EV charging infrastructure and procurement guide

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Table of contents

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Introduction

The application of electric vehicles (EV) is shifting to overdrive. Over the last few years, governments and organisations have faced mounting pressure to reduce their greenhouse gas emissions, and oil and gas prices have reached their highest levels ever. These have contributed to push technological agendas and brought the application of electric vehicles to light.

According to a consumer survey, more than 50% of the Australian population would consider an electric vehicle as their next purchase[1]. However, there remain significant challenges from a lack of understanding the benefits and capabilities of EVs, and economic barriers such as low model availability and high upfront costs.

As such, an increasing number of private and government sector organisations are actively incentivising and promoting EV access and adoption. Encouraging mass EV adoption requires a widespread EV charging network that enables accessible, user-friendly and convenient long-distance travel.

Figure 1: Example of EV charging stations in an urban area

Global Sustainable Energy Solutions (GSES) is a leading renewable energy training and engineering institution and has partnered with Prodia Partners, a leading Environmental, Social and Governance (ESG) advisory. We have joined forces to assist organisations and communities in navigating the EV revolution and have published this free EV charging procurement guide. Our aim is to educate and facilitate the widespread deployment of zero and low emissions vehicles (ZLEV) into the future. We take pride in developing the capabilities of our customers and the broader communities, as well as creating a more resilient and sustainable future.

1 https://electricvehiclecouncil.com.au/wp-content/uploads/2021/10/2021-EVC-carsales-Consumer-attitudes-survey-web.pdf

This guide and how to use it

The goal of this document is to help organisations understand charging infrastructure and procure EV supply equipment in a simplified, scalable, and cost-effective manner.

The content has been developed for stakeholders with vested interests in deploying EV charging facilities across council buildings, apartment complexes, shopping centres, offices, ports, and other locations.

This document is not intended to be an exhaustive decision-making tool. While there is valuable information to improve the understanding of EV charging infrastructure, it is important to acknowledge that designing and installing appropriate EV chargers is a process with many custom nuances and considerations. As such, it is recommended that you consult with qualified professionals before selecting EV chargers, electricity providers, and operations and maintenance partners.

This report is organised into the following sections:

- **EV charging infrastructure:** This section offers an introduction to EV charging components and details the key questions to determine which of the elements are appropriate, considering the given application.
- **Procurement and design considerations:** This topic outlines the process of designing EV charging systems that will meet a given set of requirements now and into the future.
- **Simplified procurement case study:** A case study is articulated here and links the recommended procurement steps to a real-life application.
- **Installation:** The installation section describes the considerations for work carried out on the private side and the public side of the electrical network boundary.
- **Operations and maintenance:** This section sets out maintenance and operational activities for the electric vehicle charging facilities.

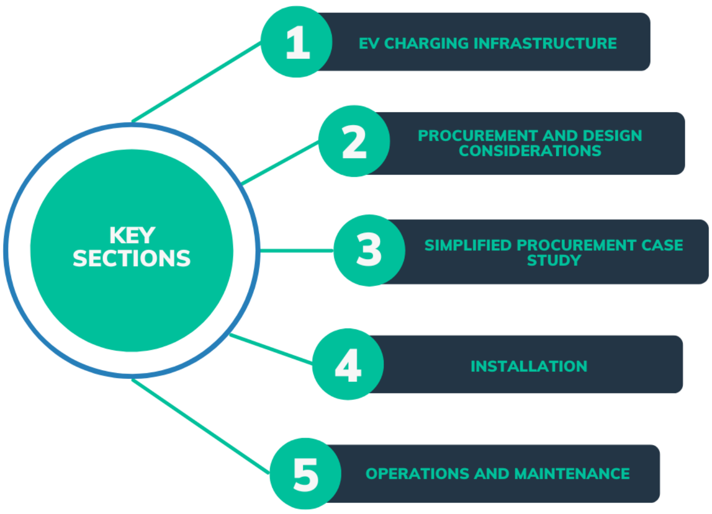

Figure 2: Key sections of the EV charging infrastructure and procurement guide

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Chapter 1: Electric vehicle charging infrastructure

This section provides insights into the systems and services related to the installation of charge points.

The collective software and hardware systems that form an electric vehicle charging station are referred to as electric vehicle supply equipment (EVSE). A charging station serves to charge a battery pack in an electric vehicle or in a plug-in electric vehicle (PEV) via the on-board charger (OBC) by using the grid for energy delivery. The hardware includes the physical charger and the associated electrical infrastructure, while the software includes the mobile charger app, local constraint management, booking, billing and payment portals.

A schematic of a typical charging station and how it connects to the grid is depicted in Figure 3 is explained in the following section.

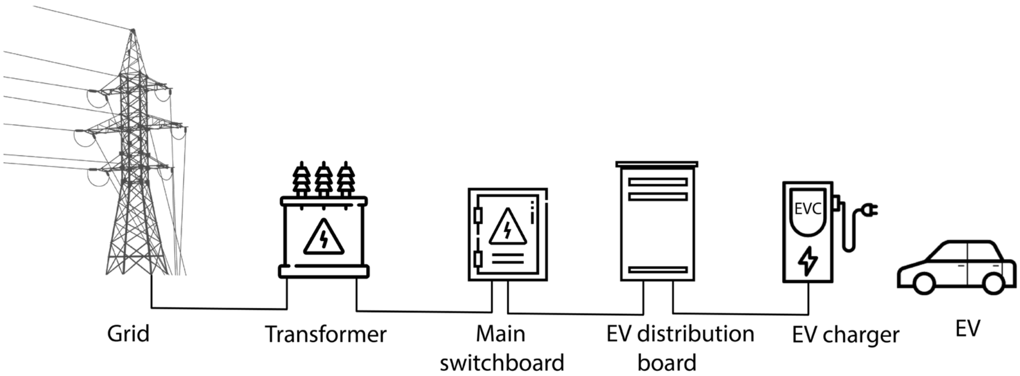

Figure 3: Layout of an EV charging station and how it connects to the grid

Types of charging stations

There are two broad categories of EV charging stations, alternating current (AC) and direct current (DC). The type of charger to be used depends on the application and vehicle type.

AC chargers are commonly referred to as the level 1 chargers (AC slow chargers) and level 2 chargers (AC fast chargers). AC power from the grid is transported to the electric vehicle and converted to DC power via the vehicle's on-board charger (OBC).

AC chargers are characterised by their low output power, which increases the overall charging time. However, the OBC can regulate the voltage and current as needed for the EV, indicating a much simpler mechanism, such that the charging station does not need communicate to the EV.

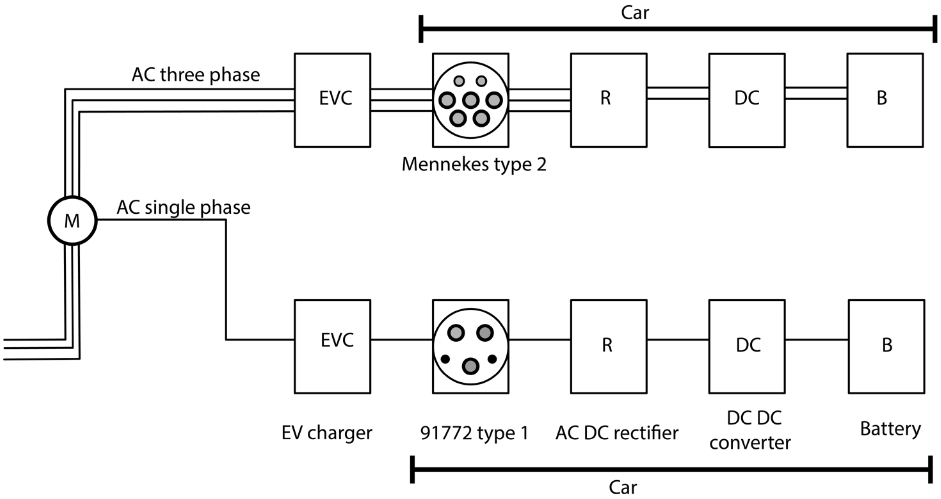

Figure 4: Schematic of an AC charging station

Conversely, DC charge points commonly known as level 3 chargers or DC fast chargers, provide superior charging speeds. The challenge is that the technology is significantly more complex and requires communication with the EV for efficient and safe charging. In the DC configuration, the EV supply equipment obtains AC power from the grid and directly converts it to DC voltage by by-passing the on-board charger to charge the vehicle's battery, as shown in the following figure.

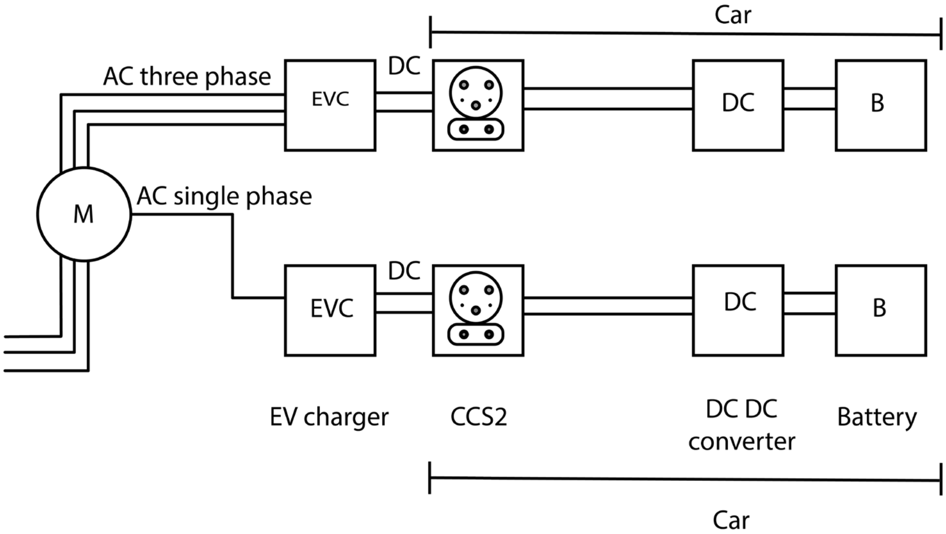

Figure 5: Schematic of an DC charging station

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DC chargers are arranged in stacks to provide high currents of up to 400A and voltage outputs of up to 600V. This translates to vehicle charging durations of 30 minutes, compared to 8 - 16 hours when using AC chargers. A more detailed comparison of the charging plug types, and their applications is presented in the following section, in Table 1.

Further to the charging stations levels, each charger type will have a specific connector suited for a vehicle type and application. For instance, a passenger vehicle is likely to use a charging port that differs to one required for heavy trucks, and a charger in a shopping centre will be unlike one in a residential setting. The main distinguishing feature of these rests on how quickly the charger can charge a vehicle.

The higher the EV charging level, the faster the charger can "top up" the vehicle. However, there is a trade-off associated with faster electric vehicle supply equipment: capital costs increase relative to charging speeds. The cost ramifications span beyond the charger itself and may necessitate expensive grid related upgrades, which are often not economically feasible. Table 1 synthesises the main characteristics of each charger type.

	Level 1 – AC slow charging	Level 2 – AC fast charging	Level 3 – DC fast charging
Connector image	 Type 1	 Mennekes - type 2	  CCS CHAdeMO
Pins	Live Neutral Earth	Live Neutral Earth	AC three phase and DC +/- or DC only +/-
Charging power	1.4kW – 2.4kW	7.4kW – 22kW	25kW – 450kW
Required outlet	Standard 240V AC household socket	Level 2 wall box connected to a standard 240V AC household socket	480V DC (requires significant infrastructure)
Range added per hour	10km	40km – 120km	150km – 300km
Conventional application	Standard when purchasing an EV, typically used in conjunction with smaller batteries, such as those found in hybrid cars.	Suitable for charging your vehicle for at least one or two hours, or overnight. At home installations requires a dedicated circuit to increase the power of the charge point.	Level 3 chargers are often located in car parks, petrol stations, roadside, and motorways. The technology boasts charging rates up to 50 times faster than level 2 chargers and can recharge EVs in minutes.
Typical locations	House, apartment building	House, apartment building, shopping centres	Petrol stations, shopping centres, destination charging

Table 1: Example system yield for a large-scale PV system using micro-inverters.

The Australian standard approves both the European and Japanese plug types, but the Federal Chamber of Automotive Industries (FCAI) endorses the Mennekes (type 2) plug for AC charging, and both CCS and CHAdeMO for DC charging. The majority of Australian EVs are supplied with type 2 or with either CHAdeMO or CCS sockets. For DC fast charging, it should be noted that CCS sockets are vastly more common than CHAdeMO.

Hardware

Despite the number of electric vehicles on the road, there are a relatively large number of EV charging equipment manufacturers that import, supply, and maintain equipment in the Australian market. The following figures provides examples of AC and DC chargers.

Figure 6: AC chargers in the market ranging from 7kW single phase to 22kW three phase

Figure 7: DC chargers in the marketing ranging from 25kW to 450kW

There are an increasing number of charging equipment manufacturers entering the Australian market, some of which are presented in the following figure.

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Figure 8: A few of the current charging equipment manufacturers

Software

One of the most important decisions when purchasing EV supply equipment is determining the type of the software or charger network. This is because the software will enable all required functionality for the various stakeholders listed below:

1. EV charging facilities asset owner
2. Energy retailer (if necessary)
3. Zero and low emissions vehicle asset owner
4. Equipment operations and maintenance (O&M) provider
5. Site operator (e.g., facility manager and embedded network operator)

Not all software providers aggregate the data between the EV supply equipment and the site itself. As such, it is vital to ensure that your selected software provider can accommodate your specific vehicle and site operating needs. Software providers that can integrate into your existing building management software or billing metering platforms can be helpful in monitoring and validating the impact of vehicle charging at your given site. A list of software functionalities include:

- Fleet management
- Payment gateway
- Time-of-use payment settings
- Variable payment rates based on user type (e.g., tenant or visitor)
- Charger group management, for instance to limit electrical demand
- Smart charging and remote access for setting parameters or troubleshooting
- Driver interface, including information such as charger locations, charger status and EV state of charge
- Assest manager interface
- Bi-directional charge information (to be relevant in the future)

As EV adoption surges in Australia, there is an increasing number of brands that provide comprehensive EV charging software solutions. The two emerging categories are software for charging stations and software for business and home charging:

Charging station focused:

- AmpCharge
- Chargefox
- E'Langa
- Evie Networks
- EVUp
- Jolt
- Tesla Supercharger

Solutions for businesses and homes:

- Everty
- Exploren
- Myenergi
- Wallbox

Figure 9: An example of a user interacting with the EV charger via a mobile app

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Chapter 2: Procurement and design considerations

A major prerequisite in procuring suitable electric vehicle charging systems is holding a deep understanding of how their operators and drivers charge their cars. Electric vehicles present new electricity "topping-up" challenges for engineers, installers, procurement teams, asset owners and tenants that traditional cars with internal combustion engines (ICE) do not.

ICE vehicles are generally refuelled at a petrol service station, forcing a specific visit while en-route or as the sole reason for the trip. This is in stark contrast to zero and low emissions vehicles, which require drivers to regularly "top up" the car battery whenever there is an opportunity to do so. This is comparable to an individual charging their mobile phone at home at night, in the office, or simply when it is convenient. The change from refuelling to recharging introduces a new driving and "topping up" behaviour for which your given site will need to be well equipped to cater for.

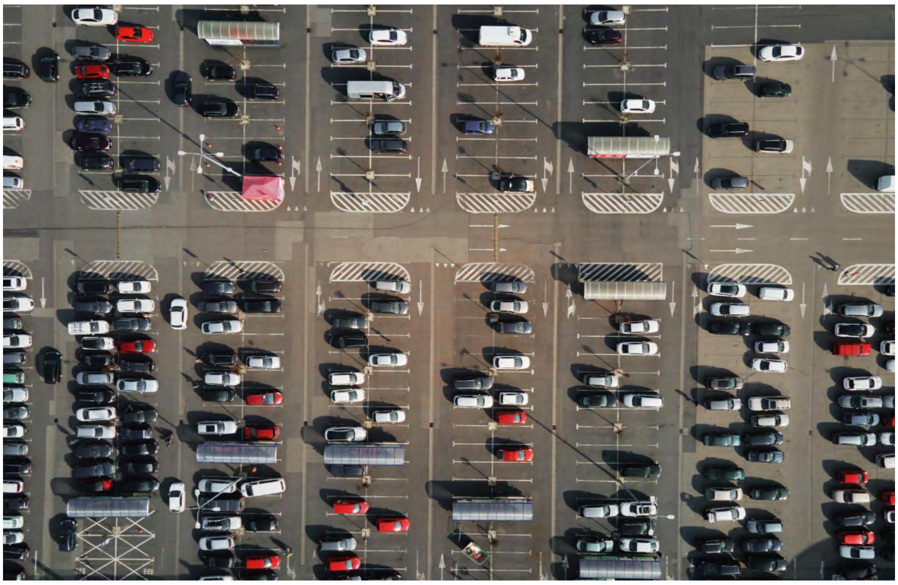

Figure 10: Example of different parking behaviour that can present challenges to asset owners and operators

The flow of EV procurement activities

The goal of the procurement process is to optimise expenditure by balancing:

- **CapEx:** The capital expenditure of the installation
- **OpEx:** The operational expenditure to operate and maintain the system
- **Utilisation factor:** The percentage of time the EV charger is being used
- **Missed sessions:** The percentage of time an EV is unable to charge due to demand limit activation or due to a charger being offline

The procurement process detailed in this guide can be used for any number of EV chargers. However, for a small number of AC chargers, the process can be significantly reduced. The following section outlines the critical EV procurement stages leading up to the installation; a case study that follows the steps is described in the next chapter.

Step 1: Understand the usage profile of your parking facility and the vehicles that use it

The first step of the procurement process is to obtain a time series data set to create a car park usage profile. This will establish the baseline number of cars that are parked at any given time interval and will provide insights into the likely change in energy draw from charging EVs at the given site.

If data cannot be obtained, the profile can be estimated based on the typical usage of the building that houses the car park. For example: A shopping centre's parking usage profile will likely be heavily skewed towards the daytime and weekends, while residential dwellings will likely see most car users leave in the mornings and returning in the evenings. The following image illustrates a basic parking usage profile with the average hours that vehicles are parked per stay at a shopping centre, and the percentage utilisation of all parking bays.

Recommended action: Contact your car park site manager or operator, as they will be well placed to inform you of parking data availability. Should it not exist, estimate the profile as per the description the above.

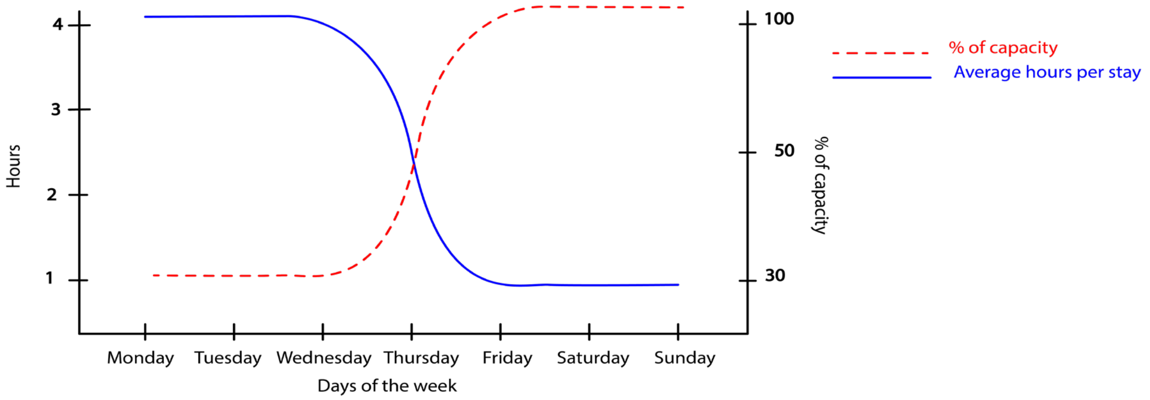

Figure 11: The usage profile example depicts high average parking stays in the first half of the week (Monday to Thursday), tapering off during weekends (blue line). The chart also shows how full the parking bays are as a percentage of total capacity. This peaks from Thursday onwards (red line).

Step 2: Estimate the predicated growth rate of EVs

Bloomberg predicts that EV car sales will increase exponentially from 1.9% in 2021 to 15% of sales in Australia by 2030. Assuming a relatively conservative growth rate, we can estimate 11.6m light passenger vehicles on Australian roads by 2030[2], of which 6.1% will be electric. Based on this, we recommend that the baseline electric vehicle growth rates depicted in Figure 12 be applied to your planning process:

2 https://www.bloomberg.com/news/articles/2022-05-16/electric-cars-could-win-a-boost-in-australia-s-federal-election

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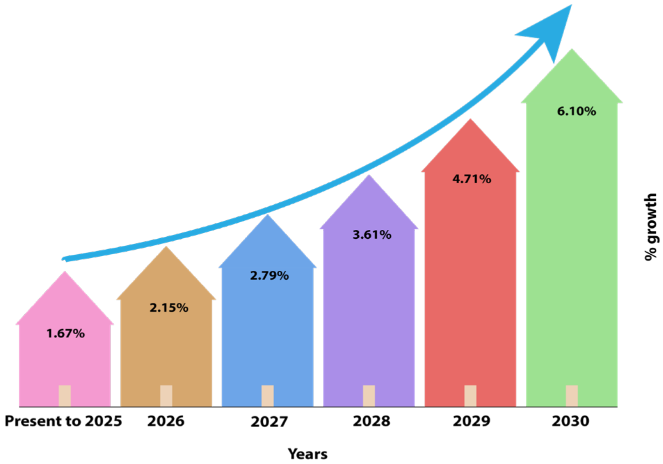

Figure 12: Predicted EV car sales growth from 2022 to 2030

These figures are relevant Australia-wide and therefore must be proportionally adjusted to suit specific locations. We recommend finding a reputable growth rate prediction and applying it to establish your growth forecast at your specific site, adjusting for any material variables. These growth rates will be used to contextualise what infrastructure should be built now and what should be provisioned for future growth as more people transition from ICE vehicles to ZLEVs.

Parties interested in building charging infrastructure must be cognisant that the installation of EV supply equipment may be staggered as adoption increases. Where possible, survey tenants and residents to understand their current ZLEV needs and whether they intend to purchase an electric vehicle in the near future. An appropriate survey will also shape an informed view of their likely future needs.

Recommended action: For an indicative growth rate, we recommend that the project owner calculates the growth rate as per the above instructions. For further information, enquire with an engineering consultant such as GSES or Prodia Partners.

Step 3: Understand the existing electrical infrastructure configuration and capacity

Understanding the existing electrical infrastructure on site is a key factor in determining how the electrical supply can accommodate the EV demand. It is important to consider all sources of generation like solar, batteries or other generators as these can impact the amount of energy required to be supplied by the grid to the EV chargers.

An engineer or electrician must locate the main switchboard (MSB) and confirm any available chassis or cubical space, then verify the protection sizing, cable sizing, and local substation capacity. The existing electrical infrastructure will be both physically and electrically constrained by a demand limit determined by the network during the application and construction process.

Electrical networks are likely to constrain the amount of power that can be used at any given point in time. To circumvent this, consider installing controls systems to dynamically ramp down charging when the site's demand limit is reached. This requires additional equipment to monitor the point of connection or point of common coupling to send a signal to the chargers specifying the power flow into the electric cars. This may reduce the charger's utilisation factor as each vehicle will be supplied with a reduced amount of power.

An alternative solution would be to upgrade the site's electrical infrastructure to increase its demand limit, but this option can be extremely costly and should be reviewed on a case-by-case basis.

Recommended action: We recommend that a technical expert be engaged for this step as it requires a deep understanding of electrical infrastructure constraints and energy systems. Contact GSES or Prodia Partners for further assistance.

Step 4: Develop the EV charging system model

Create a computational infrastructure model using appropriate variables to determine the configuration options and the capacity of those charging stations. Model variables include parking usage profiles (as per Step 1), battery states of charge, capital expenditure, missed sessions, and utilisation factors. Stakeholders interested installing electric vehicle charging facilities often seek to maximise utilisation, while minimising missed sessions and capital expenditure. The variables must be purposefully selected and modelled accurately as the model's outputs will predict EV charging use and performance. This will establish the optimal infrastructure design configuration and infer financing options. Ensuring accurate simulation results is therefore one of the most critical components in the procurement of EV charging infrastructure.

Recommended action: As this is a decisive step in determining the charging configuration and capital outlay, we recommend involving an engineering consultant to assist you in determining and modelling the most important and suitable factors for your EV charging needs. Ensure that the subject matter expert provides you with clear guidance on the path forward and an understanding of the trade-offs associated with your options. For more information, contact GSES or Prodia Partners.

Step 5: Select the EV chargers

The outputs of the EV infrastructure model will inform detailed technical considerations around switchboard design, protection, conductors, cable trays, and conduits. This will enable individuals to choose the number of charge points they would like to procure and install. The results of the model will further provide insights on how to account for future EV adoption and how to best plan for future installations at the given location.

Recommended action: Where required, consult your project stakeholders to assist in the EV charger selection. For any unresolved technical queries, consult the party that developed the computational EV infrastructure model.

Step 6: Produce schematics and layouts

Once a decision has been reached regarding the number of chargers and the desired capacity, a graphical representation of the model and design should be created. We recommend the use of electrical design software to produce a layout including the location of bollards, access and cable paths, and an electrical schematic. This will enable any experienced engineer or electrician to understand the selected design configuration when building, maintaining, or carrying out other works relating to the charging stations. An EV charger switchboard schematic and a protection and coordination study should also accompany the electrical schematic.

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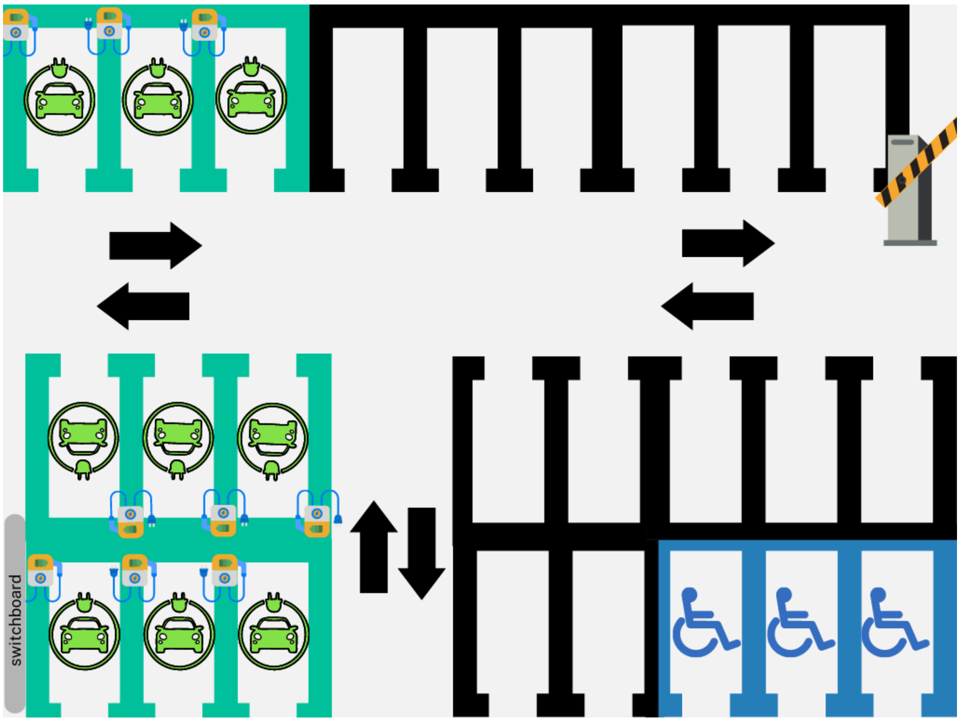

Figure 13: Basic schematic of a parking lot with EV charging bays

Recommended action: We recommend a subject matter expert to document the design configuration in case trouble-shooting is required in the future. For further clarification, reach out to GSES or Prodia Partners.

Step 7: Configure charging stations

Now we begin to optimise the charging system by clearly defining the remaining desired outcomes from the EV charger management software. This may include deciding if the chargers should be managed as a group or individually; or setting a specified demand limit which the chargers should not exceed. Another feature to consider lies in how the software should enable customer payments and designate pricing rates, e.g., time-of-use or variable rates.

Recommended action: Liaise with your project stakeholders to finalise your desired charging station outcomes.

Step 8: Summarise and tender

You are now well placed to engage in design, installation, commissioning, operating and maintenance services for your selected EV chargers. This often occurs via a competitive tendering process, and it is important to understand the cost and value stacks of the infrastructure being deployed, as these will build and support the business case for the selected method of contracting.

Figure 14 shows the elements that are associated with the upfront costs of building EV charging stations. These costs are categorised into procurement of equipment, design and construction.

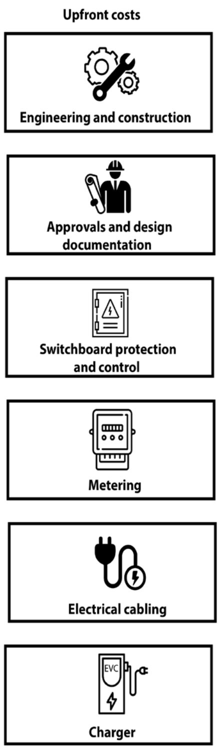

Figure 14: The upfront costs associated with building an EV charging station

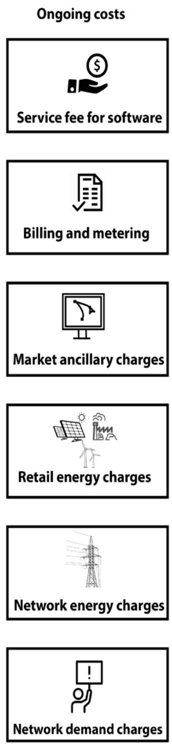

Figure 15: The ongoing costs associated with building an EV charging station

Figure 16: The value stack of charging stations presents new revenue opportunities

Ongoing EV charging infrastructure costs include software service fees for the EVSE network management, which are normally subscription based. The bulk of ongoing fees arise from your energy retailer and consist of demand and energy charges, which are further defined by network demand and energy charges, retail energy charges and market ancillary charges. These can be minimised by on-site behind the meter solar generation. It is important to note that ongoing costs are significantly lower than upfronts costs.

At face value, the cumulative costs of charging facilities may appear significant. However, when comparing the revenue generating opportunities, it becomes evident that EV charging stations can produce strong returns on investment (ROI).

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Beyond charging the EV user for energy consumption, EVSE asset operators can optimise energy and network charges by participating in energy market revenue streams, such as through demand response or embedded network services.

EV charging facilities can be used to generate alternative revenue sources through advertising, increased customer sales and can lead to an increase overall value of the property.

Note that several Australian state governments offer financial subsidies, grants, and tax exemptions for the procurement of EV charging infrastructure, and these may reduce upfront costs.

When approaching the tendering process, it is crucial to embrace a holistic view of the EV charging system. This implies understanding the discrete EVSE components, what the upgrade entails, and which standards regulate the individual activities. A summary of this is shown in Table 2.

Component	Electrical	Civil	Communiction	Relevant standard
Charger	X	X		CE, IEC 62109, AS4777
Meter	X		X	AS 1284, NER chapter 7
Point of sale terminal	X		X	PCI service provider level 1
Router and network	X		X	AESCSF
Cabling and distribution board	X	X		AS 3008
Main switchboard	X	X		AS 61439
Transformer	X	X		AS 60076

Table 2: EVSE components and their respective governing standards

Finally, with respect to tendering for charging stations, understand your selected EVSE vendor's core strengths and offering as they may not provide full turnkey installation services, triggering other suppliers to be engaged in the project. The following diagram illustrates the offerings of several industry players at the time of writing this document.

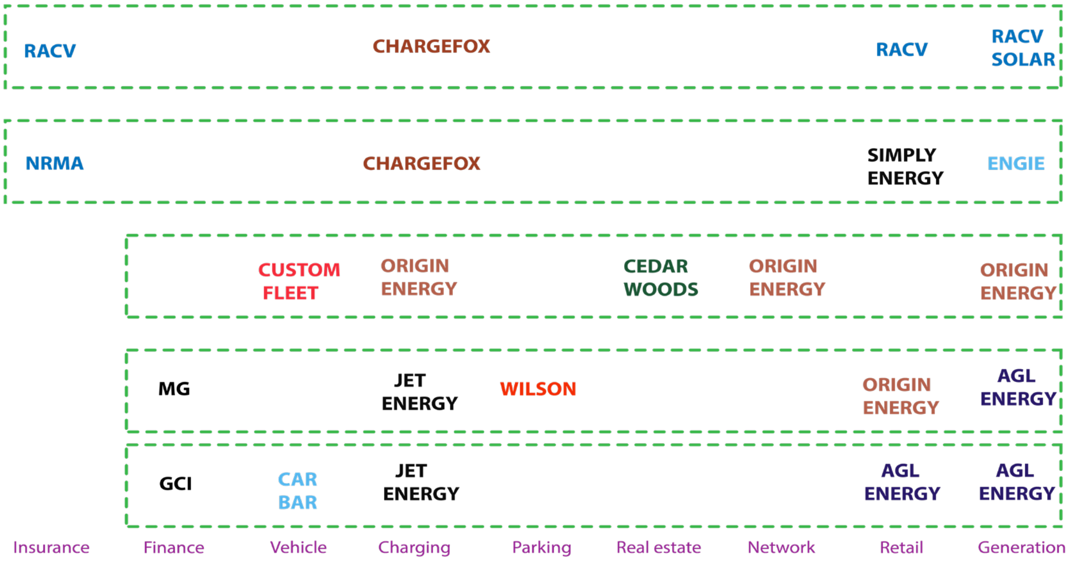

Figure 17: EV service offerings and suppliers in the Australian market

Recommended action: Establish your EV charging vision, encompassing technical and commercial outcomes. Invite vendors to the competitive tender, noting the key constraints and limitations of your site and vendor capabilities. For tendering support, contact GSES or Prodia Partners.

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Chapter 3: Simplified procurement case study

A strata representative for a residential apartment block in Sydney consisting of 100 apartments and one car spot per apartment was tasked with procuring and installing EV chargers. When we were engaged to assist in the project, there were four residents with electric vehicles. However, other residents had begun to express interest in purchasing low emissions vehicles in the near term.

1. **Understand the usage profile of your parking facility**

The site operators had not collected or recorded tenant parking data. This meant that the usage had to be estimated based on general observations and appropriate assumptions. The dwelling demonstrated a standard parking usage profile, whereby most cars would exit the garage by 8am and return by 6pm on weekdays. During weekends, cars would exit the garage by 8am and return by 8pm. These observations were used to inform the subsequent system modelling.

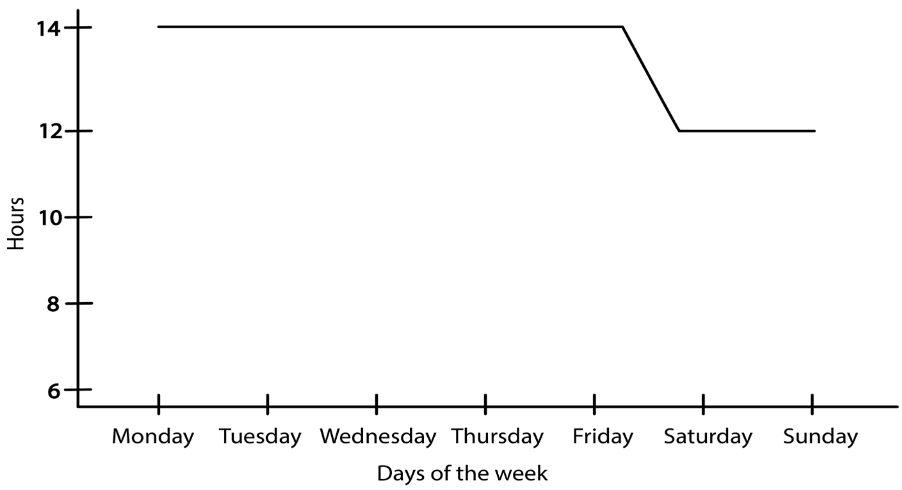

Figure 18: Graphical representation of parking behaviour in hours in a residential building throughout the week

2. **Estimate the predicted growth rate of EVs**

In this specific case, 4 of 100 tenant vehicles were already electric. To obtain an accurate growth rate, these figures were proportionally adjusted based on an industry growth rate[3] resulting in the following:

- Until 2025-4 EVs
- 2026-5 EVs
- 2027-7 EVs
- 2028-9 EVs
- 2029-12 EVs
- 2030-15 EVs

Although the above methodology was deemed to be relatively conservative, it was used in lieu of surveying all residents, as this was difficult to coordinate.

3 https://www.bloomberg.com/news/articles/2022-05-16/electric-cars-could-win-a-boost-in-australia-s-federal-election

3. **Understand the existing electrical infrastructure configuration**

A site inspection was conducted by one of our qualified engineering professionals to assess the capacity of the existing electrical infrastructure. The assessor determined the capacity of the local substation, incoming conductors, and main switchboard. This assessment established a maximum demand limit of 849A/phase (339kW), which was subsequently used as the upper limit in the EV infrastructure model. The assessment also revealed sufficient cubicle space for the placement of additional circuit breakers, which could feed new electric vehicle charging distribution boards (EV-DB).

Figure 19 shows a qualified engineering professional checking the main switchboard to find the maximum number of EV chargers the site can accommodate given the existing breakers, physical space in the board and physical space in the room.

Figure 19: A qualified engineering professional checking the main switchboard

Following the site inspection, a protection and coordination study was conducted to include the new EV-DBs. Completion of this study ensured that the proposed system was adequately protected and that any faults would be cleared using the appropriate trip regime.

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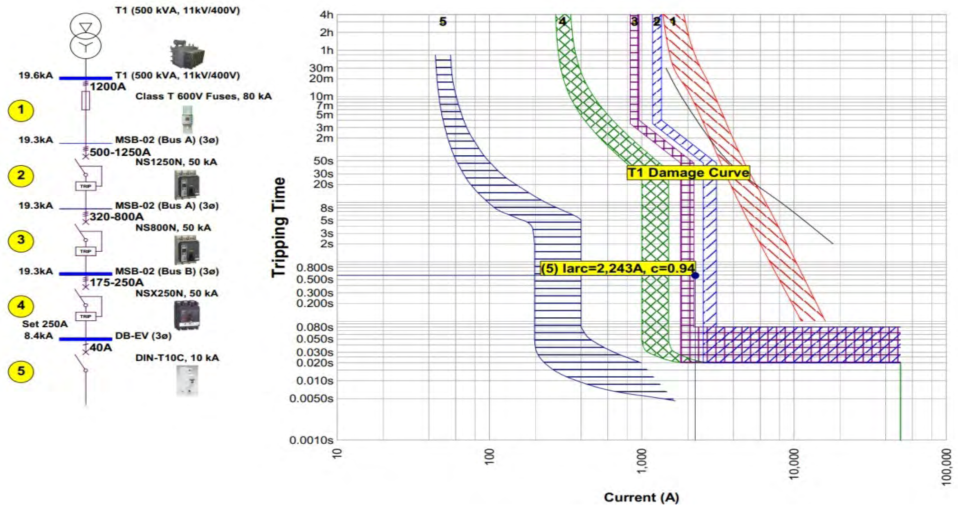

Figure 20: An example protection and coordination study

4. Develop the EV charging system model

Along with the estimated charging regimes and the existing load profile of the site, the information gathered in the previous steps was entered into a software model. It optimised the number and size of chargers given the site's constraints. As per the client's wish, the model was developed such that it minimised capital expenditure and missed sessions, while maximising the utilisation factor.

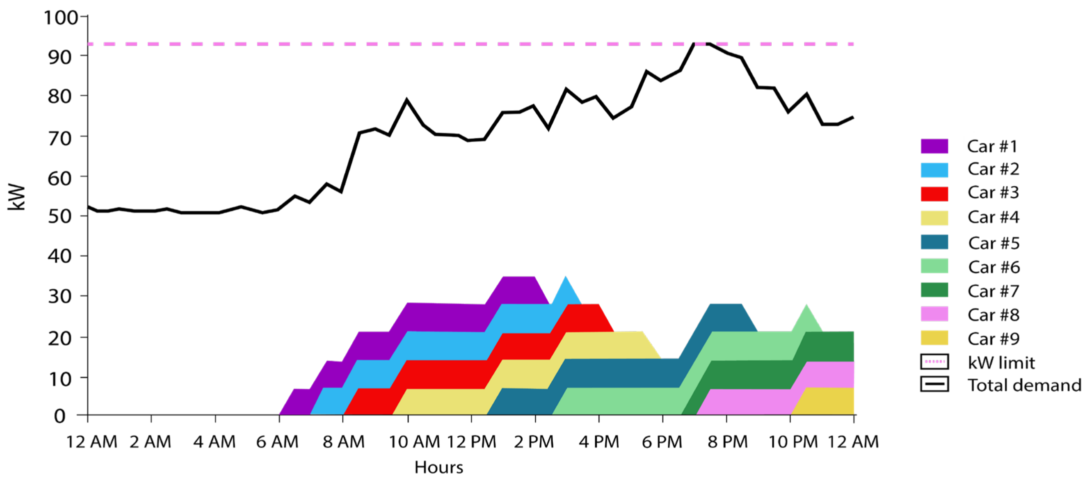

Figure 21: Example load and charge profile demonstrating how different chargers were utilised across a typical day

5. **Select the EV chargers**

The outputs from the simulation provided an accurate prediction of EV charging performance, equipping the customer with key information to select the most suitable EV chargers for their needs and constraints. The model suggested the installation of two EV-DBs, each capable of hosting 10 x 22kW EV chargers. It also advised that 20 three phase chargers be provisioned for, recommending the installation of cables, cable trays, and appropriate terminations at predetermined car spots.

Furthermore, it was suggested that 4 x 22kW EV chargers be installed to serve the existing EVs and for a dynamic load management system to be utilised at this site. The simulation revealed that the charge curtailment should only be required less than 2% of the time, even with all future 22kW EV chargers installed.

6. **Produce schematics and layouts**

Following the development of the EV model, our team of qualified engineers generated electrical schematics and protection diagrams. Layouts were drafted to demonstrate how and where the cables would be run, where terminations were to be made, the location of electric vehicle supply equipment, as well as comprehensive details on ancillary equipment, signage, and sundries.

7. **Configure charging stations**

In this scenario, the EV-DBs were fed from the common area meter although chargers were allocated to car spaces specific to tenancies.

During a consultation, Strata revealed their concern that they may not be appropriately financially compensated by each EV owner. In finalising the EV charger configuration, we helped them define a clear compensation method, and set electricity time-of-use rates, which were equivalent to their negotiated retail energy rates.

8. **Summarise and tender**

At this stage, Strata had collected the necessary information required for the procurement of electric vehicle charging stations and they could begin the open tendering process, gathering bids and assessing market options. A request for tender (RFT) evaluated the options proposed by bidding participants, comparing price, experience, capabilities, and capacity of the EVSE installation vendors. Importantly, the RFT stipulated the collective requirements that the electric vehicle charging network software was expected to meet, including setting time-of-use rates, payment systems and fault reporting.

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Chapter 4: Installation

When thinking about installation, the requirements concerning charge point placement are as key as having access to sufficient electrical supply. As such, there are two types of installation contractors that may need to be engaged: One that holds expertise on electrical activities behind the meter, namely the private side of the network boundary; another installer proficient in conducting in front of the meter electrical activities, i.e., the public side of the network boundary.

The network boundary is typically formed by the gate meter or the metering point on site, as per the following illustration. The components leading up to the meter can be modified by most qualified electricians. However, beyond this point requires a case-by-case examination, as the regulations and processes for carrying out works vary significantly in each state.

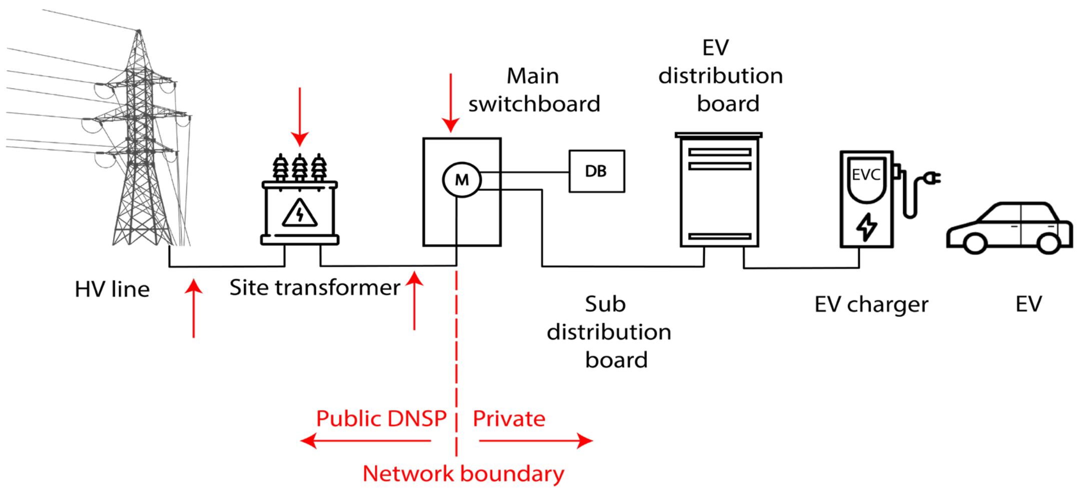

Figure 22: Description of a typical network boundary

Assessing the network capacity limits, increasing the electrical capacity of your site or maximising the physical capacity without complex upgrades beyond the boundary of the site are multi-faceted.

Adopt a comprehensive view of your existing electrical infrastructure and recognise multiple methods and locations at which upgrades can occur, including the sub-distribution board, the main switchboard, the consumer supply mains, or the site transformer. For further grid infrastructure expertise, consult a qualified engineering professional such as GSES and Prodia Partners.

Beyond grid considerations, there are other requirements and considerations to account for during the installation, even once the location has been chosen. Other considerations that may enhance the ease of charging and maintenance may include optimising the socket outlet height, impact protection, direction or bay signage, and free space around the charging station.

Figure 23: Example of parking bay that is exclusive for electric vehicles with painted signage

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Chapter 5: Operations and maintenance

General maintenance

Most EV charge points are unsupervised and require minimal maintenance. However, to ensure the safety of your equipment, it is recommended to safely store charging cables and conduct a service check of your EV chargers every year. The service check should ensure structural integrity and weatherproofing of the system, airflow to cooling fans and vents, as well as wear-and-tear of sockets and tethered plugs.

Software upgrades for the chargers and point of sale terminals will also need to be carried out regularly. For any maintenance, we suggest including a response time, duration for the required repair, and an overall uptime requirement. Other general maintenance involves keeping the charging station clean and the charging connectors dry.

When contracting for maintenance of charging stations, be clear on who holds the liability and responsibility of the system, components and the operations. This is not always consistent, and the responsibility can either rest with the site host, charging network, manufacturer or installer.

There are a wide range of maintenance contracts with differing costs, which typically encompass maintenance, servicing, extended warranties, data services and insurance. Owners should budget approximately 400 AUD for the maintenance of a single charger, annually [4].

Warranties are crucial in covering the cost of replacement and depending on a tender response, some vendors will offer extended product and workmanship warranties. Consider listing minimum warranty and service requirements in the tender document.

Figure 24: An electrician conducting maintenance for an EV charging station

4 https://afdc.energy.gov/fuels/electricity_infrastructure_maintenance_and_operation.html

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Operating EV charging stations

Operating an EV charging station involves ensuring that the site amenities are safe and functional, chargers are available to be used by electric vehicles, payment systems are online, and the energy is being supplied as per the retail and network contracts.

The largest operational costs for an EV charging station are typically the network charges within your electricity contract. These costs are fixed for the whole year once a peak demand event occurs. It is therefore important to account for this as it will impact the profitability of the EV charging stations.

There are a few ways in which this can be managed, namely by adjusting the price on a monthly basis in line with the electricity contract, installing a battery or other demand side energy management solutions or negotiating appropriate electricity tariffs.

Future solutions and trends for EV infrastructure

As indicated previously, procuring EV infrastructure may require a staggered approach as it is often not commercially feasible to electrify an entire site at a single point in time. Even though you may not wish to install EV supply equipment in the immediate future, we recommend a proactive and long-term approach on future proofing your site, as this can minimise the risks of higher costs in the future.

We recommend obtaining advice from a qualified engineering professional such as Prodia Partners or GSES, as they will be able to inform you of the electrical capacity of your site and provide suggestions on how to best future proof it. This is often technically complex and multi-faceted. Understanding each site thoroughly may include conducting a comprehensive assessment of your energy contracts, existing energy systems like solar and batteries, and planning for other fast-moving energy and eMobility trends, such as the rise of connected vehicles, or bi-directional and wireless charging.

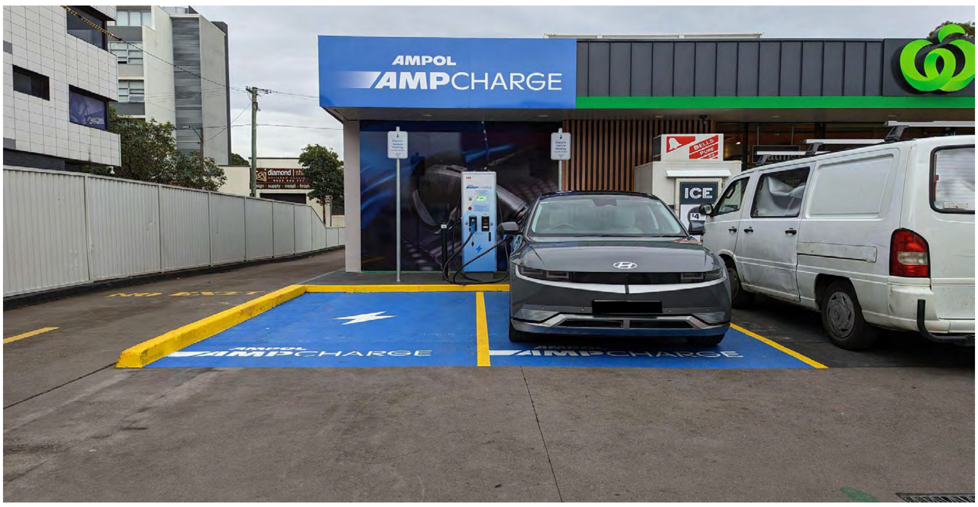

Figure 25: Example of a mix business setting with convenient EV charging bays. Image provided by plugshare.com

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Conclusion

The last few years of political and climate change related events have catapulted EVs to the global stage and there is now widespread acceptance that zero and low emissions vehicles will be adopted at mass by governments, organisations, and individuals. The ramifications of this are colossal, requiring these vehicles to be embedded into our transport and electricity networks. Zero and low emissions vehicles will infiltrate businesses and governments and they will need to be integrated into core business, assets, and activities.

There is a race to electrify transport networks and systems, but the electric vehicle industry is nascent. There are many scattered solutions on the market, often only solving a small problem within the ZLEV value chain. This has led to uninformed buyers purchasing partial solutions, incurring hidden expenses, and receiving inadequate advice for future growth.

Based on our experience, transitioning to zero and low emissions vehicles requires the adoption of a flexible, holistic, and long-term approach that accounts for a customer's unique requirements, constraints, and future demand. Prodia's and GSES's approach considers the full value chain, including the vehicle itself, software platforms, grid constraints, energy contracts and energy assets. This enables our customers to achieve their business and sustainability targets in an efficient and cost-effective manner.

The EV tidal wave is fast approaching, but the path to adoption is challenging and rests on one critical lever: a holistic procurement approach of the zero and low emissions vehicles and installing the appropriate charging infrastructure.

For more information on EV infrastrucure and other renewable energy engineering and consultancy services, plase contact GSES or Prodia Partners:

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