Harmonising Electric Vehicle Supply Equipment Connections and Service and Installation Rules

September 2024

Contents

Preface

This report was commissioned from Blunomy by Energy Networks Australia (ENA) to identify differences and gaps in Electric Vehicle Supply Equipment (EVSE) connection standards and related Service and Installation Rules (SIRs) across Australia, and identify pathways towards a better, harmonised approach.

Blunomy and ENA thank representatives from the Electric Vehicle Council, JET Charge, EVX, EVIE, NRMA, Tesla, BP Pulse Australia, BP Charge New Zealand, BP Pulse Europe, ChargeUp Europe, Next Generation Electrical, and Milence Europe for their time and insights into the key challenges and best practise of EVSE connection in Australia and globally.

Blunomy and ENA also thank the members of the DNSP working group, comprising representatives from Ausgrid, Ausnet Services, CitiPower & Powercor, United Energy, Endeavour Energy, Ergon Energy and Energex, Essential Energy, Evoenergy, Horizon Power, Jemena, PowerWater, SA Power Networks, TasNetworks, and Western Power.

Energy Networks Australia is the industry body representing Australia's electricity transmission and distribution and gas distribution networks.

Blunomy is an international strategy consulting firm focussed on accelerating the energy transition. Blunomy partners with clients over the long term, helping design robust business models, build coalitions, and attract capital to reach scale.

Abbreviations

A	Ampere
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
ASP	Accredited Service Provider
CER	Consumer Energy Resource
CPO	Charging Point Operator
DER	Distributed Energy Resource
DNSP	Distribution Network Service Provider
ENA	Energy Networks Australia
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
NEVS	National Electric Vehicle Strategy
NSW	New South Wales
NT	Northern Territory
QECM	Queensland Electricity Connection Manual
POS	Point of Supply
SA	South Australia
SIRs	Service and Installation Rules
WA	Western Australia

1 Executive summary

The Australian National Electric Vehicle Strategy highlighted the need for harmonisation of connection standards to support Electric Vehicle (EV) charging infrastructure development and, thereby, the widespread adoption of EVs. This report contributes to that objective by:

- identifying similarities and variances in EV connection standards across different jurisdictions, and
- setting out next steps to be pursued by Energy Networks Australia (ENA) and its members to achieve a better, more harmonised approach across Australia.

Insights and data were gathered through desktop research, stakeholder interviews, and analysis of Service and Installation Rules (SIRs) and connection standards from all the distribution networks in Australia.

Overall, the EV Supply Equipment (EVSE) industry in Australia identified a small number of key challenges across residential and public charging:

- 32A EVSE residential charging permitted by all current SIRs except in the ACT and NT, with a call for changes to facilitate the allowance for EVSE installations nationwide. The industry has also expressed concerns about potential new requirements from distribution networks, be it in terms of EVSE data sharing or EVSE management obligation.
- For public charging, there is notable uncertainty around the provision of additional points of supply (POS), where the industry has expressed the need for a clear and consistent set of conditions. Finally, the industry sees room for improvement in the connection process for public charging, especially as the uptake of EVs is expected to exacerbate the problem.

This plays out differently across Australia, with findings revealing commonalities and differences between networks across residential and public charging:

- Residential charging is broadly aligned, with most distribution networks accommodating installations of single-phase 32A Mode 3 EVSE. Installations can be conditional, with some distribution networks requiring provisions such as data sharing and EVSE management. Where imposed, these conditions and limitations help Distribution Network Service Providers (DNSPs) to achieve responsible management of their networks within the local context.
- Considering public charging, there are varied conditions for additional POS between jurisdictions but in all states and territories applications are assessed on a case-by-case basis. Several distribution networks currently offer location-specific LV grid capacity information through publicly-accessible online mapping tools, helping inform siting decisions and connection requests. Connection processes vary by jurisdiction: the timeline typically ranges from 2 to 18 months from application to energisation depending on project complexity, supply chain issues, and other factors. There may be opportunities for harmonisation of how these processes are managed, but the focus of this report is on rules and approaches rather than operational considerations.

ENA and its members have taken on board these key challenges expressed by the EVSE industry and are working to address them in a nationally-consistent manner as far as practicably possible. This will mean addressing a wide range of external factors, such as geographical variations, regulatory environments, and differences in technical infrastructure, which have contributed to the current differences. To guide this future work, five main focus areas were identified that ENA and its members will seek to progress:

1. **Nurture engagement between DNSPs and stakeholders.** Continued engagement with state and Commonwealth governments, the Australian EVSE industry, standards development organisations, and industry associations will ensure relevance, provide additional insights, and improve the likelihood of success of the harmonisation effort.

2. **Develop grid capacity availability maps on Medium and Low Voltage networks** to help Charging Point Operators (CPOs) and installers plan EV charging infrastructure strategically. This empowers CPOs to make informed decisions, reducing timelines and costs. It also minimises distribution networks' processing of connection requests and maximises network asset utilisation. Developing and publicly sharing such maps can help DNSPs prepare for future requirements and respond to the Australia Energy Regulator's Energy Data Reform Programs.

3. **Progress harmonisation of rule-based and specific guidelines for additional points of supply,** which can help CPOs and installers choose the best configuration for public EV charging. This can minimise costs and disruption to the end customer's activity and reduce the number of connection requests distribution networks need to process. This effort would support the broader goals of the National Consumer Energy Resources Roadmap on streamlined network connection processes.

4. **Promote a consistent data collection approach for EVSE**, benefitting stakeholders by simplifying compliance and enhancing efficiency for installers and CPOS. This will also provide distribution networks data to forecast demand and manage their network as EV uptake increases.

5. **Continue to evolve the EVSE management approach.** Shaping the profile of EV charging is recognised by distribution networks and the industry as crucial for large-scale, efficient integration of EVs. Achieving this requires a deep understanding of the benefits and nuances of different forms of EVSE management. This entails balancing short-term pragmatic solutions with exploration of longer-term, more transformational options aligned with programs of work on Customer Energy Resource (CER) integration, including the National CER Roadmap (Clean Energy Council, 2024).

2 Introduction

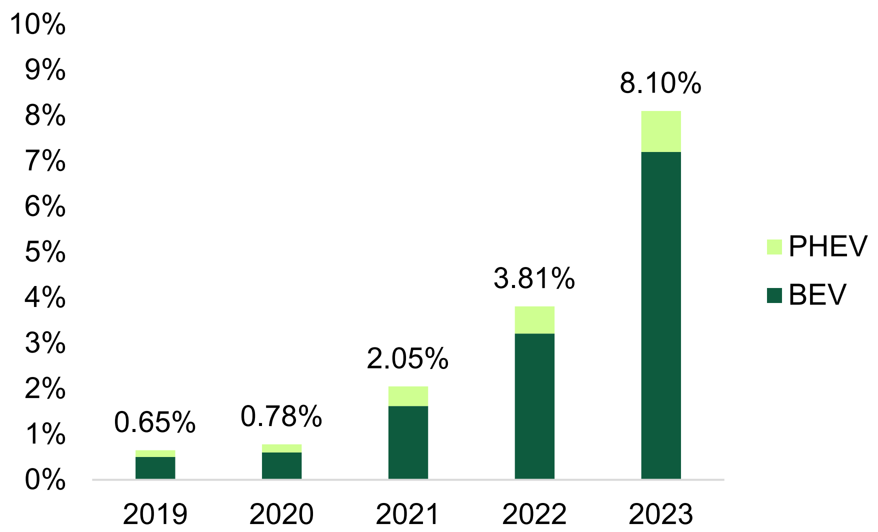
This work, initiated by Energy Networks Australia (ENA), had the objectives of:

- Identifying gaps in Electric Vehicle (EV) connection standards across different jurisdictions, and
- Offering a way ahead for achieving a better, more harmonised approach across Australia.

2.1 Context

The rapid adoption of EVs in Australia, marked by a significant increase in battery and plug-in hybrid electric vehicles, accounted for 8.1% of new vehicle sales in 2023. This is more than double the 3.8% share recorded in 2022 (Federal Chamber of Automotive Industries, 2023), as shown in Figure 1. This trend marks a major step in moving the country towards a more sustainable and energy-efficient future.

Figure 1: Annual Australian Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicles (PHEV) sales as % of total new vehicle sales (Federal Chamber of Automotive Industries, 2023) (Electric Vehicle Council, 2023)



The surge in EV uptake not only reflects the evolving market dynamics but also aligns with the Australian Government's commitment to fostering the growth of the EV industry, as outlined in the Australian National Electric Vehicle Strategy (NEVS). The NEVS particularly highlights the need for standardisation to support the widespread adoption of EVs (DCCEEW, 2023).

Distribution Network Service Providers (DNSPs) have a major role in enabling EV charging infrastructure. They own and manage the last mile of Australia's electricity network, distributing electricity to residences, government, and commercial premises and connecting customer-owned generation to the network. The Service and Installation Rules (SIRs) and connection standards determine how Electric Vehicle Supply Equipment (EVSE) connect to the grid at different locations. To support the development of EV charging infrastructure, harmonisation of EVSE-to-grid connection standards and jurisdictional SIRs is crucial.

2.2 Definition and context on EV charging

The process and complexity of connecting EVSE to the grid varies based on location and the type of EVSE used. For the purposes of this report, EV charging is classified into two main types, residential and public charging:

1. **Residential charging**: EV users charging at their residence.
2. **Public charging**: Destination charging (where an EV user charges at a location they are visiting for other reasons, typically over medium to long periods) and service stations (where an EV user is stopping specifically to charge) are together referred to as *public charging*.

There are 4 types of EVSE used for charging at these locations, as shown in Table 1. For the purposes of this report, we refer to a 32A EVSE when addressing Mode 3/Level 2 EVSE given their ability to fully charge an EV overnight and their widespread adoption.

Table 1: Types of EV chargers[1]

Type of EVSE	Location	Rated Power [kW]	Current [A]	Charge time for a 60kWh EV
Mode 2 (AC Level 1 or 2)	Residential	Up to 3.7	Up to 16	Over 16 hours
Mode 3 (AC Level 2)	Residential and destination charging	3.7 to 22	16 – 70 (Typically 32)	1 – 8 hours
Mode 4 (DC Fast Charging)	Destination charging and service stations	Varies by EVSE, typically over 50	Varies by EVSE	Less than 1.2 hours

2.3 Methodology

The project was structured in three phases: engagement with DNSPs and the EVSE industry, analysis of SIRs and connection standards, and the facilitation of workshops with DNSPs to discuss findings and build consensus for the next steps.

- The project team interviewed representatives of all DNSPs in Australia to obtain information and perspectives on the current rules and regulations relating to EVSE connections, differences and commonalities between them, and insights on why these gaps and commonalities exist.
- The project team interviewed stakeholders in the EV industry, both local and global organisations, to understand key challenges faced by the EVSE industry in Australia and identify best practices.
- The project team conducted a review of SIRs, connection policies, reports, and other relevant documentation for EVSE connections, to corroborate findings from stakeholder engagements and ensure key differences were identified.

The findings from these phases guided the development of a way ahead to achieve a better, more harmonised approach to EV connections across Australia.

[1] Mode 1 excluded due to the lack of current/shock protection and its ban in countries such as the US and the UK.

3 Insights from industry engagement

This report was developed by taking into consideration the perspective of the EV charging industry. This was achieved through interviews of representatives from the EV industry peak body, Charging Point Operators (CPOs), and installers operating in Australia nationally and overseas[2].

This was undertaken to ensure the following objectives:

- Understand the key challenges faced by the EVSE industry in Australia
- Identify any best practices from DNSPs from Australia or from more mature markets (e.g. Europe)
- Gather insights and ideas to guide future work

The findings presented in this section are based on the perspectives of stakeholders interviewed during the project and do not necessarily reflect the views of Energy Networks Australia or its members.

Overall, the insights from the industry feedback reveal some key challenges across residential and public charging:

- **Residential charging is hindered by amperage limitations in current SIRs** in some states, with a call for changes to facilitate the allowance for EVSE installations nationwide. The industry has also expressed concerns about potential new requirements from DNSPs, be it in terms of EVSE data sharing or EVSE management obligation. This is detailed in section 3.1.
- **For public charging, there is notable uncertainty around the provision of additional points of supply** (POS), where the industry has expressed the need for a clear and transparent set of conditions. The industry sees room for improvement in the connection process for public charging, especially as the uptake of EVs is expected to exacerbate the problem. This is detailed in section 3.2.

This process of industry engagement has also highlighted that fragmentation and lack of harmonisation still exist in more mature EV markets like Europe. For instance, while Germany has established national guidelines for EV connections, this has not translated into consistent adoption among its DNSPs. This shows that achieving harmonisation of EV connections is a complex challenge other countries are also facing and highlights the importance of thorough engagement of all DNSPs to achieve harmonisation.

3.1 Residential charging

3.1.1 Amperage for Basic Connections

The industry aspires to a future where customers can install Mode 3 EVSE at home in every state. This is currently hindered by amperage limitations in the rules in ACT and NT[3].

These limitations may not reflect actual practice, as the rules are not always followed. Some installers are either unaware of the amperage limit, or knowingly ignore them, which unfairly affects installers

[2] Eleven representatives from the following organisations were interviewed: Electric Vehicle Council, JET Charge, EVX, EVIE, NRMA, Tesla, BP Pulse Australia and BP Charge New Zealand, BP Pulse Europe, ChargeUp Europe, Next Generation Electrical, Milence Europe.

[3] ACT and NT impose current limitations on the EVSE which mean the drivers would not be able to utilise the full charging capacity of the Mode 3 / Level 2 EVSE even when they are able to install them.

who comply with the rules. Overall, the industry would like to see more balanced rules and higher rates of compliance.

3.1.2 Management of residential EVSE

The potential impact of residential EV charging on the network highlights the importance of managing EVSEs effectively. The industry asserts that setting appropriate tariffs is sufficient to regulate EV charging behaviour, eliminating the need for direct EVSE management by DNSPs.

However, with the anticipated rise in EV adoption, the industry also accepts that the cumulative effect of residential EVSE could still necessitate certain safeguards. Industry stakeholders stressed that, where DNSPs believe these safeguards may be required in future, it is important that they are defined as soon as possible. The industry suggests early development of these requirements[4] in close consultation with the industry will avoid grandfathering issues.

This is in line with international practice. While there is currently no direct EVSE management from distribution or transmission networks in Europe and the United Kingdom, they have established requirements around smart functionalities of EVSE. The smart functionalities required are broadly defined: the ability for EVSE to send and receive information, along with the ability to adjust charging power dynamically through electronic communication methods[5]. By having these requirements in place, it lays a foundation that allows DNSPs or other third parties to directly manage EVSE in the future.

3.1.3 Data collection for residential EVSE

The industry indicated that data collection obligations can be onerous given the relatively low cost of residential EVSE installation (say compared to solar photovoltaic systems or battery energy storage systems). To avoid non-compliance and incorrect data, the preferred approach from industry would be to rely on existing data or indirect collection. For instance, industry suggested that:

- Metering data, especially via smart meter data, should be sufficient to identify the presence of an EVSE at a premise and provide DNSPs with the data they need.
- Certificates of electrical safety[6], issued by electricians to record details of the work, could be used to provide DNSPs with the required EVSE details; given they can get access to these certificates.
- Vehicle registration data, segmented by postcode and powertrain, is readily available for all states except for South Australia, Northern Territory, and Tasmania, and can be used to identify areas with high EV uptake and assists in identifying EVSE at a premises[7].

This view resonates with practices in some more mature markets. For instance, there is no mandated data collection for EVSE installations in France, where metering data[8] is used to gain a comprehensive view of residential EVSE installations.

---

[4] The industry is open to requiring EVSE to support OCPP (1.6J or better) communication capability, if necessary, without demanding international certification, as most manufacturers would not be able to provide it yet. However, the industry is against mandating the communications feature to be activated and connected during installation, as it increases installation costs without providing immediate benefits to most consumers.
[5] Both the EU and UK did not specify standards or requirements around the electronic communication methods.
[6] The names of these certificates differ around Australia. Certificate of Compliance for Electrical Work (NSW), Certificate of Electrical Safety (VIC, ACT), Electrical Certificate of Compliance (SA), Testing and Compliance Certificate or Electrical Work Request (QLD), Certificate of Compliance – Electrical Safety (NT)
[7] Vehicle registration data also complements smart metering data by confirming whether the premises identified with an EVSE also have a registered EV.
[8] France has a 92% residential smart meter penetration (Council of European Energy Regulators, 2023)

3.2 Public Charging

3.2.1 Additional points of supply

The industry desires a clear, transparent, and reasonable set of conditions where additional POS[9] are allowed. In many cases, connecting EVSE via an additional POS would allow minimisation of both costs and disruption to the customer's activity.

The industry faces ambiguity about the provision of additional POS. CPOs' experience is that approval and provision of additional POS is difficult to secure and inconsistent across states – to the extent that one industry interviewee had the perception there is "a blanket rule" against additional POS across Australia.

The lack of uniformity in the conditions and requirements brings further confusion: the industry struggles with the fact that a given situation can be deemed safe by one DNSP but not by another.

In contrast, industry stakeholders exposed to international contexts noted that obtaining additional points of supply is generally straightforward in New Zealand or Europe, with safety concerns rarely being a barrier in doing so.

3.2.2 Connection process

The industry is concerned with the time taken from connection application to energisation of EV charging sites, currently from 2 to 18 months. Stakeholders are worried that without changes to the connection process or the resources available to handle the increasing number of applications for EVSE sites, Australia might follow the trajectory of some countries, where connection time has expanded from 12-18 months to up to 4 years in the US, and from 12-18 months to 24 months in the UK.

In addressing these challenges, the involvement of DNSPs in regulatory changes can play a crucial role. For example, the industry credited Ausgrid for their advocacy efforts in regard to the recent changes made by the NSW state government that resulted in eased local government development approval processes for certain EVSE installations. This showcases the influence DNSPs have in advocating for regulatory reforms that support streamlined processes. With this in mind, the industry has identified three 'best practices' that it believes could further improve on the status quo:

- Providing transparency on available grid capacity
- Providing connection alternatives and flexible connections
- Forming a dedicated EVSE connection team

They are described in the rest of this section.

3.2.2.1 Providing transparency on available grid capacity

The industry would like information about available grid capacity on the low voltage network to be publicly available to help identify suitable locations for EVSE installation prior to lodging a connection request. Without it, the connection process is said to be akin to a shot in the dark with a slow feedback loop.

[9] A point of supply in this report refers to the connection point between the DNSP's network and the customer's electrical installation. Different technical terms are used across Australia: in Tasmania, Victoria, and WA, this is referred to as a point of supply; in Queensland, it is referred to as a DNSP Service Point; in the ACT and NT it is referred to as a connection or a service; and in NSW and SA it is referred to as a connection point.

CPOs are thus compelled to lodge applications for many locations, and for multiple capacities. This leads to an inefficient process, redundant applications, unnecessary costs and efforts on both sides, as CPOs would only accept one connection offer even if multiple were proposed.

Some industry interviewees identified Essential Energy as an example of best practice in this area in Australia, by providing a map that offers preliminary insights into potential sites and corresponding available grid capacity on their low voltage network. Similar maps are also available from several other DNSPs not specifically mentioned in interviews. Such maps are also available at a national level in several European countries such as France, the Netherlands, and Norway (Eurelectric, 2023).

3.2.2.2 Providing connection alternatives and flexible connections

Another best practice identified by the industry is the choice offered by certain DNSPs regarding site capacity options, both at time of lodgement and, maybe more importantly, in their connection offers.

For example, in a response to a CPO's application for a 500 kVA capacity, a DNSP presented two alternatives: either having to wait 1 year and incur costs of $1m for that capacity or opt for a significantly reduced waiting time and cost for a 200 kVA capacity. Essential Energy, SA Power Networks, Ergon Energy and Energex are examples of DNSPs providing this type of choice in their response to connection requests.

The industry also expressed openness towards having the ability to elect a cheaper flexible connection (e.g. with a limitation of demand for restricted periods in the year). However, scepticism remained regarding DNSPs' ability to implement such approach in the short term, given the various technical and contractual challenges. The ability to understand and foresee operational impacts[10] were seen as critical by CPOs, to structure contracts with their customers in consequence.

3.2.2.3 Forming a dedicated EVSE connection team

Lastly, the industry shared that having a dedicated EVSE connection team at DNSPs tends to make the connection process easier for both the networks and the CPO / installers. This is evidenced by examples from Australia and overseas (e.g. Europe where it is a growing trend).

Having a specialised EVSE team ensures they have a nuanced understanding of the unique aspects of EVSE, allowing them to provide relevant options proactively to CPOs / installers during the connection process, especially in congested areas.

[10] The industry emphasises the importance of DNSPs providing transparency about the timing and conditions triggering demand restrictions on flexible connections. This clarity is crucial for CPOs to assess how these restrictions, potentially during peak times like hot summer afternoons in popular areas, might affect operations. Without this understanding, there could be substantial queues at charging stations, and negative backlash on CPOs, DNSPs, and the government.

4 Current situation of EVSE connections

The chapter analyses the current rules and standards related to EVSE connections. The analysis and findings presented reflect a snapshot in time, based on information available as of July 2024[11]. This was achieved through the review of relevant documentation, through those submitted by DNSPs and those available online, complemented by a series of interviews with the representatives from each DNSP.

This was undertaken to ensure the following objectives:

- Understand the current rules and regulations relating to EVSE connections.
- Identify the gaps and commonalities between them.
- Gather insights on why these gaps and commonalities exist.

Similar to the insights from industry, the findings reveal some commonalities and differences between DNSPs on residential and public charging.

- Residential charging is mostly aligned, with most DNSPs accommodating Mode 3/Level 2 EVSE installations. Some DNSPs require additional conditions, such as data sharing on the installation or management/control of the EVSE. Additionally, some DNSPs collect data upon new application submissions. This is detailed in section 4.1.
- In public charging, there are varied conditions for additional POS between jurisdictions, though all applications are assessed on a case-by-case basis. Connection processes also vary by state, with timelines ranging from two to 18 months from application to energisation. Some DNSPs now provide upfront grid capacity information by location, with others looking to adopt similar practices. This is detailed in section 4.2.

4.1 Residential charging

4.1.1 Amperage for Basic Connections

The ability to fully charge an EV overnight at home provides convenience to EV owners: this requires a Mode 3/Level 2 EVSE. While there is a broad range of Mode 3 EVSE, a typical unit intended for home use has a rated amperage of 32A. SIRs for each jurisdiction have specifications on the maximum amperage of an appliance[12]. These specifications are critical as they limit the type of EVSE that a resident can install at their premises. The main factors to consider for evaluating if a 32A EVSE is allowed are:

- maximum amperage allowed per appliance,
- whether the maximum amperage is a mandatory requirement or guidance, and
- any exemptions that might apply to EVSE.

In most cases it is permissible to install and use at full power a 32A EVSE on a basic connection, although there is variation both within and between DNSPs dependent on the capacity of the local network to support it.

[11] Readers are advised to check the latest editions of SIRs, technical regulations, and any other relevant information from the respective providers for authoritative information on current guidelines and requirements.

[12] Amperage limits on single-phase equipment are imposed by DNSPs to maintain power quality by limiting flicker (from motors and other large equipment starting or varying output significantly), imbalance (which can exacerbate voltage sags, swells, or brownouts, and substantially reduce network capacity) and neutral currents (which in some circumstances can increase the risk of shocks in addition to the points above).

Currently, the Australian Capital Territory and the Northern Territory have specific provisions within their SIRs that present obstacles to the installation of 32A EVSE, and do not provide any exemptions that could be used to work around these obstacles. However, DNSPs in both territories have expressed a willingness to review the limits in these SIRs to potentially allow for the installation of these EVSE in the future.

For more information on the ability of a customer on a basic connection[13] to install a 32A Mode 3 EVSE, refer to Appendix 1 – EVSE installation policies and amperage limits by DNSP, which provides an overview across DNSPs.

4.1.2 Management of EVSE

EVSE management is essential for ensuring the efficient and reliable integration of EVs into the grid. Different approaches can be employed to manage EVSE and can be broadly categorised into connection-level management, device-level management, pricing or tariff differentiation, and hybrid methods. Table 2 provides an overview of each management approach.

Table 2: Approaches to manage EVSE

Approach	Description
Connection-level management	Manage load at the household level, ensure the connection does not exceed a certain threshold.
Device-level management	Manage load at the EVSE level, either through controlled load or directly changing the EVSE import limit through communication protocols[14].
Pricing or tariff differentiation	Create incentive structures through pricing to influence charging behaviour[15], for example, time-of-use tariffs[16].
Hybrid	Combinations of the above options.

Queensland is currently the only state in Australia that requires the management of residential EV charging for installation of EVSEs over 20A[17]. DNSPs facilitate installation of a 32A EVSE in Queensland by offering customers the option of choosing one of the following management options:

- **Load control tariff via a network device**: This method utilises one-way communication from the DNSP, to a DNSP-owned device installed in the customer switchboard. This setup allows the DNSP to control the EVSE load during network constraints. The EVSE will be installed on a controlled tariff.

[13] "Basic connection" refers to the common type of connection for residential/small businesses, defined in the National Electricity Rules section 5A.A.1 (AEMC, 2024).
[14] This approach requires the use of "smart" EVSE or network devices, which needs infrastructure from a DNSP. "Smart" EVSE is a loosely defined term that have several features, the critical one being the ability for two-way communication, which enables the management of the device. There are currently no requirements for "smart" EVSE in Australia, but DNSPs broadly recognise their potential benefits for the management of EVSE.
[15] Vehicle-to-Grid trials indicate that the adoption of dynamic pricing models lead to a decrease in peak electricity demand. However, it may lead to sharp responses from vehicles during price fluctuations, creating secondary peaks. The implementation of dynamic operating envelopes effectively mitigated the adverse outcome while still retaining the benefits. (enX & ARENA, 2024)
[16] EVSE represent a significant load that could be shifted easily for customers presenting an opportunity for time-of-use tariffs for both customers and retailers. However, it will ultimately be up to retailers, to pass on the time-of-use tariffs to the customers.
[17] For a single-phase connection. Queensland DNSPs require active management for large EV chargers to avoid overloading their networks, which were designed for an average load of 3-4 kW per customer (single phase) at peak times. As these chargers can double that load, the EVSE management provides an approach for the networks to offer larger equipment connections.

- **Basic active management via a network device**: Similar in function to the controlled tariff method, this also employs one-way communication from the DNSP to a DNSP-owned device in the customer switchboard. However, the EVSE will be installed on the primary tariff, which unlike the previous option, will allow customers to use their rooftop solar, if installed, for EV charging.
- **Dynamic connection**: This approach introduces two-way communication[18] between the EVSE and the DNSP, facilitating management through dynamic operating envelopes provided by the DNSP. The minimum limit for import will be 1.5 kW and the maximum is set at 15 kW, which is approximately the maximum circuit breaker rating for a standard household (Energy Queensland, 2023).

4.1.3 EVSE data collection

Similar to regulatory requirements to capture data on distributed energy resources, data collection on EVSE (e.g., amperage, type/model) would be beneficial for network planning and establishing demand forecasts. Table 3 provides approaches that can be taken to collect EVSE data.

Table 3: EVSE data collection approaches

Approach	Description
When new connection applications are submitted	Include a question in the connection application on whether a Mode 3 EVSE will be installed in the premises.
Static data from installation of an EVSE	Potentially require government mandate for Mode 3 EVSE to only be installed if the installer were to provide data. Can also be collected via certificate of electrical safety.
Smart EVSE data with communication protocols	Through direct communication with smart EVSE. Requires communication protocol/infrastructure.
Smart meter data	Derived through smart meter interval data (i.e., spotting a ~32A increase in demand) – data gathered might be more limited.

Some DNSPs have already started collecting data on residential EVSE installations, and more are planning to do so in the future. Current practices include:

- In South Australia, static data is collected through connection applications for EVSE installations over 20A[19].
- In Western Australia, Horizon Power collects static data through connection applications for EVSE installations over 10A (2.4kW)[20].
- In New South Wales, Essential Energy gathers static data on EVSE installations in their network through a specific field in their application form that enquires about the presence of any EVSE.

[18] Via SEP2 using CSIP-AUS directly or via a third party.
[19] SA Power Networks collects data on EVSE installations over 20A for single-phase connections and 25A three-phase connections through its SmartApply process. For more information, see https://www.sapowernetworks.com.au/connections/connect-solar-and-ev-chargers/
[20] Horizon Power collects data through an online application form. For more information, see https://www.horizonpower.com.au/contractors-installers/connect-solar-battery-ev/connecting-ev-chargers/

The lack of centralised data-sharing mechanisms has led DNSPs to create their own data. This not only duplicates efforts but also places additional responsibilities on installers to apply for different exemption application processes.

4.2 Public charging

4.2.1 Additional points of supply or connections

EV charging installations in public areas such as shopping centres and office buildings can represent a significant increase in the local load. Connecting through the existing electrical installation can be impractical and/or require costly upgrades. In such cases, installers and CPOs may prefer to reduce costs and disruption by connecting the EVSE to the network via a separate point of supply. DNSPs, in turn, may place greater weight on safety outcomes and long-term technical suitability for the site as per the requirements set out in SIRs.

The current rules for additional points of supply are consistent at a high level, where every DNSP provides only one point of supply and allows additional points at its discretion[21] on a case-by-case basis. However, the requirements and level of details differ between SIRs[22].

There are some themes that cut across multiple SIRs, e.g., multiple occupancy or large properties, the magnitude of the load, and clear separation of circuits or points of supply. However, there are still differences in the conditions specified in the SIRs.

Refer to Appendix 2 – Information in SIRs on conditions for additional points of supply for more detailed information.

4.2.2 Connection process

The timeline for EVSE connection varies, with timelines from application to energisation ranging from 6-9 weeks where capacity is available, to 6-18 months in cases requiring network augmentation. This is influenced by numerous factors, including technical requirements, supply chain constraints, and regulatory schemes.

Many customers, both residential and commercial, have limited awareness or visibility of the technical constraints faced by networks when considering connection of high-amperage loads such as EVSE. Besides simple capacity limits of physical assets, DNSPs must consider the following:

- **Voltage regulation:** DNSPs must ensure voltage remains within mandated limits. High-amperage loads can cause deviations that must be managed.
- **Phase balancing**: Residential and some small commercial customers are connected to single phase supplies. DNSPs must manage the balance of load between the three phases employed in the wider network.
- **Cost considerations**: DNSPs have a responsibility to consumers to manage networks cost-effectively and equitably. Although the individual impact of a single EVSE may be minimal, collectively many EVSE may represent significant additional load, requiring network upgrades and incurring costs that are ultimately borne by all consumers in an area – including those that do not directly benefit.

Other factors also influence the connection process:

[21] The provision of additional points of supply in WA is not at the DNSP's full discretion, but within the bounds of the WA Department of Energy, Mines, Industry Regulation and Safety – Building & Energy division.
[22] In WA, the requirements are provided in the Western Australia Electrical Requirements

- **Supply chain dependencies**: The timeline for connection, especially when requiring network augmentation, is often impacted by supply chain constraints. For example, the delivery of essential components like transformers could extend well beyond the anticipated timeline.
- **Availability of grid capacity information on the LV network**: Several DNSPs currently offer location-specific LV grid capacity information through a publicly-accessible online mapping tool. This feature is commended by industry stakeholders for its potential in streamlining the connection process. There is interest in broader adoption of such tools across the sector.
- **The Accredited Service Provider (ASP) scheme in NSW**: The competitive market created by the ASP scheme in NSW mandates customer engagement with ASPs for some services, e.g. connection design and certification to ensure compliance with minimum standards. This scheme would have an impact on the connection process. While engaging competent ASPs generally leads to quick approval, collaborations with less proficient ASPs often result in repeated rejections, delaying the connection process and inadvertently directing blame towards the DNSPs. Revision of the scheme is currently underway based on the recommendations of the ASP scheme review (NSW Office of Environment and Climate Change, 2022).

4.3 Contextual differences between jurisdictions

The variations in rules and regulations regarding EVSE connections across different DNSPs can be attributed to a range of contextual factors unique to each DNSP's operating environment. These differences are shaped by geographical, regulatory, technical, and consumer-related factors, which influence the specific requirements and approaches adopted by each DNSP.

- **Geographical variations**: The geographic area covered by a DNSP affects the rules and regulations. Areas with dense urban development face different challenges and different capacities compared to more rural or sparsely populated regions. For example, basic residential connections in remote locations are capped at lower amperages, which means that allowing a Mode 3 charger without conditions could lead to potential issues, necessitating the management or control of these EVSE. This necessity becomes even more pronounced when dealing with mini and microgrids, which are even more vulnerable to the additional load.
- **Regulatory environment**: State-specific regulations, safety standards, and energy policies can dictate different requirements for EVSE connections. For example, in Western Australia, the regulation of additional points of supply is developed by the Building and Energy Department, implying that any updates to regulation may require greater coordination. When trying to change processes, more management from DNSPs could be required in NSW due to the ASP scheme.
- **Consumer demand and behaviour**: The level of EV adoption and consumer behaviour can influence connection rules. Areas with higher EV penetration might have evolved more streamlined processes to accommodate the growing demand. An example of this is seen in NSW, as mentioned in section 3.2, where recent regulatory changes have simplified and accelerated certain installations of charging stations by bypassing the need for local government approval.
- **Technical infrastructure**: The existing technical infrastructure of the DNSP, including the age, design, and capacity of the network also plays a role, as well as the current penetration of smart meters. DNSPs might not be able to currently provide certain features such as the grid capacity map due to the lack of smart meter penetration and data on the LV network.

5 Way ahead

This chapter describes the broad next steps ENA and its members intend to take to advance the harmonisation of EVSE connection standards and facilitate EV uptake in Australia. Five main actions are detailed in the rest of the chapter:

1. **Nurture engagement between DNSPs and stakeholders** for implementation of recommendations. Collaboration with international organisations in areas like EV charging standards and industry associations in other parts of the world can help in developing solutions.
2. **Develop grid capacity availability maps for Medium and Low Voltage networks**, helping CPOs and installer streamline charging infrastructure installation. This empowers them by identifying suitable areas, reducing grid upgrade costs and connection timelines.
3. **Progress harmonisation of rule-based and specific guidelines for additional points of supply,** helping CPOs and installers choose the best configuration for public EV charging. This will clarify EV charging site feasibility, reducing application backlog in DNSPs and expediting the connection process.
4. **Promote a consistent data collection approach for EVSE**, benefitting stakeholders by simplifying compliance and enhancing efficiency for installers and CPOs. This will also improve energy demand forecasting and grid management for DNSPs.
5. **Continue to evolve the EVSE management approach**, to efficiently integrate EVs at scale. This will require a deep understanding of the benefits and nuances of different forms of EVSE management, and balancing short term pragmatic solutions with exploration of longer-term options.

In addition to these national initiatives, DNSPs in the Australian Capital Territory and the Northern Territory will launch initiatives to revisit their SIRs to review the ability of their networks to facilitate the installation of 32A Mode 3 EVSE.

5.1 Nurture engagement between DNSPs and stakeholders

ENA and its members are aligned on the next steps needed to improve EVSE connection standards in Australia: but this cannot be achieved by networks in isolation. Constructive engagement with key stakeholders is necessary to shape and deliver those next steps.

Several initiatives are underway in Australia and globally to improve EVSE or Consumer Energy Resources (CER) connection standards. ENA and DNSPs can leverage and connect with these, to benefit from their momentum and learnings.

Specifically, ENA intends to progress the following actions:

- **Engage with state and Commonwealth governments** on the recommendations of this report.
- **Continue engagement with the Australian EVSE industry**, including via peak bodies such as the Electric Vehicle Council, to maintain a constructive dialogue.
- **Continue engagement with standards development organisations,** such as the Open Charge Alliance, OpenADR, and others to share knowledge and align with global developments.
- **Initiate international liaison with EV charging industry associations** who are working through similar challenges in other regions, e.g. ChargeUp in Europe.

5.2 Develop grid capacity availability maps for Medium and Low Voltage networks

Maps showing available capacity for new connections help CPOs and installers in their siting choices for EV charging infrastructure. Making such information public empowers CPOs and installers and helps minimise timelines and costs associated with connections by making the connections process more efficient. To achieve this, DNSPs will have to overcome challenges related to data availability, accuracy, and privacy[23].

ENA will provide a forum for discussion and co-ordination to:

- **Collaborate on common approaches.** DNSPs have various levels of maturity on the topic, but also common challenges to address. This makes it a fertile ground for learning from peers within the ENA network while facilitating implementation of common and/or proven solutions by others.
- **Engage with the EVSE industry** to ensure the right information is communicated in the best possible way and seek input to achieve the best user experience, also taking inspiration from existing platforms nationally and internationally.
- **Develop and implement public grid capacity availability maps, where this is practical.** After consolidating the common set of data parameters, develop online tools for publicly sharing the maps. In some areas network characteristics or other factors may make capacity calculations complex, and in this case a simplistic measure of capacity may lead to a mismatch between customer expectations and the reality of what the network can support. Rather than risk making the customer experience worse, mapping should clearly indicate areas for which a more bespoke engagement with DNSPs is needed.

5.3 Progress harmonisation of rule-based and specific guidelines for additional points of supply

Spelling out clear conditions and guidelines for additional points of supply will help CPOs and installers understand their options better when figuring out the best configuration for public charging at a particular site. In many cases, connecting EVSE via an additional POS would allow to minimise costs and disruption to the end customer's activity. It will also avoid CPOs lodging multiple connection applications due to the uncertainty surrounding additional POS, reducing the number of connections requests DNSPs have to process.

To achieve this, DNSPs will have to balance simplicity with physical, technical, and safety considerations, and overcome the variability in state regulatory landscape.

ENA will co-ordinate efforts to:

- **Engage with DNSPs in other countries**. CPOs and installers working across multiple countries shared the example of New Zealand and Europe where additional POS approval process is streamlined. Engaging with ENA's counterparts in those countries would be useful to understand the rules in place and assess their current approach.
- **Form a Working Group across DNSPs** to define national guidelines around the supply of additional POS. These guidelines can be informed by international as well as domestic examples that follow such a rule-based approach. This Working Group will likely need to be cross-functional and require the collaboration of several teams from each DNSP (e.g. connections, safety, commercial).

[23] Subject to compliance with the Security of Critical Infrastructure (SOCI) Act 2018. Further research and consultation may be required to fully understand the legal implications and ensure adherence to the Act.

- **Engage with industry stakeholders**, as they can provide valuable feedback, and in doing so help the Working Group develop relevant, transparent and safe guidelines.
- **Implement these guidelines in the rules of each state.** This will require going through state-specific processes, engaging with state-specific bodies (e.g. SIRs committees and state safety regulators) and amending SIRs or other relevant documents as required. Cost-recovery considerations may also require engaging with the Australian Energy Market Commission and amend the National Electricity Rules.

5.4 Promote a consistent data collection approach for EVSE

As EV uptake increases in Australia, having reliable EVSE standing data will become more and more important for DNSPs to forecast demand, plan, and manage their network. The Australian Energy Market Operator (AEMO) has also identified such data as a requirement for the secure operation of the electricity system.

In December 2023, AEMO submitted a rule change request to include EVSE standing data in the Distributed Energy Resource (DER) register[24]. That proposition, if accepted, will place an obligation on DNSPs to provide EVSE standing information to AEMO. Doing so efficiently and accurately will be a key challenge for DNSPs, and there are several different approaches that could be followed, as discussed in 4.1.3. Efficiency will ensure best cost outcomes for the customers, and also help ensure the quality of the data by avoiding non-compliance. Specifically, the following actions, to be led and coordinated by ENA, can be taken to that effect:

- **Leverage learnings from the ongoing data collection for the DER register**, to guide the scope and nature of EVSE data collected. Experience from SA Power Networks, Western Power, Horizon Power, and Essential Energy in collecting EVSE data should also be taken advantage of.
- **Identify efficient data collection procedures in consultation with the industry**. If possible leveraging indirect (e.g. Advanced Metering Infrastructure) or existing procedures (e.g. safety compliance certificates and vehicle registration data[25]), to minimise the burden on installers and help maximise compliance.
- **Implement data collection procedures**, leveraging the previous actions to develop and implement a standardised data collection approach for EVSE across all DNSPs to ensure consistency and accuracy. This will involve setting up systems and processes to collect and report EVSE data efficiently.

5.5 Continue to evolve the EVSE management approach

Shaping the profile of EV charging through EVSE management is seen by DNSPs and accepted by the industry as a key ingredient to efficiently integrate EVs at scale in the system, minimise costs, maximise asset utilisation, and ensure fair access to the grid in the future. This is still a developing area, both in terms of technical standards and the operationalisation of the systems and technologies involved. It will be important to use the learnings from engagements with standards-setting bodies from the first recommendation, *Nurture engagement between DNSPs and stakeholders*, to keep abreast of and influence evolving standards.

The EVSE management approach should also be considered in the broader context of the CER integration question, and even more so with the future emergence of vehicle-to-grid. Though the solutions to an efficient integration of CER into the electricity system have started to take shape – from flexible connections to more dynamic pricing and dynamic operating envelopes – much remains

[24] This rule change applies to the National Electricity Market (NEM) (AEMO, 2023); the rules in the Wholesale Electricity Market (WEM) operating in Western Australia already require EVSE data to be included in the DER Register.
[25] Not readily available to SA, NT, and TAS distribution networks.

to be done to reach that desired end-state. This is highlighted by the numerous ongoing programs, from technical trials to ongoing reforms as described in the *Consumer Energy Resources and the Transformation of NEM* report (Energy Security Board, 2024) and the *National Consumer Energy Resources Roadmap* (Energy and Climate Change Ministerial Council, 2024).

Actions in this area should therefore balance short term pragmatic solutions with exploration of longer-term, more transformational options aligned with programs of work on CER integration. For some network areas, the optimal outcome for customers, allowing the greatest number of EVSE installations and the least-restrictive amperage limitations, may require that the DNSP has the ability to set dynamic constraints to assure network stability and reliability. ENA and its members will continue to monitor developments and work with stakeholders to explore how application of these management approaches can increase the EVSE hosting capacity of networks. ENA and its members will consider the following areas for further examination:

- **Leveraging tariffs[16] to manage EV load** from early adopters in the short term, using the learnings from past and ongoing EV pricing trials and programs in Australia and overseas.
- **Anticipating large-scale EV adoption** to understand longer-term constraints, especially at low voltage level. Use this to guide reflections on efficient grid capacity allocation, and considerations on making EVSE connection conditional on implementation of some form of management, through tariffs, dynamic operating envelopes, or other approaches.
- **Exploring offering flexible EV connections** in responses to public charging connection enquiries, along with fitting tariffs. This should offer an effective ground to deliver value to customers in the shorter term, while providing learnings for larger scale deployment of CER integration measures. Modalities should be defined in consultation with the industry to ensure they are fit for purpose and achieve best outcomes.
- **Working with stakeholders to set national standards for functional requirements of EVSE** to ensure consistency, reliability and interoperability across Australia's EV infrastructure. Selecting a nationally consistent standard would facilitate the integration of EVSE into the broader context of CER integration, for instance through IEEE 2030.5 and CSIP-AUS[26]. Further research and industry consultations would be necessary to inform the development and implementation of the standards so that EVSE integrate successfully and cost-efficiently into the smart-grid ecosystem. This would improve the ability to use flexible EV connections and enhance the ability to deal with large-scale EV adoption.

[26] IEEE 2030.5 and CSIP-AUS are standards used for smart grids and connection-level management of loads by distribution networks. The integration of EVSE functionality to these standards is likely to be indirect, and require that EVSE have the capability to communicate with the gateways that are used for the connection-level management.

6 Appendices

6.1 Appendix 1 – EVSE installation policies and amperage limits by DNSP

The information presented below reflects a snapshot in time, based on information available as of July 2024. Readers are advised to refer to the latest SIRs, technical regulations, and any other relevant information from the respective providers for the most up-to-date guidelines and requirements.

DNSP	Can a 32A EVSE be installed on a single-phase connection?	Maximum amperage per appliance (single-phase) [A]	Total amperage allocation per connection[27] [A]
Evoenergy	No	25 (Evoenergy, 2023)	100 (Evoenergy, n.d.)
Ausgrid	Yes	25 (guideline only) (SIR NSW Management Committee, 2019)	100 (Ausgrid, 2018)
Endeavour Energy	Yes	25 (guideline only) (SIR NSW Management Committee, 2019)	100 (Endeavour Energy, n.d.)
Essential Energy	Yes	25 (guideline only) (SIR NSW Management Committee, 2019)	100 (Essential Energy, n.d.)
PowerWater	No	25 (PowerWater, 2024)	40 (PowerWater, 2024)
Ergon Energy and Energex[28]	Yes	20 (increasable to 35 with active device management) (EnergyQ, 2023)	100 for urban, 80 for rural, and 40 for SWER (Energex, 2020) (Ergon Energy, n.d.)
SA Power Networks	Yes	20 (EVSE are eligible for an exemption obtainable through SmartApply, SA Power Networks' online portal) (SA Power Networks, 2023)	100 (SA Power Networks, 2018)
TasNetworks	Yes	None specified (TasNetworks, 2023)	100 (TasNetworks, 2019)

[27] Amperage allocation per connection is based on the allowed maximum amperage from the connection policy for a basic single-phase 230V connection. While the DNSP's allocation represents the maximum supply capacity available, the actual usable capacity may be lower due to safety requirements in the AS/NZS 3000 standards influencing the rating of the main switch at the switchboard.
[28] Based on the version 4 of the QECM, effective from 21 February 2024.

DNSP	Can a 32A EVSE be installed on a single-phase connection?	Maximum amperage per appliance (single-phase) [A]	Total amperage allocation per connection[27] [A]
AusNet Services	Yes	25 (guideline only) (VIC SIR Management Committee, 2022)	40 (AusNet, 2020)
CitiPower, Powercor and United Energy	Yes	25 (guideline only) (VIC SIR Management Committee, 2022)	100-170 for most customers, dependent on local network capacity, or 40 for customers supplied by SWER lines. (CitiPower, 2021) (PowerCor, 2021) (United Energy, 2021)
Jemena	Yes	25 (guideline only) (VIC SIR Management Committee, 2022)	76 (Jemena, n.d.)
Horizon Power	Yes	20 (EVSE are exempt from this limit) (Horizon Power and Western Power, 2023)	63 (Horizon Power and Western Power, 2023)
Western Power	Yes	20 (EVSE are exempt from this limit) (Horizon Power and Western Power, 2023)	63 (Western Power, n.d.)

There are also considerations regarding the maximum amperage per appliance and exemptions, which exist in some jurisdictions, as explained below.

- **Maximum amperage per appliance (1-phase)**: All jurisdictions other than Tasmania currently have a maximum amperage per appliance specification that is lower than 32A. However, for NSW and VIC, the max amperage values provided in the SIRs are a guidance, not a mandatory requirement. Therefore, residents in TAS, NSW, and VIC can install a 32A EVSE.
- **Exemptions on amperage limitation**: There are three states that have exemptions for EVSEs on the amperage limitation:
    - For South Australia, the SIRs state that EVSEs are exempt from the 20A limitation if approval is sought through SA Power Networks SmartApply application process. The SmartApply application process is automatically approved for EVSEs rated 32A or under.
    - For Western Australia, the section in the SIRs that determines the maximum amperage per equipment limitation does not apply for EVSEs (Western Power, 2023).
    - For Queensland, the amperage limitation is increased to 35A if there is an active device management Type 2 (controlled tariff via network device) and Type 3 (Dynamic/Basic active management via network device) (EnergyQ, 2023). While this rule is not specific to EVSE, it allows residential customers to install a 32A EVSE if they have eligible active device management.

6.2 Appendix 2 – Information in SIRs on conditions for additional points of supply

Jurisdiction	Information in SIRs
Australian Capital Territory **(Evoenergy, 2023)**	• Premises: Without intermixture or electrical interconnection of the portions. • Labelling: Clear labelling of switchboards and distribution boards.
Northern Territory **(PowerWater, 2024)**	• Premises: Each service must supply a separate and clearly defined portion of the premises without intermixture or electrical interconnection of the portions. • Labelling: Customer must affix labels at each main switchboard to define the areas or equipment it supplies, and to indicate the presence and location of other supplies. A label must also be affixed to each distribution board to indicate the main switchboard from which it is supplied.
New South Wales **(SIR NSW Management Committee, 2019)**	• Magnitude of load: Specification not provided. • Distance between 'sub installations': Specification not provided. • Nature of customer's activities: Specification not provided. • Site conditions: Specification not provided. • Ongoing segregation: Specification not provided.
Queensland **(EnergyQ, 2023)**	• Voltage: A single connection voltage is required for all DNSP Service Points. HV and LV DNSP service points are not offered at the same site. • Physical separation: Buildings supplied by the additional DNSP Service Point must be physically separated from any other building or structure supplied from the distribution network, including all associated structural metalwork, conductive building materials and underground levels. More detailed requirements for physical separation depend on which option for provision of an additional DNSP Service Point is taken. • Additional, detailed requirements exist for electrical separation, zone boundaries, and labelling. These vary according to the requirements of the selected option, with further information available from the DNSP.
South Australia **(SA Power Networks, 2023)**	• Sites where it may be approved: Multiple occupancy or large property requiring additional service for ancillary functions; Separation of connections.
Tasmania **(TasNetworks , 2023)**	• Magnitude of load: Customer's load is high and cannot be supplied by a single substation located within the property. • Distance separating installations from existing POS: Impracticable to supply the relevant load using a LV sub-main from the primary electrical installation or environment limits the ability to have one POS. • Labelling and signage: Appropriate to ensure safety. • Isolation point: POS can be clearly identified as the supply point for isolation.

Victoria **(VIC SIR Management Committee, 2022)**	• Sites where it may be approved: Multiple occupancy or subdivision. • Load: Cannot be supported by a single substation located within the property. • Distance: Impractical to supply the relevant load using a low voltage sub-main or final sub-circuit originating at the primary electrical installation.
Western Australia **(Horizon Power and Western Power, 2023) (WA DMIRS, 2023)**	• Switchboard: Unique identifier required. • Labelling: Warnings to be installed; All items within 100 metres of zone boundaries have been clearly labelled with a unique identifier, notification warning the property has more than one point of supply. • Zoning for commercial and industrial premises: Buildings adjacent have sufficient separation, and a condition for separate zone – distance from zone boundaries to equipment and POS, switchboards in adjacent zone, may also be provided given: zone boundaries are a minimum of 10 metres from equipment and point of supply, and the remote equipment associated switchboard are at least 50 metres from any building in an adjacent zone. Each zone has a building with a minimum four-metre-wide ground level street frontage The Western Australia Electrical Requirements also provides an example of the zone diagram. • Documents: A copy of all zone diagrams provided.

7 Bibliography

AEMC, 2024. *National Electricity Rules.* s.l.:s.n.

AEMO, 2023. *Electricity Rule Change Proposal: EVSE Standing Data,* s.l.: s.n.

AEMO, 2023. *WEM Procedure: Distributed Energy Resource (DER) Register Information.* [Online]
Available at: https://aemo.com.au/-/media/files/electricity/wem/procedures/der-register-information-procedure.pdf

Ausgrid, 2018. *Basic Connection Services - 100 Amps Connection.* [Online]
Available at: https://www.ausgrid.com.au/-/media/Documents/Connections/Offers/Connection-Offer-Overview-Basic-Connection-Services-100-Amps-Connection.pdf

AusNet, 2020. *Model Standing Offer for Basic Connection Services.* [Online]
Available at: https://www.ausnetservices.com.au/-/media/project/ausnet/corporate-website/files/electricity/connection-types/model-standing-offer-for-metered-load-submission.pdf?rev=0405ab7abdd84e719eeada9b2570d0cd&hash=4957C06323E9F1B4AAB15E5B150ADF15

CitiPower, 2021. *Connection Policy.* [Online]
Available at: https://media.powercor.com.au/wp-content/uploads/2022/01/18151115/CitiPower-Connection-policy-1-July-2021.pdf

Clean Energy Council, 2024. *Powering homes, empowering people: a national consumer energy resources roadmap.* [Online].

Council of European Energy Regulators, 2023. *Energy Retail and Consumer Protection - 2023 Market Monitoring Report.* [Online].

DCCEEW, 2023. *The National Electric Vehicle Strategy.* [Online].

Electric Vehicle Council, 2023. *State of Electric Vehicles July 2023,* s.l.: s.n.

Endeavour Energy, n.d. *Basic Connections - Connect Online.* [Online]
Available at: https://www.endeavourenergy.com.au/connections/connect-online
[Accessed July 2024].

Energex, 2020. *Basic Connection Service Model Standing Offer.* [Online]
Available at: https://www.energex.com.au/__data/assets/pdf_file/0007/1019986/MSO-Basic-Connecting-Metered-Load-EGX-3070111.pdf

Energy and Climate Change Ministerial Council, 2024. *National Consumer Energy Resources Roadmap,* s.l.: s.n.

Energy Queensland, 2023. *EV Charging and QECM V4: 2024.* [Online]
Available at: https://www.ergon.com.au/__data/assets/pdf_file/0003/1171884/EV-Charging-and-QECM-V4-2024.pdf

Energy Security Board, 2024. *Consumer Energy Resources and the Transformation of the NEM.* [Online].

EnergyQ, 2023. *Queensland Electricity Connection Manual - Service and Installation Rules v4.* [Online].

enX & ARENA, 2024. *Network tariffs for V2G,* s.l.: s.n.

Ergon Energy, n.d. *Basic Connection Service Model Standing Offer.* [Online]
Available at: https://www.ergon.com.au/__data/assets/pdf_file/0006/1019985/MSO-Basic-Connecting-Metered-Load-EE-11042359.pdf

Essential Energy, n.d. *Connection Offers and Contracts.* [Online]
Available at: https://www.essentialenergy.com.au/our-network/network-pricing-and-regulatory-reporting/connection-offers-and-contracts
[Accessed July 2024].

Eurelectric, 2023. *Power System of the Future: Keys to delivering capacity on the grid.* [Online].

Evoenergy, 2023. *Evoenergy Service and Installation Rules v11.4.* [Online].

Evoenergy, n.d. *Basic Residential Connections - Connections Overview.* [Online]
Available at: https://www.evoenergy.com.au/connections-overview
[Accessed July 2024].

Federal Chamber of Automotive Industries, 2023. *Media Release: Australia breaks all-time new vehicle sales in 2023,* s.l.: s.n.

Horizon Power and Western Power, 2023. *Western Australian Service and Installation Requirements.* [Online].

Jemena, n.d. *Basic Connections.* [Online]
Available at: https://www.jemena.com.au/electricity/new-connections/basic-connections/
[Accessed July 2024].

NSW Office of Environment and Climate Change, 2022. *Accredited Service Provider Scheme Review,* s.l.: s.n.

PowerCor, 2021. *Connection Policy.* [Online]
Available at: https://media.powercor.com.au/wp-content/uploads/2022/01/18151112/Powercor-Connection-policy-1-July-2021.pdf

PowerWater, 2024. *Basic Connection Application Form.* [Online]
Available at: https://www.powerwater.com.au/__data/assets/pdf_file/0021/43770/Basic-Connection-Application-Form.pdf

PowerWater, 2024. *Power and Water Corporation Service and Installation Rules 2024,* s.l.: s.n.

SA Power Networks, 2018. *Model Standing Offer for Basic Connection Services.* [Online]
Available at: https://www.sapowernetworks.com.au/public/download.jsp?id=9702

SA Power Networks, 2023. *Service and Installation Rules.* [Online].

SIR NSW Management Committee, 2019. *Service and Installation Rules of New South Wales.* [Online].

TasNetworks, 2019. *Basic Connection Application.* [Online]
Available at: https://www.tasnetworks.com.au/config/getattachment/448041e7-b0a7-4fb0-9270-d5ea3b49adb8/Basic-Connection-Application-Form-2022.pdf

TasNetworks, 2023. *Service and Installation Rules v8.4.* [Online].

United Energy, 2021. *Connection Policy.* [Online]
Available at: https://media.unitedenergy.com.au/factsheets/United-Energy-Connection-policy-1-July-2021.pdf

VIC SIR Management Committee, 2022. *Victorian Electricity Distributors Service & Installation Rules (Incorporating Amendment 1-3).* [Online].

WA DMIRS, 2023. *WA Electrical Requirements.* [Online].

Western Power, 2023. *Installing Electric Vehicle Charging Stations.* [Online]
Available at: https://www.westernpower.com.au/news/installing-electric-vehicle-charging-stations/

Western Power, n.d. *Standard connection service capacity.* [Online]
Available at: https://www.westernpower.com.au/resources-education/industry-resources/electrical-contractors/standard-connection-service-capacity/
[Accessed July 2024].

Energy Networks Australia