day.

Parts of an EV charger

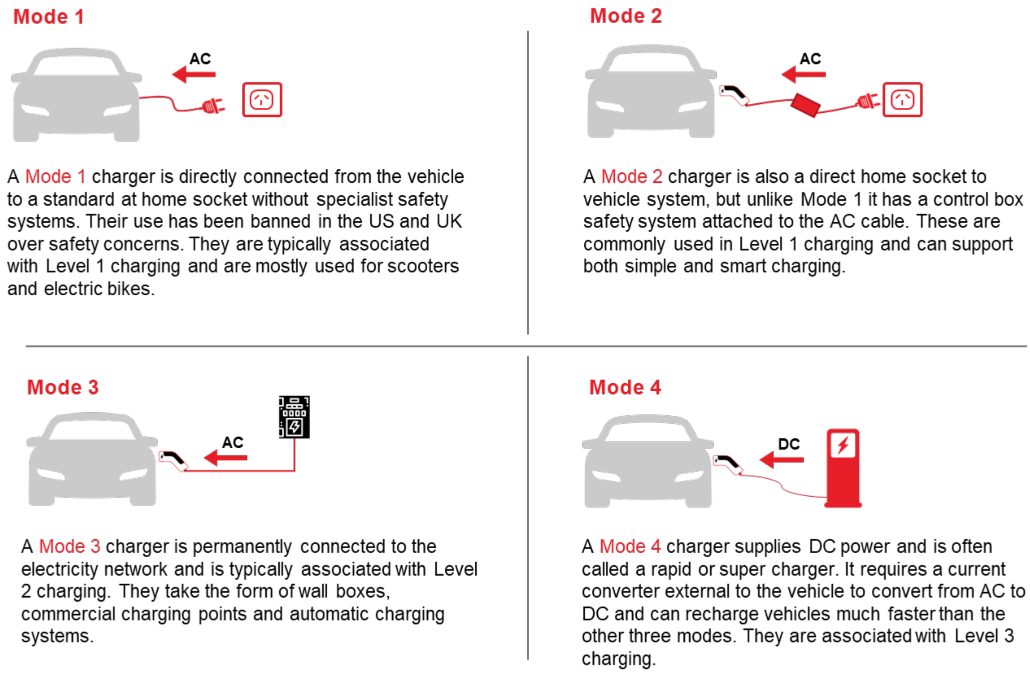
The primary hardware of an EV charger includes the charging station itself, the plug that connects to the vehicle, and the electrical infrastructure needed to support the charger.

Charging stations also have software to manage the charging process. This includes monitoring power flow, optimising charging times based on energy usage rates, and ensuring safety protocols are maintained to prevent overcharging and electrical faults.

Charging modes explained

The mode of a charger refers to the electronic connection (charging cable) between the car’s battery and the external power source or charging station. There are 4 modes used to categorise the current chargers available on the market, shown in Figure 2.

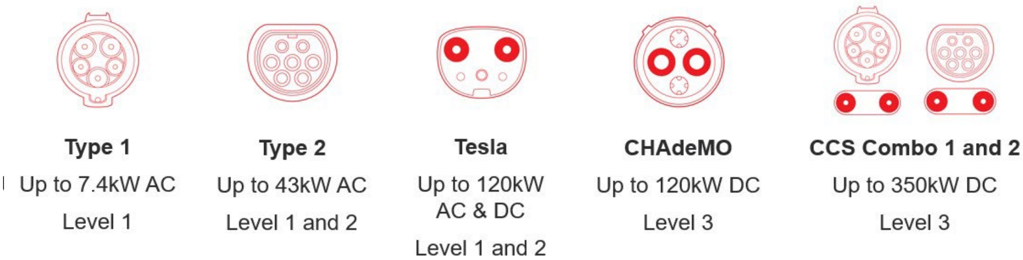
Figure 2: EV charging modes



Charging plugs

The type of charger sometimes refers to the model of plug that is connected to the charging cable and attaches to the vehicle inlet. There are a variety of charger types available on the market including specialty plugs that are unique to vehicle manufacturers such as Tesla (Figure 3). In Australia and New Zealand, the type 2, Combined Charging System 2 (CCS2) and CHAdeMO plug types are the common AC and DC plug types. All new EVs sold in Australia and New Zealand are compatible with type 2 plugs, with all vehicles also compatible with CCS2 or CHAdeMO plug types. However, EVs with type 2 and CCS2 plug types are recommended, as these plug types becoming more commonly supported by manufacturers and becoming the standard in Australia and New Zealand.

Figure 3: EV charging plugs



Understanding EV charging infrastructure

Effective power management is essential, especially in settings with multiple charging stations. This might include upgrading electrical panels, incorporating sub-meters and employing energy management systems to handle the increased load.

Planning for the future

As the adoption of EVs grows, the need for more charging stations will likely increase. Planning for scalability involves considering extra space and power capacity for future expansions.

2.10 Electric vehicle readiness

To help roll out EV infrastructure in stages, standard terminology has been adopted to describe the level of charging provision provided at the time of construction. It should be noted that this is international guidance and terminology may not align with local jurisdiction norms.

The terminology follows 3 categories of EV readiness:

- EV-capable
- EV-ready
- EV-installed.

A description of each category including their ‘day 1’ charging capabilities and typical locations is summarised in Figure 4 and Table 7. It is important to recognise that these categories are scalable, meaning that provided the bay is constructed to be EV-capable, all levels of charging infrastructure will be possible in the future.

Figure 4: EV-readiness terminology

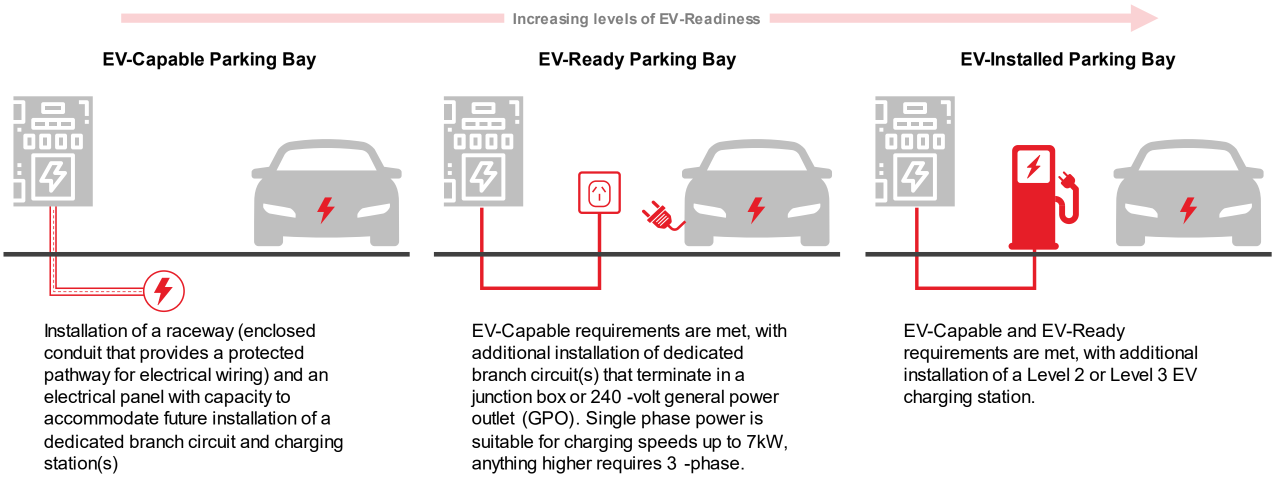


Table 7: EV-readiness terminology

	EV-Capable Parking Bay	EV-Ready Parking Bay	EV-Installed Parking Bay
Level 1	✗	✓	✓
Level 2	✗	✗	✓
Level 3	✗	✗	✓
Additional infrastructure required to achieve future charging levels	• 240-volt GPO (Level 1) • Wall-mounted 7-22kW charger attached to 240-volt GPO (Level 2) • DC charger 25-250kW (Level 3)	• Wall-mounted 7-22kW charger attached to 240-volt GPO (Level 2) • DC charger 25-250kW (Level 3)	• All infrastructure provided from ‘day-one’
Typical location(s)	Apartment complexes, company fleet parking bays	Residential dwellings, offices, destinations	Destinations, service stations, highways, charging hubs

2.11 Common misconceptions

When considering implementing EVs, it’s important to separate fact from fiction. Here are several common myths debunked to ensure decision-makers have the correct information.

Range anxiety is a thing of the past

One of the most common myths is that EVs lack sufficient range. Modern EVs now offer ranges that are well-suited for most daily travel needs, with many models capable of driving more than 300 km on a single charge. This exceeds the daily mileage requirements of most users, including those in healthcare services. It is important to note that EV range issues persist in remote and rural areas, particularly where destination charging infrastructure is lacking.

Charging electric vehicles is easier than you think

The notion that charging an EV is a long and cumbersome process is outdated. With the expansion of fast-charging networks and the convenience of home and workplace charging solutions, topping up an EV's battery has become as routine as charging a smartphone. Charging can be done overnight or during work hours, ensuring vehicles are ready when needed.

Battery longevity has improved

The early models of EVs faced concerns over battery lifespan, but advances in battery technology have significantly improved durability. Modern EV batteries are designed to last between 100,000 and 200,000 miles, or about 15 to 20 years.

Power grids are adapting to electric vehicle charging needs

There's a common misconception that the rise in EV usage will lead to an overwhelmed power grid. In reality, grids are becoming smarter and more flexible. With innovations such as demand response systems, EV charging can be managed to coincide with off-peak energy times, balancing the load and preventing grid overload.

Electric vehicles are relatively safe from fire

One of the most commonly shared EV myths is that they regularly catch fire. While it's no secret that EV fires present an increased danger once the battery starts burning, studies show that the likelihood of an EV catching fire is significantly less than that of a petrol or diesel car.

Fast charging is not detrimental to battery health

Fast charging technology has improved, and while it's true that it can contribute to battery wear if used excessively, manufacturers have implemented battery management systems to minimise the impact. Most EV users will not rely solely on fast charging, making it a convenient option rather than a daily necessity.

Electric vehicle battery recycling is on the rise

Another misconception is that EV batteries are not recyclable and pose environmental risks at the end of their lifecycle. However, battery recycling is becoming more common, and the industry is developing methods to recover valuable materials, reducing the environmental footprint.

There are enough resources for battery production

Concerns about a shortage of lithium and other critical minerals for batteries have been circulating, but the industry is actively working on solutions. Recycling, new mining technologies and alternative battery chemistries are all contributing to a more sustainable battery supply chain.

NT Health Electric Vehicle Fleet Rollout

In 2021 the Northern Territory Government committed to transitioning to a low carbon economy. The NTG vehicle policy framework now requires agencies to transition pool vehicles to EVs where suitable. NT Health, with NT Fleet, rolled out EVs in Darwin, Palmerston and Alice Springs. EVs in the NT Health fleet have a range of 220–450 km and typically charge in under 8 hours.

Challenges include ageing infrastructure, delayed charger installation, shared charger use, landlord permissions and staff reluctance to drive EVs.

Successes feature reduced refuelling and maintenance time and costs, and lower carbon emissions. Lessons learned emphasise the need for infrastructure planning, operating procedures, staff education, increased Radio-Frequency Identification (RFID) access, and installing 4G capabilities for future use. For more information, refer to the case studies in the Appendix.

Lifecycle emissions are lower for electric vehicles

Some believe that when considering the production of batteries, EVs may have higher lifecycle emissions than fossil fuel cars. However, studies have consistently shown that even when accounting for battery production, EVs typically have a smaller carbon footprint over their lifetime, which continues to shrink as the energy grid becomes greener.

Electric vehicles are better on a whole-of-life perspective, even with grid power

Despite concerns about the current carbon intensity of grid power, EVs still offer a lower whole-of-life carbon footprint compared with fossil fuel vehicles. As the energy grid transitions to greener sources, the environmental benefits of EVs will further increase. This underscores the long-term sustainability advantage of EVs.

3 Design of EV infrastructure

3.1 Regulations

National Construction Code requirements (Australia only)

This section explains the National Construction Code (NCC) requirements for EV charging infrastructure in new buildings. This is provided as guidance only and is not to replace formal advice from a NCC consultant.

As a performance-based code, the NCC sets the minimum required level for the safety, health, amenity, accessibility and sustainability of certain buildings. The Australian Building Codes Board (ABCB), on behalf of the Australian Government and each state and territory government, produces and maintains the NCC. To support Australians making the switch to EVs, the NCC is requiring new buildings to be ready for EV charging. To help industry, the ABCB has published a new advisory note. EV-ready was introduced in the 2022 NCC version.

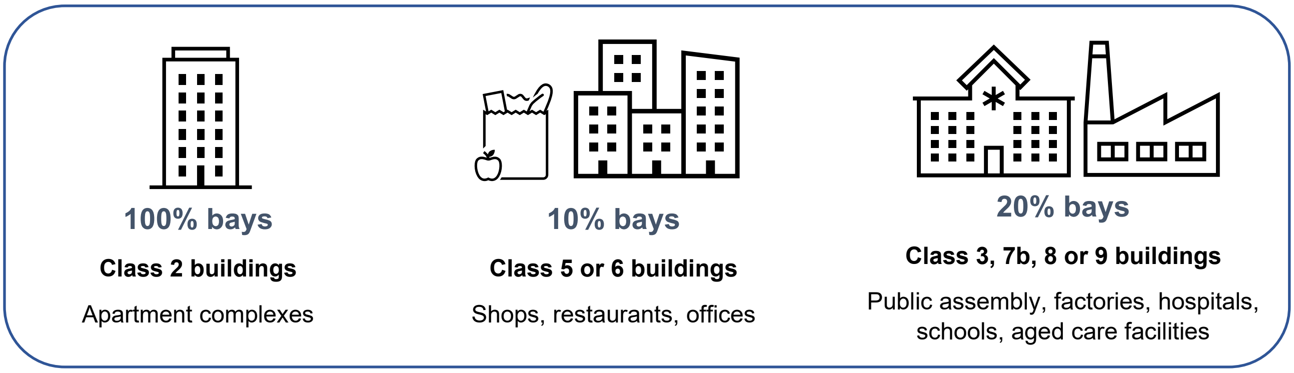
Section J9D4 of the NCC 2022 mandates that Class 9 structures must have electrical distribution boards to facilitate EV charging for 20% of available car parking spaces (Figure 5).

The electrical distribution boards are to be sized to support the future installation of 7 kW (32A) type 2 chargers for the 20% of spaces mentioned above. For Class 9 buildings, the electrical distribution boards serving the car park must have the capacity for each circuit to support an EV charger able to deliver a minimum of 12 kWh from 9:00 am to 5:00 pm daily. There is no mandatory requirement for a minimum number of EV chargers for health infrastructure projects.

Also, J9D4 does not apply to standalone Class 7a buildings such as multistorey car parks. Where the project includes a multistorey car park that stands alone, the NCC consultant should be consulted to confirm that it is classed as a standalone Class 7a building.

If the provision of electric vehicle supply equipment for fleet vehicles meets or exceeds the 20% requirement set by the NCC, there is no need for any further EV charging provisions. However, if the provision falls below 20%, other provisions must comply with the NCC.

Figure 5: Minimum compliance for new charging infrastructure according to J9D4 facilities for electric vehicle charging equipment



Source: National Construction Code 2022

At the time of publishing this guidance the NZBC did not include specific EV charging requirements.

AS/NZS 3000 requirements

AS/NZS 3000 lists requirements for designing, installing and maintaining electrical installations in Australia and New Zealand. It covers various aspects such as wiring systems, equipment selection, protection against electrical faults and safety considerations. AS/NZS 3000 is an essential reference for electricians, electrical engineers and anyone involved in electrical work to ensure compliance with safety and regulatory requirements.

Appendix P of AS/NZS 3000 has guidance for installing and locating electrical vehicle socket-outlets and charging stations.

In New Zealand only, requirements for installing and locating socket-outlets for EV charging stations are provided in AS/NZS 3000 clause 7.9.

3.2 Design process

Table 8 outlines the essential steps in designing EV charging stations for healthcare facilities, distinguishing between requirements for new builds and existing structures. It serves as a practical guide, helping decision-makers understand the necessary actions at each stage, from initial planning to final construction. This ensures the integration of EV charging infrastructure is efficient and compliant with relevant standards, while meeting both current and future demands.

Table 8: Healthcare design process

DESIGN PHASE	NEW-BUILD SCOPE	EXISTING FACILITIES SCOPE
Master planning	Determine high-level EV requirements based on available information, market practices, business case, stakeholder engagement.	Determine high-level EV requirements based on available information, market practices, business case, stakeholder engagement.
	Identify EV charging load centres and plan the electrical infrastructure accordingly.	Identify existing and proposed EV charging load centres and assess implications on current electrical infrastructure.
	Explore future expansion possibilities.	Explore potential for future expansion within existing site constraints.
		Identify potential compliance issue in the existing electrical infrastructure and how this might affect the EV proposals.
Concept	Engage with stakeholders to communicate and/or determine high-level EV charging requirements.	Engage with stakeholders to communicate and/or determine high level EV charging requirements, considering retrofitting constraints.
	Review sustainability targets and align the design with them.	Review and align retrofit plans with sustainability targets.
	Define the EV charging strategy including potential users, charger types, billing requirements, charger locations and quantities. (Note: Billing will not be required for fleet but may need to be considered for future expansion to staff or public EV charging.)	Define retrofit EV charging strategy including potential users, charger types, billing requirements, charger locations and quantities. (Note: Billing will not be required for fleet but may need to be considered for future expansion to staff or public EV charging.)
	Concept plant massing to inform electrical plant for both day 1 and future.	Plan modifications to the existing electrical plant to accommodate immediate and future EV charging needs.
Concept	Develop a high-level maximum demand to inform infrastructure capacity.	Develop a high-level maximum demand calculation to inform infrastructure upgrade capacity.

DESIGN PHASE	NEW-BUILD SCOPE	EXISTING FACILITIES SCOPE
	Complete a multidisciplinary constraint and opportunities analysis.	Complete a multidisciplinary analysis considering existing building constraints and opportunities.
	Identify initial compliance requirements with AS/NZS 3000 and the NCC.	Identify initial compliance requirements with AS/NZS 3000 and the NCC. Complete detailed site investigations to identify existing noncompliance.
	Report, drawings and schematic development.	Report, drawings and schematic development.
	Cost review and safety in design.	Cost review and safety in design.
Schematic design	Develop maximum demand calculation suitable for early-stage electrical authority supply application.	Develop maximum demand calculation for modifying existing electrical infrastructure.
	Determine back-up power requirements.	Determine back-up power requirements considering existing systems.
	Application for supply including EV charging requirements.	Review existing supply constraints and seek approval for extra capacity as needed to supply the new EVs.
	Align design with project sustainability targets.	Align retrofit design with project sustainability targets.
	Develop reticulation strategies.	Develop reticulation pathways strategy within existing infrastructure. Ensure a below-ground survey has been completed. Determine diversions as required.
	Develop plant massing for electrical infrastructure.	Develop electrical plant massing and check that space is available via site inspections and review of as-built drawings.
	Report, drawings and schematic development.	Report, drawings and schematic development.
	Cost review and safety in design.	Cost review and safety in design.
Design development	Detailed design and coordination of systems.	Detailed design and coordination for integration into existing systems.
	Prepare detailed specifications, drawings and schematics.	Prepare detailed specifications, drawings and schematics.
	Develop LMS and integrate with supply infrastructure.	Develop LMS and integrate with supply infrastructure. Investigate any existing systems to identify feasibility of reuse or the need for upgrades.
	Develop electrical infrastructure arrangements.	Detailed assessment of existing single-line diagrams and integration of new EV charging infrastructure. Site inspections to validate as installed and assumptions.
	Cost review and safety in design.	Cost review and safety in design.

DESIGN PHASE	NEW-BUILD SCOPE	EXISTING FACILITIES SCOPE
Construction drawings	Produce detailed construction-ready drawings specifying installation procedures, timelines and coordination with construction teams.	Produce retrofit construction-ready drawings specifying installation procedures, timelines and coordination needs.
	Include final equipment selections and detailed set-out plans.	Finalise equipment selections and adapt set-out plans to existing building layout.
	Ensure compliance with all required construction and safety standards.	Ensure retrofit complies with current construction and safety standards.
	Submit final documentation for health authority approval.	Submit final documentation for health authority approval.
	Operation and maintenance manual development.	Operation and maintenance manual development.
	Training program development.	Training program development.
	Cost review and safety in design.	Cost review and safety in design.

3.3 Number and type of chargers

Calculating the exact number of chargers needed for a specific fleet size isn't straightforward. So fleet managers often use the 'start-stop' system. This involves installing enough chargers in each bay to ensure vehicles are fully charged at the beginning and end of their operating day, whether they charge overnight or during the day. This method also must consider the administrative work needed to coordinate charger sharing among bays versus providing a dedicated charger for each bay. Typically, the solutions range from:

- individual provision – equipping each bay with its own charger to guarantee that all vehicles can be charged on site, either overnight or intermittently during the day
- shared provision – having fewer chargers that are used collectively by multiple bays.

The pros and cons for each approach are summarised in Table 9, with the appropriateness of each approach for typical operations discussed further below.

Assessment of electric vehicle volume and usage

The current and projected volume of EVs, considering fleet vehicle needs over the next 5 to 10 years should be analysed. This should include an assessment of peak charging times, which may correlate with staff shift changes, to understand the demand for charging facilities.

Table 9: Individual versus shared charger provision comparison

	INDIVIDUAL PROVISION (1:1 CHARGER RATIO)	SHARED PROVISION (1:2+ CHARGER RATIO)
Pros	✓ Reduced time/effort needed to manage charging. ✓ Reduced risk of vehicles being unable to access a charger when needed. ✓ Most applicable to sites with high daily kilometre requirements.	✓ Lower capital investment. ✓ Lower maintenance costs. ✓ Most applicable to sites with low daily kilometre requirements. ✓ Flexibility to add more EVs without adding more chargers.

	INDIVIDUAL PROVISION (1:1 CHARGER RATIO)	SHARED PROVISION (1:2+ CHARGER RATIO)
Cons	× Higher capital investment and maintenance costs. × Risk of wasted investment if chargers aren't fully used. × Greater LMS required to coordinate the distribution of power across all chargers. × Potential barrier for adding more EVs.	× Requires increased management systems (car bay booking or possibly human resources to shift vehicles in and out of bays). × Requires staff acceptance to share assets. × Dependent on staff following policies, or need for central fleet manager support.

Local and international guidance for EV charger provision highlights that, for most workplaces, a combination of individual provision and shared provision is most appropriate, differing on the vehicle's use and the reliance on onsite chargers. A summary of best practice provision of EV chargers in workplaces is shown in Table 10.

Table 10: Local and international best practice charger provisions

	FLEET VEHICLES	STAFF	VISITORS
Charger-to-bay ratio	1:1	1:10–1:5	1:10–1:4
Reliance on onsite chargers	All charging except for while on very long trips.	Low	Low
Justification based on user behaviour and policy provisions from local and international case studies	Ensures all pool vehicles start the day at 100% charge. Staff avoid needing to wait potentially long times at public chargers during the workday. Close to 100% of fleet vehicle charging will happen on site, reducing charging costs. Maximises fleet use.	Only 10–20% of staff would need to charge their vehicle on any given day. Staff are generally open and willing to share chargers. Promotes less reliance on private vehicles.	Only 10–25% of visitors would likely need to charge their vehicle during their stay. Visitors are slightly more likely to have driven further than staff.

Charger types – level 1, level 2, and DC fast chargers

Level 1 chargers offer the slowest charging through standard wall outlets (230 V) and are typically used for overnight charging or long-duration parking.

Level 2 chargers provide a faster charging option through 240–400 V outlets, suitable for fleet vehicles that need quicker charging capabilities during the day.

DC fast chargers deliver the fastest charging and are suitable for locations where vehicles need to be rapidly charged and made ready for use, such as for emergency service vehicles.

There is a trend towards adopting a single type of charger and using a management platform to control charge rates and scheduling.

Considerations for charger type selection

Operational needs: Select charger types that align with the vehicle usage and operational requirements.

Site limitations: Evaluate the feasibility of installing various charger types within the physical and electrical constraints of the site.

Cost implications: Consider the installation and operational costs associated with different types of chargers.

Implementation strategy

Establish the mix of level 1, level 2 and DC fast chargers based on usage patterns and needs assessment.

Provide a range of chargers to offer flexibility for different EV user groups and vehicle demands.

Design the charging infrastructure to be scalable, allowing for an increase in the number and types of chargers as EV adoption grows.

Stakeholder consultation

Gather input from facility management, healthcare professionals and fleet operators to gauge their charging requirements and preferences, which will inform the selection process.

Regulatory compliance

Select chargers that comply with the relevant electrical codes and standards, ensuring they are compatible with the broad range of EVs that will use the facility.

Final selection

Make a well-informed decision that accounts for both the current charging needs and the anticipated advancements in EV technology and usage patterns. The chosen infrastructure should reflect the facility's sustainability objectives and budgetary considerations.

The outcome should be a solution that provides reliable service today and can adapt to the evolving landscape of EVs in the future.

3.4 Demand management and essential services

Effective demand management is critical to the integration and operation of EV charging stations, particularly in high-demand environments like healthcare facilities. Demand management strategies can help align the availability of charging services with the electrical supply's capacity, ensuring the charging infrastructure is both efficient and sustainable.

Understanding demand management:

Demand management involves controlling the power load of EV charging stations to avoid peak energy usage times, which can strain the electrical supply, leading to power outages and higher energy costs. By using smart charging strategies, healthcare facilities can balance the charging load throughout a 24-hour period, reducing the impact on the facility's overall energy consumption.

Charge scheduling for optimal demand management

Generally, vehicle batteries should have plenty of capacity for a typical day's usage. Therefore, the default setting for EV chargers should be overnight charging when site electrical demand is low. This approach not only helps balance the load on the electrical supply but also takes advantage of lower energy costs during off-peak hours.

If overnight charging is adopted, consider prioritising vehicles and charging bays. It is essential to ensure certain vehicles, especially those designated for emergency use, always have enough charge. This can be achieved by allocating specific charging bays for these priority vehicles and incorporating smart charging systems that can manage and prioritise these needs. Also, allow for an operator override. This feature would allow vehicles that return partway through the day with a low battery to begin charging immediately. This flexibility ensures operational efficiency is maintained and that vehicles are always ready for use.

Load management systems

LMS is a technology solution that intelligently manages the power output of EV charging stations. It can adjust charging rates or defer charging based on real-time energy usage, grid demands and predetermined settings. An LMS can prioritise charging for essential service vehicles or allocate power across multiple charging stations to prevent overloading the system.

Demand response programs

Demand response programs involve coordinating with utility providers to reduce or shift electricity usage during peak periods in response to time-based rates or other forms of financial incentives. Taking part in these programs can lead to cost savings for healthcare facilities and contribute to overall grid stability.

Benefits of demand management

Reduced energy costs: By avoiding peak tariff periods, healthcare facilities can minimise the cost associated with charging EVs.

Enhanced grid stability: Smart charging can prevent spikes in electricity demand, which helps maintain the stability of the local power grid.

Increased charger availability: An LMS ensures chargers are available when needed without exceeding the facility's electrical capacity.

Sustainability goals: Aligning EV charging with demand response initiatives supports broader environmental and sustainability objectives by optimising energy usage.

ICT considerations

It is essential to specify a preference for wired communications because SOCI and government cybersecurity requirements generally mandate their use. Wired connections offer enhanced security and reliability, which are crucial for maintaining the integrity and functionality of EV charging infrastructure in healthcare facilities.

Implementing demand management

To implement effective demand management for EV charging:

- Install smart chargers that can communicate with an LMS and respond to demand response signals.
- Work with utility providers to understand and enrol in available demand response programs.
- Develop site-specific charging policies that prioritise vehicle charging based on need and utility rate structures.
- Monitor and review charging data to continually optimise demand management strategies.

By carefully managing when and how EVs are charged, healthcare facilities can ensure a reliable and cost-effective charging infrastructure that supports the move to electric mobility while contributing to the resilience and sustainability of the power system.

Health New Zealand / Te Whatu Ora BEV rollout

With support from New Zealand's Carbon Neutral Government Programme, Health New Zealand Te Whatu Ora replaced more than 700 internal combustion engine (ICE) vehicles with battery electric vehicles (BEVs) by Q2 FY 2022–23, adding around 200 more each quarter. The Te Tai Tokerau / Northern division, which began with 6 BEVs in 2017, now has 150 fully electric and 36 plug-in hybrid vehicles in its 300-vehicle fleet.

Challenges included insufficient charging infrastructure, mitigated by smart chargers, and maintaining vehicle operation during power outages, necessitating some ICE vehicles. Collaboration overcame range anxiety and limited BEV models. Successes include expanded charging networks and better battery technology. Key lessons were the complexity of charging infrastructure, the importance of understanding the operating environment and leveraging decarbonisation funds to offset costs because BEVs have lower long-term operating expenses than ICE vehicles. For more information, refer to the case studies in the Appendix.

Essential services

A fundamental part of ensuring service continuity is the thorough assessment of backup power needs specifically for the fleet vehicle EV chargers. This assessment helps to establish a plan that keeps fleet vehicles charged and ready, a crucial consideration for the uninterrupted operation of healthcare services.

If EV infrastructure is connected to essential power and backup generators, it needs to be determined that the additional electrical demand can be met by the generators without compromising other essential loads in the facility. If this is not the case, additional backup generator capacity and fuel tanks may need to be installed.

In cases where backup generators are not viable, alternative strategies should be developed to address potential power outages. Instead of relying on generator power, the focus shifts to procedures that can mitigate the impact of outages, such as:

- developing agreements with nearby off-campus charging facilities to ensure fleet vehicles can be charged even during local power disruptions
- creating robust communication plans to inform staff of alternative charging locations and procedures swiftly during an outage
- establishing priority charging windows for essential service vehicles to ensure they maintain enough charge.

Collaborating with stakeholders is essential in tailoring these strategies to the specific operational realities of each healthcare facility. Stakeholder input can help shape practical and site-specific responses to power outages, ensuring crucial healthcare services remain unaffected. These contingency plans should be clearly documented and communicated to all relevant personnel to ensure effective implementation when needed.

3.5 Reporting

Accurate reporting of energy used for charging EVs is essential to ensure an accurate total of organisational energy use. Energy usage can be categorised into:

- energy used at healthcare facilities
- energy used from other public or private chargers.

Ensure compliance with specific reporting requirements for each jurisdiction early in the project.

Local and remote reporting

Healthcare facilities:

- ensure the energy used for charging EVs is not counted twice in the facility's total energy usage report
- capture energy usage data directly from the EV charger system/software to ensure accurate measurement and reporting.

External facilities:

- add the measured energy consumption from external chargers to the total organisational energy consumption
- capture energy usage data from external chargers, whether public or private, through fuel cards or manual logging.

Include emissions from both local and remote energy use when calculating transport-related greenhouse gas emissions.

Capturing data from external sites

Public chargers collect usage data through network management systems as part of a 'fuel card' type arrangement.

Private chargers:

- source data from the EV charger's control system, capturing the energy flowing out of the charger
- avoid privacy issues and complexities associated with submetering
- use manual logging by drivers if automated data collection is not possible.

Benefits of automated data feeds

The benefits of automated data feeds are that they:

- enhance accuracy and reduce manual workload
- minimise reliance on spreadsheets and manual data entry
- implement automatic data feeds between EV charging systems and environmental data management systems.

Best practices

Automated data collection: Integrate automatic data feeds to capture real-time electricity usage data.

Accurate categorisation: Accurately categorise electricity usage between onsite and offsite charging to prevent double counting.

Transparent reporting: Clearly report all relevant data in the entity's annual environmental report.

Ensure compliance with applicable guidelines.

National Australian Built Environment Rating System (NABERS) public hospitals: Exclude electricity used to charge EVs from the NABERS reporting boundary. Public hospitals charging EVs on site should consult their NABERS assessor about excluding this data from the rating process.

Compliance

Determine specific reporting requirements for each jurisdiction to ensure compliance with local regulations and standards.

3.6 Security

Consider the following factors when deploying EV infrastructure:

- Location: Place EV chargers in well-lit, easily accessible areas that are visible to security personnel and close to the entrance or designated parking areas. Ensure they do not obstruct emergency routes or cause congestion.
- Access control: Implement access control measures to restrict usage to authorised personnel. This can be achieved through key card access, RFID tags and so on.
- Security: Install security cameras or surveillance systems to monitor the charging stations and surrounding areas. Ensure the charging stations are tamper-proof and/or securely mounted to prevent vandalism.
- Emergency access: Designate certain charging stations for essential vehicles such as emergency vehicles to ensure they have priority access when needed. Clearly mark these stations and ensure they are always available for emergency use.
- User identification: Implement systems for user identification to track usage and prevent unauthorised access.
- Payment and fees: Determine whether EV charging will be offered for free or if fees will be applied. If fees apply, ensure payment methods are secure and convenient for users, such as credit card payments or mobile payment apps.
- Maintenance and support: Establish protocols for regular maintenance and troubleshooting of the charging infrastructure to ensure reliability. Provide users with contact information or a helpdesk for technical support and assistance.
- Accessibility: Ensure charging stations comply with accessibility standards and are easily accessible to people with disabilities. Provide designated parking spaces with accessible charging infrastructure and appropriate signage as per the NCC.
- Training and education: Offer training/education about the availability and use of EV charging infrastructure. Provide information on how to access the charging stations and any relevant policies or guidelines.
- Restrict access: Restrict access via a swipe card to ensure authorised access only.
- Routine patrols: Conduct routine patrols to prevent unauthorised charging.
- Staff policies: Implement staff policies on using EV charging infrastructure.
- Cybersecurity: Prioritise wired communication systems as required by SOCI and government cybersecurity mandates, ensuring secure installation and configuration of all hardware and software with strong passwords, encryption and regular security updates.

3.7 Fire safety

The planning and design of EV charging stations in car parks must comply with the requirements of the Australasian Fire and Emergency Service Authorities Council document *Electric vehicles (EV) and EV* *charging equipment in the built environment*. The ABCB Advisory Notice, dated June 2023, must also be included. The design of the EV infrastructure should be coordinated with local fire brigade requirements:

1. A master isolation switch with signage is to be provided at the fire indicator panel or fire detection indicator control equipment or building entrance. If provided at the building entrance, the isolation switch must be protected from the public and accessed with a 003 key.
2. Chargers must have the Regulatory Compliance Mark.
3. Develop emergency services information packs for each site and provided for first responders. For example, in NSW refer to the Fire and Rescue NSW website <https://www.fire.nsw.gov.au/gallery/files/pdf/guidelines/guidelines_ESIP_and_TFP.pdf>.
4. Provide signage to identify each EV charge point (see points 10 and 24 for more detail).
5. Provide collision protection bollards to protect the charging stations from vehicular damage.
6. Update fire alarm block plans for existing sites and implement plans for new builds to clearly show the location of charging hubs and the master isolation switch.
7. Mode 3 and 4 chargers should only be installed by a qualified person and in line with AS/NZS 3000.
8. Locate the EV charging bays where they avoid blocking evacuation routes (in the event of a vehicle fire). Also, EV charging stations need to be reviewed in both isolation and in conjunction with any other fire engineered performance solutions.
9. Where possible, use 'smart charging' to enable remote monitoring and access to disconnect the power supply to a connected EV.
10. For sites with 5 or more Mode 3 or 4 chargers, install fire brigade signposting at the site entrance and/or other appropriate level(s) to indicate which entrance/route is most closely located to the EV charging hub.
11. Where 5 or more chargers are installed, develop a pre-incident plan (PIP). Invite the local fire station to attend a site familiarisation visit to help develop the PIP.

Other requirements

For large-scale, high-density or complex health facilities, other considerations include the following:

12. Any walls bounding/adjoining the charging stations must have an FRL of 60/60/60. Where charging stations are in basement car parks, this is to be increased to 120/120/120.
13. Charging stations should be located away from any combustible materials or near any utilities (substations, fuel storage and medical gases). Consider raising charging stations above ground level to mitigate against flooding risk.
14. Consider locating hydrants so the brigade can safely connect without direct exposure to an EV fire in the charging station area while being close to effectively fight a fire.
15. Parking structures must install a clearly signposted break glass alarm (with an explanation of its purpose) at each charging station bank. The break glass is to activate the fire alarm system, which in turn will cut off the power to all charging points.
16. Consider manual shut-off for all charging stations (without activating the fire alarm), which should be clearly signposted. Isolation of charging stations should have a lock out method to prevent unauthorised reactivation.
17. The location of the exhaust air vents must be considered to ensure fumes from a fire and vapour cloud are not exhausted to an area that may affect occupants, the functionality of the building, such as air intakes, or other facilities.

18. Charging stations should be located away from any storage or charging facilities for light EVs (e-scooters, e-bikes).
19. EV charging stations must be accessible for towing vehicles away from the area (once it is safe to do so). Allow for the carcass of an EV to be transported to an open area 15 metres from all combustibles and structures.
20. Where systems can accommodate, consider limiting the charging station's maximum state of charge (SoC) to 80%. EVs operate most effectively between 20 and 80% of SoC. Degradation and heat production is greater when charging between 80 and 100%. Also, repeated over discharge can cause thermal runaway.
21. Where a sprinkler or fire detection system is not installed, CCTV monitoring must be installed to view all charging stations.
22. The entry barriers (where provided) should prevent entry upon activation of a fire system. The barrier is to be overridden by way of a 003 key for emergency vehicles and signposted accordingly.
23. Where possible, there should be an increased distance between charging bays (as much as practicable) to create distance between vehicles as flames flare horizontally, and also to allow fire fighters better access to the underside of the vehicle with hose reels.
24. EV charging point should be located away from critical hospital infrastructure. Clinical service functions such as basement car parks below clinical buildings should be avoided for EV charging.
25. Instructions on how to use the charging stations should be clearly displayed at the stations, easy to understand and include the actions required to deal with error messages from the EV or station and in the event of fire or other vehicular issues.

4 Risk management and resilience planning

4.1 Risks

Identifying and managing risks is crucial for successfully implementing EV infrastructure in healthcare settings. These risks can vary significantly across different types of healthcare projects and jurisdictions, influenced by local regulations, infrastructure limitations and specific healthcare needs. Table 11 lists some key considerations for balancing these risks with the requirements for EV implementation.

Table 11: EV charger risks and mitigation strategies

RISK	NEW-BUILD MITIGATION	EXISTING FACILITY MITIGATION
Infrastructure compatibility and upgrades	Ensure new designs accommodate EV charging needs with scalable electrical infrastructure.	Conduct a comprehensive electrical capacity assessment. Consider phased charger installations or smart charging solutions to manage the load.
Financial risks	Seek government grants and incentives. Integrate EV charging costs into the initial budget with a clear financial plan.	Seek government grants and incentives. Integrate EV charging costs into the initial budget with a clear financial plan.
Outdating technology	Choose modular and upgradeable charging systems. Maintain flexibility in design to accommodate future advancements.	Investigate existing systems to understand their remaining design life and when they may become obsolete. New chargers may mean existing systems need to be upgraded.
Regulatory and compliance risks	Incorporate compliance with AS/NZS 3000 and the NCC into the design and planning. Engage with compliance consultants.	Incorporate compliance with AS/NZS 3000 and the NCC into the design and planning. Engage with compliance consultants. Conduct a detailed site inspection to understand legacy issues. Seek agreement from a building's regulation approver for any noncompliance.
User adoption and engagement	Plan for user-friendly design and accessibility. Implement awareness and incentive programs from the start.	Implement awareness campaigns. Provide incentives for EV adoption and engage with stakeholders early in the planning process.
Space and accessibility challenges	Design to maximise space and ensure accessibility from the outset, including the potential for future expansions.	Carefully plan charger locations to maximise space and ensure accessibility. Access existing and future workflows to ensure the new design does not have a negative impact on existing workflows.

RISK	NEW-BUILD MITIGATION	EXISTING FACILITY MITIGATION
Impact on emergency and essential services	Stakeholder engagement to determine the extent of standby power requirements. Budget reviews to ensure proposals are feasible. LMS to ensure the build loads are prioritised.	Stakeholder engagement to determine the extent of standby power requirements. Budget reviews to ensure proposals are feasible. LMS to ensure the build loads are prioritised. Review existing generator capacity in the first instance because upgrading the generators may not be possible.
Charging infrastructure security risk	Implement robust security measures including surveillance and secure network protocols during the design phase.	Implement robust security measures including surveillance and secure network protocols during the design phase. Speak to stakeholders about existing security concerns and include mitigations as necessary.
Fire risk	Use charging equipment that adheres to safety standards. Plan for regular maintenance and safety inspections. Engage a fire engineer to review the fire safety issues for multistorey or inbuilding parking.	Use charging equipment that adheres to safety standards. Plan for regular maintenance and safety inspections. Engage a fire engineer to review the fire safety issues for multistorey or inbuilding parking. Inspect existing buildings to identify and fire risks. Update fire risk plans and procedures.
Power supply disruption (fleet vehicles)	Integrate backup power solutions in the initial design to ensure uninterrupted charging capability where required. Develop a management plan for power outages.	Integrate backup power solutions in the initial design to ensure uninterrupted charging capability where required. Develop a management plan for power outages. Existing generators may limit charger standby power, so there may be more focus on a management plan.
Vehicle versus charger accident	Designate clear vehicle pathways and protective barriers around chargers to prevent collisions.	Designate clear vehicle pathways and protective barriers around chargers to prevent collisions.
Vehicle versus charger cable	Ensure cables are securely mounted and protected and consider retractable cable systems to reduce tripping hazards.	Ensure cables are securely mounted and protected and consider retractable cable systems to reduce tripping hazards.
Pedestrian versus charger cable	Design charger placement to avoid pedestrian pathways.	Design charger placement to avoid pedestrian pathways.

Balancing these risks with the specific needs and constraints of healthcare facilities requires a strategic approach involving thorough planning, stakeholder engagement and flexibility to adapt to changing circumstances and technologies. By carefully considering these factors, healthcare organisations can effectively integrate EV infrastructure, supporting their sustainability goals while maintaining high-quality patient care.

4.2 Resilience planning

Building resilience against weather events and enhancing disaster readiness are critical for maintaining the reliability of EV charging infrastructure. Facilities should be designed to withstand adverse weather conditions and ensure continuity of service during emergencies, including blackouts. Strategies include installing weather-resistant charging equipment, ensuring adequate drainage and surge protection, and developing backup power solutions. Also, incorporating redundancy in the electrical design can help mitigate the effects of power outages on EV charging capabilities, ensuring essential healthcare services remain mobile and responsive, even in the face of unforeseen events.

5 Appendix: Case Studies

Case Study 1: Royal Melbourne Hospital Electric Vehicle Project

The Royal Melbourne Hospital (RMH) has set a goal for 99% of its fleet to be EVs by 2026. In 2023, RMH increased its EVs to 34 out of its total fleet of 170 vehicles. In this case, moving to EVs represented a cost saving due to funding available through the Department of Transport and Planning's Zero Emissions Vehicle Program. The remaining petrol fleet vehicles are generally on existing leases, and conversion to EV or hybrid (for interstate travel) will be investigated at the end of these leases.

To enable this transition, RMH has installed significant EV charging infrastructure. RMH's project partner, JET Charge, investigated various options to optimise the installation of 32 chargers that balanced available car parking space, existing electrical infrastructure capacity and fleet vehicle usage patterns. The best value for money solution was 10 chargers located in the underground car park at the main Parkville site and 22 chargers at the Royal Park aged care and rehabilitation site. All installed chargers were 22 kW.

RMH found that providing fleet and trip management support through staff education and training was a key enabler for success. As the EV fleet expands more advanced support will be required, such as management of vehicle charge level versus trip requirements and charger availability onsite, offsite and potentially home charging by staff – a model that has been successful in Norway.

Challenges

- Balancing EV charging requirements with existing infrastructure requires options analysis.
- There is lack of clear fire safety requirements for installing chargers in basement car parks.

Successes

- The move to an EV fleet has generally been well received, although staff training and education was needed to assist the transition.
- Grant funding provided a cost saving for EVs compared with petrol-powered vehicles.

Lessons learned

- As the EV fleet expands, more management and home charging may be required.
- Where possible, future-proof for a fully electric fleet.
- Vehicle leasing contracts may need to change to accelerate adoption of EVs.

Links:
https://www.thermh.org.au/news/electric-vehicles-join-the-rmh-fleet;
https://www.buyingfor.vic.gov.au/zero-emissions-vehicle-program

Case Study 2: Metro North Health zero emissions vehicle transition

As the largest health service in Australia, Metro North Health is committed to acting towards environmental sustainability and delivery high-quality health services for its community and future generations. The *Green Metro North sustainability strategy 2021–2026* is the strategy for a net zero future for Metro North Health and presents a commitment to environmental sustainability over five strategic elements. One of these elements is ‘green initiatives’ of which “Transport” is a key focus. The primary objective of this initiative is to transition 100% of eligible passenger vehicles to ZEVs by the end of 2026, aligning with the *Queensland’s zero emission vehicle strategy 2022–2032* and the *QFleet electric vehicle transition strategy 2023–2026*.

To support the move to ZEV, a dedicated project within Sustainable Assets and Infrastructure was established to manage the installation of EV charging infrastructure across Metro North Health sites. The primary objective is to provide enough charging capacity for the growing ZEV fleet and to liaise with the extensive network of health facilities and managers to provide guidance and plan an initial rollout of charging infrastructure.

Challenges

- Aligning funding and installation of charging infrastructure
- Educating user groups on EV use, management and misinformation
- The supporting policies and procedures are not geared for EV and require updating
- Higher initial expense means cost benefit is long term

Successes

- 131 ZEV passenger vehicle (56%) as of May 2024
- 60%+ more ZEV transition achieved for equipment vehicles
- 118 EV charging points installed so far across 16 locations
- Senior fleet operations manager recruited to champion the EV transition

Lessons learned

- Comprehensive stakeholder engagement is required due to the other considerations of EVs
- Just as petrol vehicles don’t need refuelling every day, ZEVs don’t need recharging every day; it depends entirely on the use case
- Teams and departments will inevitably change locations and want to take their vehicles home

Link: https://metronorth.health.qld.gov.au/about-us/green

Case study 3: NT Health electric vehicle fleet rollout

In 2021, the Northern Territory Government (NTG) committed to transitioning the NT to a low-carbon economy. The NTG has committed to increase the number of Fleet EVs 20 per year over 10 years, totalling 200 vehicles by 2030. The NTG vehicle policy framework has been modified, requiring agencies to transition pool vehicles to EVs where fit for purpose. NTG is committed to installing a minimum of 400 charging points at identified priority NTG buildings. This includes a requirement for EV charging facilities in NTG standard lease agreements where appropriate.

NT Health, with the help of NT Fleet, has rolled out 42 EVs in the metro areas of Darwin, Palmerston and Alice Springs. This represents 35% of the 118 EVs for the NTG. NT Health EV Fleet has a range of 220 to 450 km. Typical EV takes under 8 hours to charge from empty to full using an EV charging point. EV charger installation is funded by NT Fleet for NTG business units. Where an infrastructure upgrade is required to switchboards, transformers and mains the NT Department of Infrastructure Planning & Logistics and the business unit are responsible for funding and expenditure of the electrical upgrade.

NT Health's charger types range from general power outlets, wall-mounted EV chargers and dual or single-port charging stands. Charger types range from slow – level 1 (2.5–7 kW) to fast – level 2 (7–22 kW).

Challenges

- Ageing infrastructure
- Timing of EV charger installation is delayed until after delivery of EVs
- Departments sharing and use of EV chargers can be challenging
- Permission by landlords to allow NTG to install EV chargers on leased property
- Staff reluctant to drive EVs due to new technology and unfamiliar operating functions

Successes

- NTG has 118 EVs and the Department of Health has 42 EVs or 35% of the total NTG fleet
- 6% of Department of Health Fleet vehicles are EVs
- Less time to refuel and maintenance of EVs
- Cheaper fuel and maintenance for EVs
- Less carbon emissions
- Less consumable waste (filters, oil and coolant)

Lessons learned

- Identify EV charging load centres and plan infrastructure accordingly
- EV operating procedures are required
- Education and training on using EVs is required
- Increase RFID access and operation of EVs
- EVs work well for NT metro areas
- Install 4G capability for future use

Link: https://dipl.nt.gov.au/strategies/electric-vehicle

Case study 4: Health New Zealand / Te Whatu Ora BEV rollout

With the help of the New Zealand Government's Carbon Neutral Government Programme, Health New Zealand / Te Whatu Ora replaced more than 700 internal combustion engine (ICE) vehicles with battery-electric variants (BEVs) by the end of Q2 FY 2022–23. Since then, the rate at which BEVs have been entering the fleet has accelerated, with around 200 more BEVs added per quarter.

The national health operational agency's Te Tai Tokerau / Northern division has been a pioneer within the organisation, starting with a trial of 6 BEVs in 2017. By the start of 2024, its total fleet of 300 light passenger vehicles included 150 fully EVs and 36 plug-in hybrid EVs.

Challenges

- Healthcare infrastructure often can't support the demand from charging multiple BEVs at once. To get around this, smart chargers were installed, which draw power when the demand across the site is lower
- Need to ensure resilience so vehicles can operate when power is lost. This has led to retaining a small number of ICEs
- Issues such as 'range anxiety' and the limited number of BEV models available in New Zealand has created the perception that these vehicles are unsuitable for community-based health care

Successes

- The real and perceived barriers to this transition were overcome through extensive collaboration between the clinical, fleet and facility teams, with Te Tai Tokerau clinicians championing BEVs among their colleagues
- Expansion of local charging networks, improved battery technology and a more diverse BEV market mean that BEVs are suitable for community-based health care
- The work done in Te Tai Tokerau has yielded some valuable lessons for other government agencies

Lessons learned

- Developing charging infrastructure is the most complex and time-consuming aspect to an EV fleet and requires collaboration
- A thorough understanding of the operating environment should be developed and plans made for the worst-case scenarios
- Opportunities to access capital expenditure through decarbonisation funds or loans should be used to offset vehicle and infrastructure cost, on the basis that the long-term operating costs of BEVs is lower than ICEs

Link: https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/carbon-neutral-government-programme/

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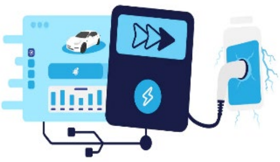
Alternative and innovative future technologies

Technology is continuing to develop, offering innovations in EV batteries, charging systems and fuels. Four examples are discussed below.

Bidirectional charging (vehicle to grid)

An EV with bidirectional charging capability can discharge energy from its battery to power a home/building (vehicle-to-home) or supply energy to the grid (vehicle-to-grid). This means EVs can be used to stabilise the energy grid at peak times or store energy generated by rooftop solar during the day.

Currently, only EVs fitted with a CHAdeMO plug can facilitate bidirectional charging, but CCS2 charge ports are becoming increasingly popular and the globally accepted standard. Therefore, the future use of bidirectional charging in Australia and New Zealand is contingent on it being readily available at a commercial scale and accepted by the charging and electricity network.



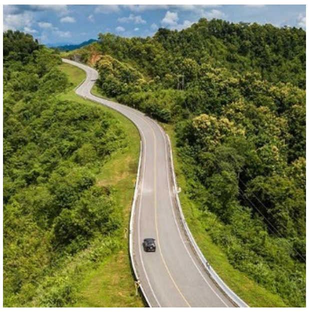
Smart charging digital fleet management systems

Smart charging refers to the ability of private EV users or third parties to manage charging times based primarily on financial incentive or grid benefits. Typically, this includes charging during off-peak electricity hours to both stabilise the grid and take advantage of cheaper electricity rates. Third-party providers in Australia offer this service for fleet charging at work as well as home charging for fleet vehicles garaged at staff homes overnight.

Wireless charging

Although wireless charging technology is still in its infancy, it is likely to have major implications for charging behaviour and infrastructure requirements. It sees traditional cables replaced by inductive charging powered through contact between the vehicle and an inductive plate that is installed on the ground, on adjustable beams, or under concrete.

Current wireless technology can only be used to charge stationary vehicles, but it could one day be integrated into road design such as ‘charging lanes’ on highways and major roads to enable charging on the go.



Improved battery technology

EVs are typically powered by lithium-ion batteries. The energy storage capacity of these batteries has grown over the past decade, with EVs on the market now showcasing an average range of 150–500 km before requiring a recharge. Researchers seeking to improve battery efficiency and driving range for EVs are developing alternatives to lithium-ion batteries, including solid-state lithium batteries and flow batteries. These alternatives could allow batteries to become smaller and increase their energy capacity, with the expectation that within the next decade vehicles with range exceeding 650 km will become widely available.