REGIONAL EV CHARGING INFRASTRUCTURE IN CENTRAL NSW

PREPARED FOR: CENTRAL NSW JOINT ORGANISATION

Image credit, Destination NSW - Mayfield Gardens

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Executive summary

The Central NSW region is a popular destination for domestic and international travellers, with 6.4 million domestic and international tourists per year and growing. These visitors also stay in the region and spend locally, with over 7.4 million nights stayed and $1.9 billion spent in the region every year[1].

The tourism industry in Central NSW is a critical part of the local economy, and barriers to getting to the region present a significant risk as vehicle technology changes and electric vehicles become the preferred mode of transport. Destination NSW 'Central NSW Visitor Profile' shows the region's daytrip visitors travel to the region by private car 97% of the time, and the vast majority of overnight visitors also reach the region by private car.

Electric vehicles will start to impact the region by 2023, with exponential growth expected. While the uptake of EVs is only at 0.6% of new vehicles sold today, our analysis predicts that by 2025 this could grow to around 2% of new vehicles sold[2]. This projection would mean 5-6,000 Central NSW residents could own an electric vehicle by 2025 and approximately 270,000 of the existing tranche of tourists visiting annually will drive EVs.

In mid 2020 the MG EV was launched in Australia at a price point of just over $40,000. This could be seen as a turning point in the development of the Australian EV market

The electrification of road transport presents a risk and an opportunity for the Central NSW region. If the region is not prepared, then the cohort of tourists that travel to the region may be at threat. If the region is prepared adequately then the transition represents an opportunity to expand the cohort. This expansion has been evidenced in Bathurst which has evidence that effective charging infrastructure networks attract a new type of experience-based tourist to the region.

The purpose of this report is to identify the base level of network coverage required to ensure that the region has established the optimum strategy in terms of advocacy and the level of council participation in ensuring that this coverage is available as the electric vehicle market grows.

[1] https://www.destinationnsw.com.au/wp-content/uploads/2020/08/central-nsw-fact-sheet-ye-mar-20.pdf
[2] https://aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/Inputs-Assumptions-Methodologies/2020/CSIRO-DER-Forecast-Report

Key findings

2020 represents a turning point in the EV market in Australia and particularly in NSW

In 2020, the NSW Government has turned the corner on its commitment to electric vehicles. This year saw the release of the first dedicated grant for electric vehicles from the NSW Government, commitment to 100% electrify their bus fleet by 2030, funding for charging infrastructure and several other measures. The ACT Government has brought in even stronger commitments in the coming 2-3 years, and the Federal Government has announced a 72 million dollar Future Fuels fund dedicated to zero emission vehicles.

As outlined above, this year also saw the release of the first electric vehicle in Australia at a price point lower than $45,000.

While there is a pipeline of planned state and federal funding for EV charging infrastructure that may benefit the region, there will be areas left behind with insufficient charging

Charging infrastructure is being provided in NSW by ChargeFox, Evie Networks, Tesla and NRMA along with a host of destination charging stations being installed by businesses. Despite this, this report has identified that there will be significant blackspots (areas that will not be adequately covered by charging to meet peak demands).

Although consumers will accept paying for fast charging, most blackspot sites will not have a commercial return

Providing adequate fast charging infrastructure in the early years can require expensive network upgrades and civil works along with the hardware and software required to manage charging. The likely traffic in the early years will be inadequate, particularly where those hotspots are dealing with seasonal peaks.

There is a once in a generation opportunity to ensure that the Central NSW region has stronger coverage than other regional areas

NSW and Commonwealth governments are looking to invest in charging in the regions in 2021. These grants will provide funding that could help establish some regions as ideal tourism locations for electric vehicle drivers.

It is critical that councils become clear on how they want to participate in the charging infrastructure value chain and become grant ready

This document has outlined the various requirements for development of charging infrastructure. CNSWJO has already focused on helping businesses establish destination charging by providing an EV-Tool kit. The next step is to determine how the councils want to support the commercial infrastructure providers and how they want to ensure that grant funding is dedicated to the region. This could involve supporting and working with private sector players or becoming a site owner.

Selecting sites has become a well understood process, but securing sites is harder

The criteria for a good site is now well understood, and the research in this document has included a process of identifying many potential sites for charging. Well lit sites near amenity, with access to good reliable power supply is an important starting point. Locating sites that meet this criteria and then securing the rights to develop charging on these sites is more challenging and is why often local governments are called upon to provide sites to private project developers.

Installation and operations of charging infrastructure is also well understood and low technical risk

Charging infrastructure market is maturing. In Australia plug-type standards have stabilised and the process of installing, commissioning and operating infrastructure is well understood across the country, with a number of established hardware and software providers and infrastructure operators in the market.

The key risk is ensuring there is sufficient power on a site and dealing with the local electricity distribution business is a critical part of the electric vehicle charging ecosystem.

The largest potential planning and implementation delays can come from approvals from distributors. Much of the region suffers from significant network constraints and this will steer site selection. It is recommended that a strong partnership with Essential Energy is formed as the project progresses.

Charging sites are best located in townships that serve as regional nodes for tourism, commerce and regional populations.

The best sites cater to a number of different users (including council fleets), delivering the maximum benefit. Charging stations in these locations can be set up for journey enablement and destination/convenience charging, with co-location of level 2 and level 3 chargers that share site electrical systems.

CNSWJO should advocate for prioritisation of regional infrastructure and linkages to tourism co-benefits

The JO should focus on advocacy that brings grant funding into regional charging infrastructure. This also means that the focus should not only be on ultra-fast chargers, which are often more than is required for touring, but on more expansive use of chargers from 50 kW - 150 kW so that there is a greater spread of funding across the vast regional areas.

There also needs to be a focus on ensuring that the JO has influence in how grant money is spent, so that it is not squandered on private sector operators who snap up monetizable sites, without considering the importance of coverage for regional tourism and development.

Councils will be most effective in stimulating private investment if they provide high quality and transparent information, streamline planning processes, and offer site leases at nominal or no cost where appropriate.

This report has developed a format for site classification and should provide helpful insight for future developers seeking to install infrastructure.

Recommendations

Recommendation 1: CNSWJO support private sector operators for sites that can be monetised, but consider becoming the lead proponents for providing "blackspot" charging infrastructure in the region

The recommendation of this report, based on an understanding of the capabilities and positioning of CNSWJO is that they should be the lead proponent on behalf of councils and that councils should own the charging assets but outsource installation and operation to a single provider based on a tender process. CNSWJO should advocate for the benefits of being the network owner with councils and gain support for CNSWJO applying for grants. This will require the following actions

Actions	
Action description	Action detail
Obtain council commitments	Participating councils will need to agree to owning the assets in perpetuity and providing in kind contributions of staff time and sites as appropriate

Recommendation 2: Focus efforts on being grant ready

Actions	
Action description	Action detail
Identify final sites	Work with councils to finalise the list of sites. Sit evaluation matrix provided as part of the EV Toolkit should be used finalise sites
Gain a clearer cost for each site	Civil and electrical cost estimates should be sourced for the shortlist of sites
Identify key skills required appoint team	To attract the grant funding and to convince grant bodies that CNSWJO has the skills required to deploy the funding and manage operations, key resources from the region should be identified (ie from councils) and consideration to appointing an "owners engineer" to manage the grant process and procurement post-application.

Recommendation 3: Focus on ARENA and NSW Government funding rounds. Continue to advocate with NSW Government and ARENA to position for this funding

The two most important sources of funding for this program will be from ARENA and the NSW Government so while other sources may be possible in future, the immediate focus should be on these opportunities.

Recommendation 4: Present findings from this document to internal stakeholders to get buy-in

The key to a coordinated response across the region is to have clarity in terms of how each council would like to approach key questions around property provision and asset ownership.

Recommendation 5: Explore synergistic opportunities around council fleet electrification and freight electrification

If councils are to fully exploit transition opportunities, there will be needs for charging their own fleets as well as potential for council property to be used to provide charging for future opportunities such as taxis, car share and freight.

Recommendation 6: Collaboration on infrastructure projects in the region is more efficient than going it alone

If councils are to forge the most efficient pathway to effective regional charging infrastructure through Central NSW, bringing together aligned entities through formation of a collective vision and pooled resources will optimise efforts, aligned consumer experience and mitigate the risk of charging blackspots that impact the whole region.

Recommendation 7: Communications and marketing opportunities

Travel through the region has close alignment to stakeholders in the major centres of Western Sydney and Canberra. Engagement with these major centres should be explored to identify communication and marketing opportunities that benefit all regions and present a fluid user experience.

Background

About Central NSW Joint Organisation

The Central NSW Joint Organisation (CNSWJO) consists of 10 member councils and is a diverse area that covers around 47,000 km^2 with a population of around 158,000. The Local Government Act 1993 establishes the requirement for and functions of Joint Organisations, with these functions including:

- To establish strategic regional priorities for the joint organisation area and to establish strategies and plans for delivering those strategic regional priorities;
- To provide regional leadership for the joint organisation area and to be an advocate for strategic regional priorities; and
- To identify and take up opportunities for intergovernmental cooperation on matters relating to the joint organisation area.

Established by legislation as a coordination body, the connections with the Department of Regional NSW and NSW Department of Planning, Industry and Environment (DPIE) are a critical point of leverage for strategic funding. This section explores linkages with NSW Government's Future Transport 2056 Strategy, identifies specific points of leverage, and explores other strategic perspectives.

Why is charging infrastructure important to the region?

In recent research by Evenergi for the South Australian government it was found in a sample of 439 potential electric vehicle buyers that two in five were concerned about how they would charge their electric vehicle. In the same study almost 9 in 10 believed that they would only buy an electric vehicle if it had the ability to travel further than 150 kms on one charge. This will be mitigated if consumers have a second vehicle; however, there is literature that supports the concept that increased regional infrastructure charging drives uptake[3].

Early adopters of EVs may be forgiving of charging challenges but, like a mobile phone network, there is a requirement for general "coverage" in the midterm. Regardless of the logic behind the placement of infrastructure, drivers will just expect a certain coverage and to be comfortable that an area caters adequately to EV drivers. While statistically drivers will frequent certain routes, psychologically they will not want to have a sense of being "trapped" into particular routes just because they have an EV. As such our recommendations are a combination of data-driven analysis, and a general precedent set in other markets around driver anxieties.

[3] Governing the electric vehicle transition – Near term interventions to support a green energy economy M. Nilsson, B. Nykvist / Applied Energy 179 (2016) 1360–1371

It is likely that almost 2% of the vehicle fleet in NSW will be electric by 2025, in line with projected Australian uptake[4]. The provision of adequate charging infrastructure could represent a tourism decision point for many of these EV owners. If the region can strategically prepare for this change, it could mean additional tourism dollars, and equally, if the region is seen as a risk for EV drivers, it could lose tourism to other regions.

Aim of this report

CNSWJO is recognised as the lead organisation advocating on agreed regional positions and priorities for Central NSW whilst providing a forum for facilitating regional cooperation and sharing of knowledge, expertise and resources. Using regional strength and leadership in advocacy, CNSWJO lobbies State and Federal Governments to present a more compelling case for regional priorities.

CNSWJO has recognised that the electrification of road transport presents a risk and an opportunity for the Central NSW region. If the region is not prepared, then the cohort of tourists that travel to the region may be at threat. If the region is prepared adequately then the transition represents an opportunity to expand the cohort.

The purpose of this report is to identify the base level of network coverage required to ensure that the region has established the optimum strategy in terms of advocacy and the level of council participation in ensuring that this coverage is available as the electric vehicle market grows.

More specific objectives are to:

1. Provide strategic context around how the transition to electric vehicles will impact on the region and how this fits within other related regional plans

2. Understand the existing charging infrastructure installed in the region and the infrastructure to be installed in the near-term

3. Understand the optimal infrastructure installation that would provide comfort to electric vehicle drivers so that they can travel through the region without fear of running out of charge

4. Various ways to close this gap in infrastructure and pathways for meeting this gap in infrastructure though making the region "grant ready"

5. Educating council stakeholders about the technical and economic requirements of installation of infrastructure

[4] https://aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/Inputs-Assumptions-Methodologies/2020/CSIRO-DER-Forecast-Report

Charging infrastructure is being installed in regional areas across the world, and the co-ordination of this infrastructure implementation can be the difference between ensuring a region is seen as an ideal tourist destination for EV drivers or an area that represents a risk.

The CNSWJO plays a lead role in sub-regional projects requiring cross LGA cooperation and knowledge sharing. The organisation has a focus on sustainability and creating resilient communities.This mandate puts CNSWJO in an ideal position to help facilitate a sub-regional approach to charging infrastructure.

Electric vehicle transition and electric vehicle infrastructure - strategic and policy context

The Central NSW region is a popular destination for domestic and international travellers, with 6.4 million domestic and international tourists per year and growing. These visitors also stay in the region and spend locally, with over 7.4 million nights stayed and $1.9 billion spent in the region every year[5].

The tourism industry in Central NSW is a critical part of the local economy, and barriers to getting to the region present a significant risk as vehicle technology changes and electric vehicles become the preferred mode of transport. According to Destination NSW's 'Central NSW Visitor Profile,' the region's daytrip visitors travel to the region by private car 97% of the time, and the vast majority of overnight visitors also reach the region by private car.

Given the critical importance of travel and tourism to the region, this makes it the strongest economic driver and a key vector from which the internal and external business case for support of charging infrastructure in the region is based. This angle is presented in more detail in Schedule 5.

Linkages with Transport for NSW plans

There are a number of pathways of influence related to Transport for NSW (TfNSW) and broader NSW Government plans and these are outlined in the following sections. The effectiveness of each pathway as a means to influence the direction and timing of state budgets is difficult to qualify and will to a large extent depend on the established understanding and relationships of the CNSWJO, member councils and specific senior management.

The following table presents areas of linkage with TfNSW plans and notes on strategic positioning to gain support. Further details are provided in Schedule 4.

Areas of linkage with Transport for NSW plans		
Area	Takeaways	Strategic positioning
The Future Transport 2056 Strategy	• Future travel in regional NSW is covered in the Future Transport 2056 Strategy, with a particular focus on connections through a 'hub and spoke' network model radiating out from regional cities, rather than	• The economic argument around tourism provides a strong case for local support of charging infrastructure • TfNSW's *Electric vehicle infrastructure and model availability*

[5] https://www.destinationnsw.com.au/wp-content/uploads/2020/08/central-nsw-fact-sheet-ye-mar-20.pdf

	a network focused on Sydney. ● DPIE has been working on mapping and investing in potential charging infrastructure through the *Electric vehicle infrastructure and model availability fund* announced in March 2020. ● Lower regional transport costs lower barriers to accessing national and international markets. ● Attracting tourists through infrastructure supporting eco-tourism and bespoke EV-centric regional travel experiences is a key avenue for securing new revenue sources.	*fund* provides a timely avenue to seek State support for charging in the region of Central NSW. ● This analysis quantifying and locating the need for charging infrastructure in the region establishes member councils in a strong position for funding. ● Application for grant funding will require further preparedness and exposure internally to the case for support, given it is anticipated the program will only open for a relatively short time frame.
The Central West and Orana Regional Plan 2036	● 20-year blueprint for the future of the Central West and Orana region, and is a related plan to the Future Transport 2056 Strategy. ● The top 3 economic opportunities per LGA highlights the importance of tourism, which is consistently a top three economic opportunity ● Another clear takeaway is the importance of agriculture, transport and logistics, manufacturing and mining. These economic verticals can be well served through transport electrification, ● The NSW Government has established the Central West and Orana Delivery, Coordination and Monitoring Committee to deliver, coordinate and be accountable for achieving the vision and goals of this Plan. In the short term, its focus includes planning for growth and change in the region's centres, which strongly aligns with the endeavours of the CNSWJO.	● The 8 identified directions and two actions from the Central West and Orange Regional Plan 2036 are consistent with the outcomes of investing in optimised charging infrastructure for the Central NSW region. ● The Central West and Orana Delivery, Coordination and Monitoring Committee should be receptive to the arguments put forward for funding assistance by the CNSWJO and member councils. While there may not be an existing budget in the regional plan to support new activities, establishing charging infrastructure as a priority should be seen as a strategic position that will gain momentum as stakeholders come to understand its alignment with their core value proposition. In time, such stakeholders will likely come to see it as an opportunity to increase funding through their organisations.
TfNSW Freight and Ports Plan	● TfNSW Freight and Ports Plan 2018-2023 sees electrification as a focus for 'sustainability', and not health, nor economic benefit. This is	● Progress in this area can further benefit TfNSW investment in connecting the region to key 'Global Gateway Cities' by lowering barriers

2018-2023	an issue of parts of government not talking to each other and a missed opportunity. ● Infrastructure to support freight electrification such as Hydrogen refuelling and ultra-fast charging can come with high up-front costs. As such, the issue of freight electrification becomes a strategic discussion.	to global competitiveness for local export such as agricultural produce. ● It is recommended that CNSWJO seeks to raise and sustain the topic of charging infrastructure supporting increased competitiveness of industries through all relevant pathways of influence, including through the TfNSW Section responsible for the Freight and Ports Plan 2018-2023.
Transport and Tourism Plan and Visitor Economy Industry Action Plan 2030	● Transport has the potential to support and enhance existing tourism as well as create new economic development opportunities. ● As transport electrification gains deeper penetration of the total vehicle pool, and of the cohort that may travel to the region, the performance and transparency of the regional charging infrastructure will play an increasingly pivotal role. ● By improving existing infrastructure and expanding infrastructure to new destinations, transport can create new visitor experiences and support new industries and employment in regional communities. ● Transport not only gets visitors to destinations, but can also be an attraction in itself.	● Framing charging infrastructure as a tourism enabler and tourism driver in its own right is a strong proposition. Experience in Bathurst demonstrates that effective charging infrastructure networks attract a new type of experience based tourist to the region. ● A strategic overlay identifying the scope of investment and how charging infrastructure supports creating spaces may provide a persuasive argument. ● Funding streams are established through the Destination Network mechanism coordinated by the NSW Government. The Country and Outback NSW Destination Network offers a potential pathway to progress requests for funding. ● Direct unsolicited approaches to Destination NSW, TfNSW or other areas of the NSW Government or elected leaders may also present valid and effective funding pathways.
Regional NSW Services and Infrastructure Plan	● The Regional NSW Services and Infrastructure Plan is the NSW Government's blueprint for transport in regional NSW out to 2056. It sets out the Government's thinking on the big trends, issues, services and infrastructure needs which are now, or will soon shape transport in	● The Plan specifically calls out that a plan and vision will be prepared for the Central West and Orana region by TfNSW in conjunction with key stakeholders such as the local government and Department of Planning and Environment. This mechanism may be a key pathway

	regional NSW. ● The 5 customer outcomes identified in the Regional NSW Services and Infrastructure Plan are consistent with the outcomes of investing in optimised charging infrastructure for the Central NSW region. ● Designated key hubs including Bathurst, Forbes, Orange and Parkes receive place-based plans and may have an advantage in accessing funding owing to their designation.	for influence. ● The Plan proposes to take a flexible, agile investment. Given the strong alignment of the identified customer outcomes of this Plan, there may be a high level of receptiveness to unsolicited requests for funding where alignment can be demonstrated.

Delivering a regional charging network for Central NSW

The development of the current and planned charging network is based on funding from the Australian Renewable Energy Agency, direct investment from Tesla, some local government investment and limited private investment. The reality is that in most cases charging infrastructure in Regional areas will not have a strong economic case and will require some form of subsidisation. As such the ideal network from a regional tourism perspective is unlikely to be funded privately in the short term.

One of the key outcomes of this document is to understand the ideal charging infrastructure network in the region to cater to the needs of electric vehicle drivers and drive regional tourism. To deliver the ideal charging infrastructure will require :

1. Understanding who will need to use the network
2. What will they need to have comfort when driving through the region in terms of charging infrastructure
3. Understanding the existing and planned infrastructure coming into the region
4. Performing a gap analysis to understand where charging "blackspots" may occur
5. Providing strategies to address these gaps

Who will buy and drive EVs through the region and what will they need?

Electric vehicles will start to impact the region by 2023, with exponential growth expected. While the uptake of EVs is only at 0.6% of new vehicles sold today, our analysis predicts that by 2025 this could grow to around 2% of new vehicles sold[6]. This projection would mean 5-6,000 Central NSW residents could own an electric vehicle by 2025 and approximately 270,000 of the existing tranche of tourists visiting annually will drive EVs.

Following consultation with tourism representatives from CNSWJO participating councils, the following list of key personas, their characteristics and implications.

[6] https://aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/Inputs-Assumptions-Methodologies/2020/CSIRO-DER-Forecast-Report

Key personas visiting Central NSW, their characteristics and implications		
Personas	**Characteristics**	**Implications**
The retired couple 	• Longer duration trips • Stick to the rules (e.g. take recommended breaks, drive more efficiently, etc.) • Lower* adoption rate of EVs[7][8] • Higher range anxiety • Value safety at stops • Cash-flow sensitive • Stick to traditional attractions • Seek out history and heritage	• Likely to top-up at each stop • Dwell times higher • More overnight stops • Will value amenity such as lighting, emergency phones and CCTV at charging locations • May seek out cheaper rate if price variance along route • Demand for charging limited to high-visitation locations
The young professionals 	• Day or weekend trips • Want the 'lifestyle pic' for social media • Likely to be early EV adopters • Lower tolerance for wait times • Environmentally conscious • Want an action, fast paced and fitting in as much as possible • Shorter trips 1-2 days, high spending tendencies	• Likely to use higher output, faster chargers • Will choose charge powered by renewables over fossil fuels • Destination charging • In early years of EV adoptions a higher percentage of EV drivers may be of this demographic • May not rely on public infrastructure for shorter trips
The active family 	• Interstate driving holidays • Reliant on maps and technology to find POIs and charging • Want to maximise time at sights and attractions • Overnight stays • Fearful of being stranded • Seek to reconnect through unique types of experiences • Mid-length stays of a week are typical, with tendency to anchor at a location and travel	• More likely to be passing from interstate, starting state of charge may be unknown • Start/End location variability • Destination charging • Will choose a hotel with a charger over one without (no home to return to) • Often base themselves at a destination and travel to other nearby destinations

* In more mature EV markets around the world, electric vehicle ownership for older drivers is the lowest of all cohorts, with higher psychological barriers to entry. In Australia, older Australians are better placed to afford the currently very high purchase price of electric vehicles[9], but this trend is likely to reduce as electric vehicle prices trend towards parity.

[7] https://www.sciencedirect.com/science/article/pii/S095937801830030X
[8] https://www.thisismoney.co.uk/money/cars/article-7686157/New-research-says-cut-age-motorists-reluctant-consider-EV-55-years.html
[9] https://www.aph.gov.au/DocumentStore.ashx?id=489f7663-3a9b-4d90-aeaa-1dc25618e37b

Where should charging infrastructure be located to ensure that chargers are available when required

The development of the regional infrastructure plan is based on Evenergi's GridFleet ™ model, which is a sophisticated spatial planning model for charging infrastructure. The detailed model methodology and results are presented dn Schedule A, however the core aim of the model is to determine the minimum electric vehicle charging infrastructure required to facilitate uninhibited access to Central NSW by tourists, transport through the region supporting critical industries, and for local residents and businesses requires the ability to understand both where and to what degree charging demand will occur.

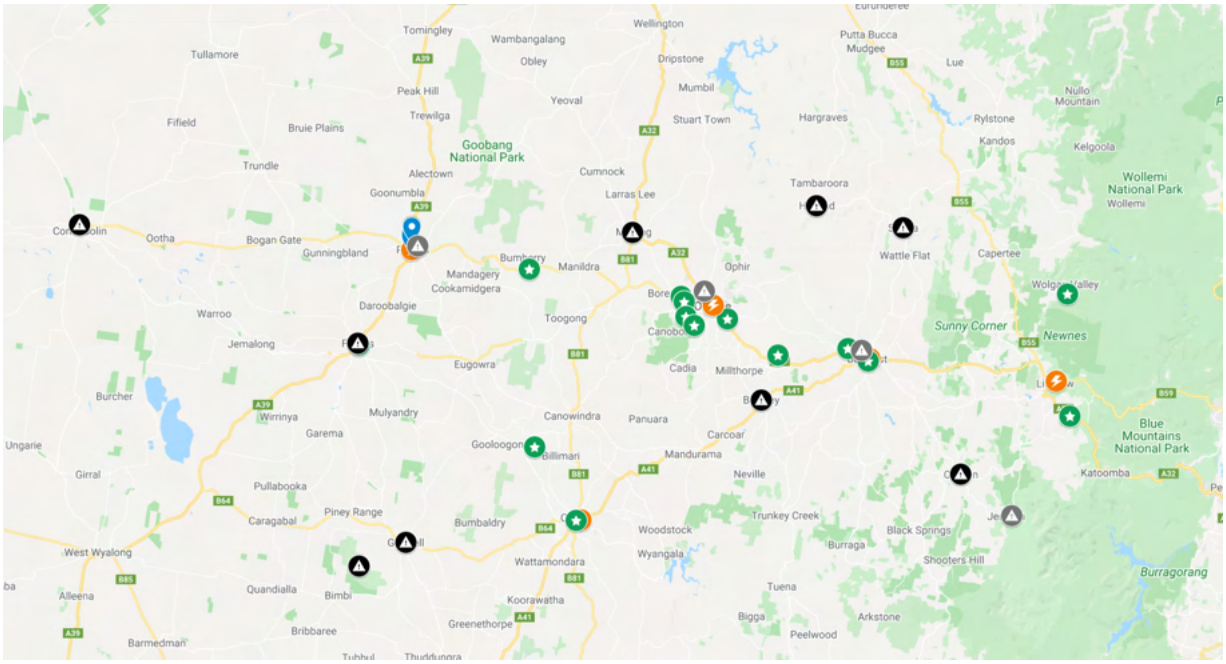
The technical model created followed the following methodology:

STEP 1: Establish the key routes
STEP 2: Analyse key "journey enablement" sites for fast charging
STEP 3: Feedback from each council with potential points of interest and council land available for charging synthesised
STEP 4: Create a map of highway, opportunity, destination and stay-over charging to allay range anxiety for drivers
STEP 5: Consider peak travel flows to understand the potential density of charging infrastructure placement
STEP 6: Create shortlist of sites and their optimised charger characteristics
STEP 7: Determine feasible charger ratings and quantities based on network capacity

From this methodology a long list of sites has been developed as well as an estimate of the number of chargers required over time. The following page provides some key maps with an overview of the results of this analysis.

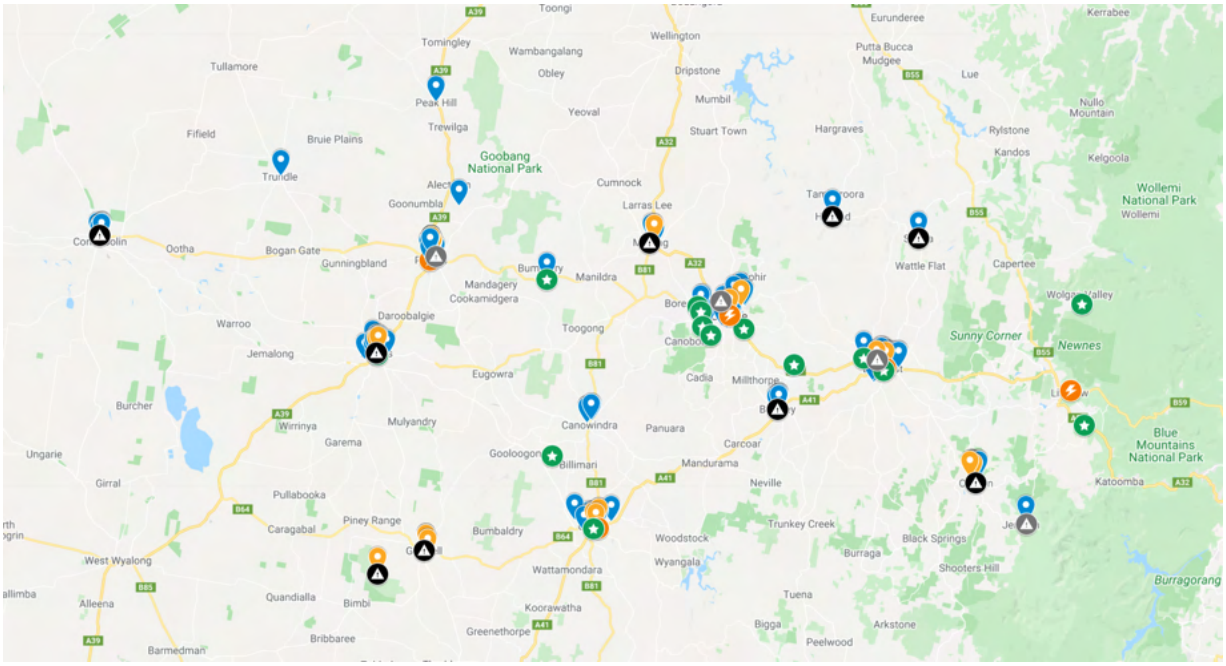
The following map shows the existing charging network in Central NSW, the blackspots and underserviced areas. There are no publicly announced committed projects in Central NSW at this stage.

Existing charging network in Central NSW



The following map shows the proposed POI sites where charging infrastructure could be located in the region to address the blackspots and underserviced areas.

Existing charging network in Central NSW



Legend

- Slow chargers
- Fast chargers
- Blackspots
- Underserviced
- Proposed sites
- Proposed sites - council owned

Existing and planned charging networks in the region

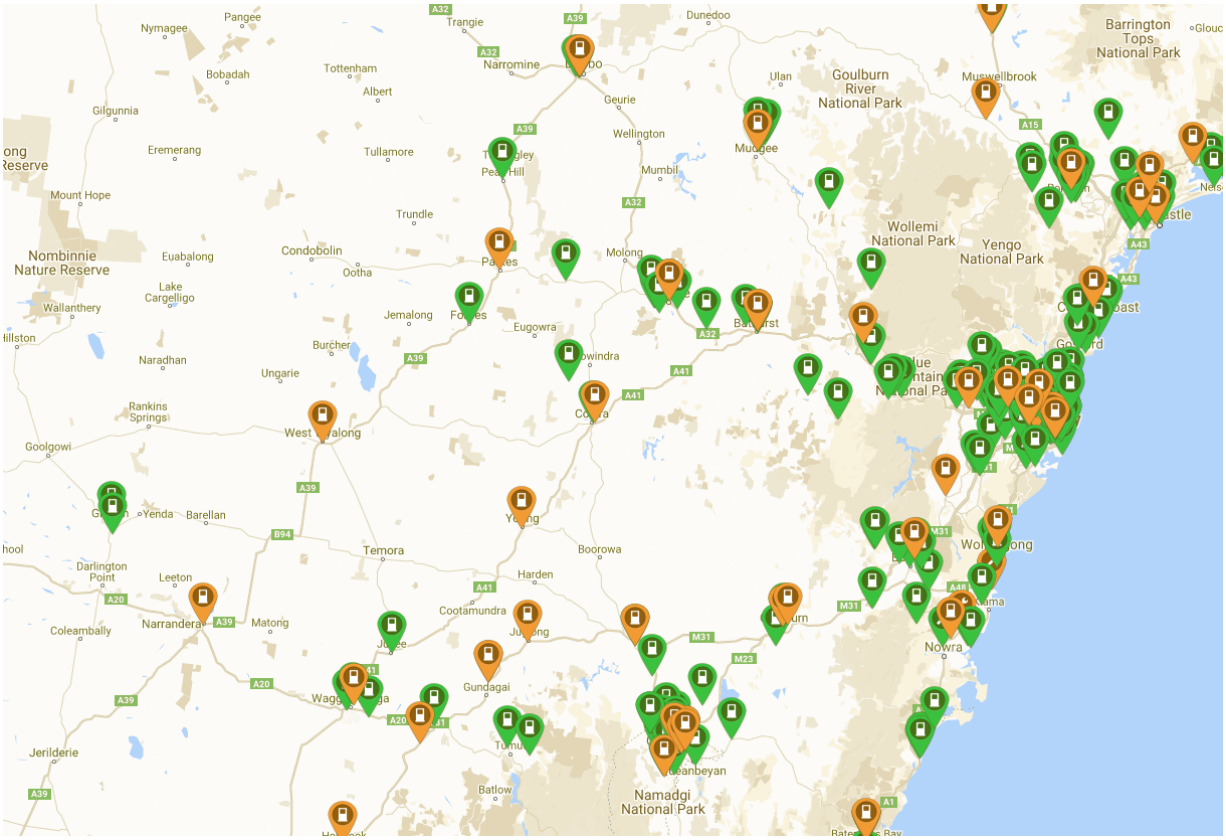
The charging infrastructure supporting local and visiting road users in Central NSW is made predominantly of infrastructure supported by NRMA, Tesla and ChargeFox. The location and number of chargers on offer are as diverse as the performance and cost of charging available through these providers.

The NRMA network is designed to facilitate travel through the regions, being of higher power and installed at convenient distances apart in towns along major highways through the region.

The Tesla network is the next most prolific after the NRMA network, with 35 charging stations nationally (multiple charging plugs per station) and 18 of those sites in NSW. The Tesla 'Supercharger' network (a brand name for their network of rapid chargers) is unique in Australia for vehicle manufacturers. The Tesla network is designed to support Tesla-only charging and charging other vehicles through their network is effectively not possible.

The ChargeFox network claims to be the largest in Australia, consisting of over 1,100 plugs (rather than chargers, or locations), and including 22 kW, 50 kW and 350 kW chargers. All ChargeFox 350kW chargers are powered by 100% renewable energy. According to their website, ChargeFox in NSW currently consists of 13 charging sites in NSW. The ChargeFox network is focused mainly around more profitable locations in metropolitan cities, though as a commercial charging operator it will likely grow into regional Australia when the commercial case makes sense.

Existing charging network - Central NSW



Source: NRMA/ NSW Government joint media release

NRMA network

The NRMA's Electric Vehicle Fast Charging Network now sits at over 38 fast chargers installed across regional NSW along most major highways including the Hume, Newell, Sturt and Oxley Highways as well as the Mitchell, Pacific, Olympic and Great Western Highways.

A recent joint announcement by the NRMA and NSW Government said that the NRMA will partner with the NSW Government in delivering at least 20 additional electric vehicle fast chargers across major regional corridors, creating the most comprehensive regional charging network in the country. A map of existing and proposed chargers as presented in the joint announcement is provided below.

The NRMA announced in 2017 it would build one of Australia's largest fast charging networks in Australia, free for NRMA members and at cost for non-members. More than 95 per cent of NRMA Member road trips are proposed to be covered by the network. The investment more than

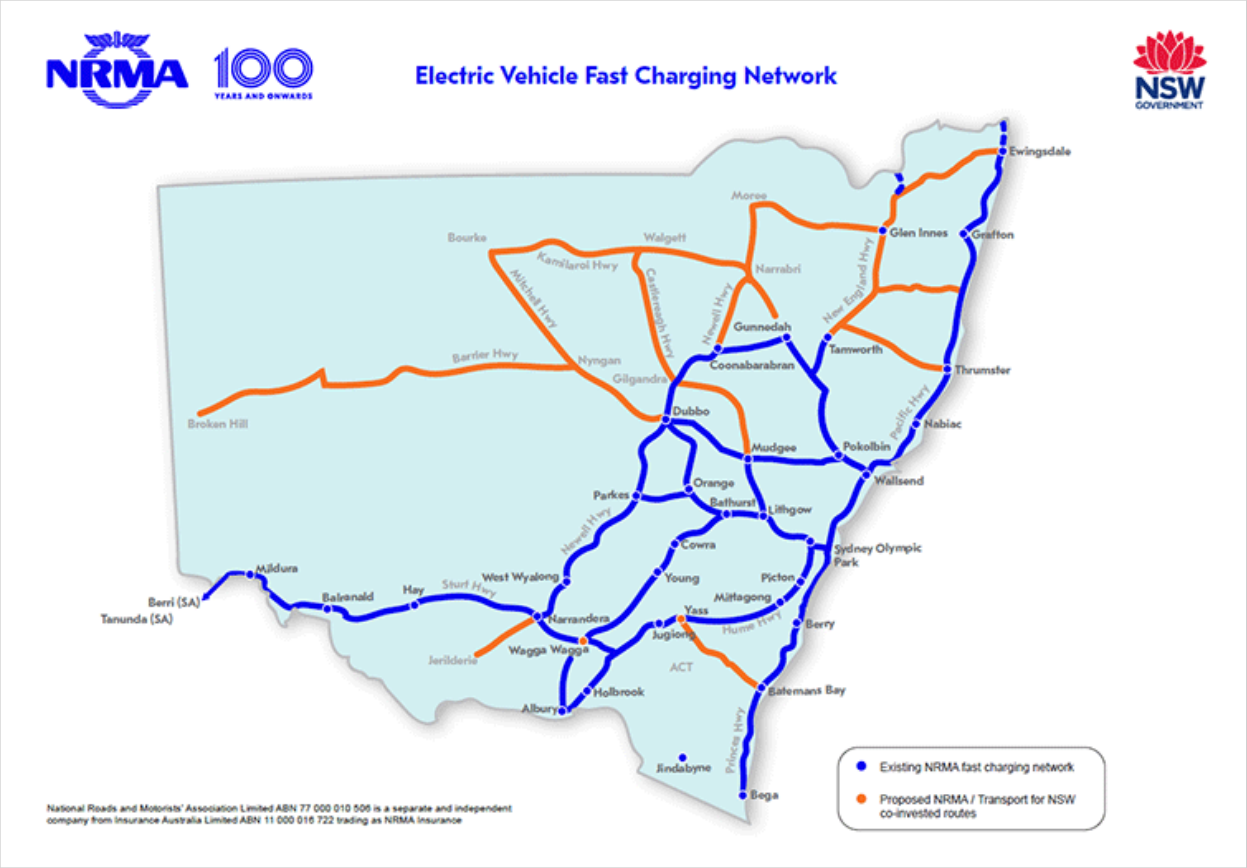
doubled the size of the network of chargers in NSW and the ACT, and importantly are of the higher powered fast charging DC charger variety, strongly suited to journey enablement.

The 50kW NRMA charging network is designed to enable journeys across NSW and the ACT and reaches out to South Australia, with chargers in small and large cities spaced at intervals such that a rapid charger is available to drivers wherever they travel in the region.

The NRMA has been a first mover alongside Tesla and as such has put itself into a strategic position, accessing preferential approval processes, support from state and local governments, and priority sites. As a cornerstone service provider, the NRMA network has become a critical component of Central NSW' charging network.

A side-effect of gaining first access to the best sites and having the business-model to offer the service at no cost for an extended period of time, is that investment by competing networks is made more complex. Without the capacity to charge a monetary amount for the service of charging, only well-capitalised network providers looking at the 'long game' and seeking next-best charger locations are likely to seek to invest.

NRMA current and future charging network[10]



[10] Source: NRMA/ NSW Government joint media release

Tesla network

The Tesla network is the next most prolific after the NRMA network, with 35 charging stations nationally (multiple charging plugs per station) and 18 of those sites in NSW. The Tesla 'Supercharger' network (a brand name for their network of rapid chargers) is unique in Australia for vehicle manufacturers. Overseas, especially in Europe, it is more common for manufacturers to invest in charging infrastructure.

The network of Superchargers work with Tesla vehicles only, with the vehicles able to map a journey with accurate stopping location and charging duration details available to the driver within the car. The network is available free of charge to pre-2018 Tesla models and models purchased with Supercharger credits and at a rate of 0.53c/kWh to other drivers[11]. Tesla currently offers up to 120 kW charging rate.

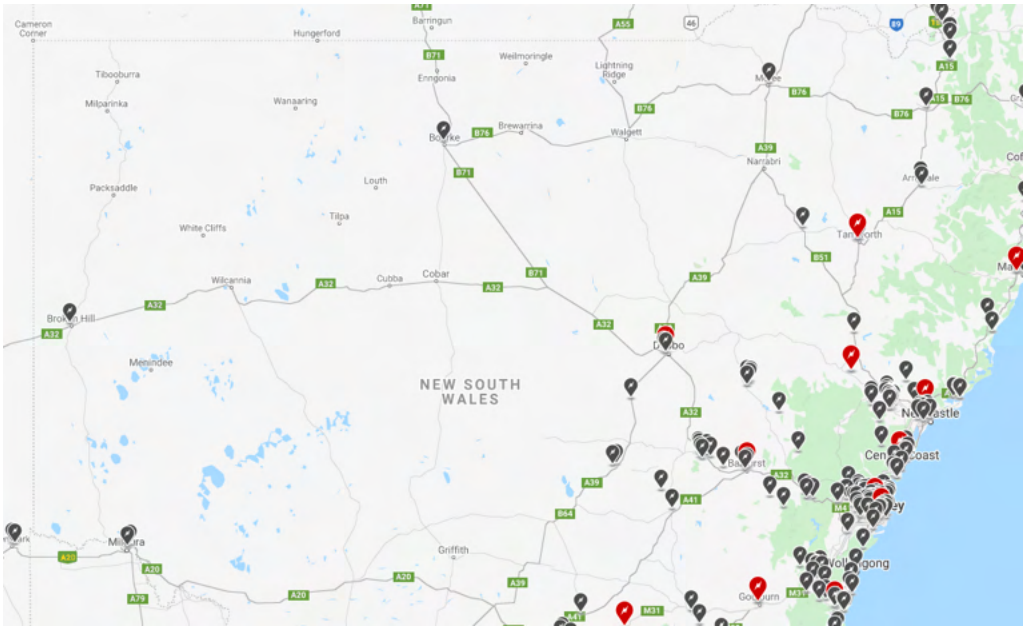
New versions of Tesla Supercharger launched overseas in 2019 offer a significantly higher charge rate of 250 kW, with battery-preparation software in the car able to prepare the battery for rapid charging while approaching the Supercharger, saving 25% in charging time. In the US market, Version 2 Superchargers like those available in Australia have been upgraded to provide 145 kW charging rates.

Tesla uniquely offers zero-cost 'Tesla Wall Connector' chargers to every Tesla buyer as well as to 'Charging Partners' businesses, with 2.3 - 16.5 kW outputs possible from the same device. These charging stations have been accepted by hundreds of businesses around Australia, with NSW alone home to over 100 such chargers.

The majority of destination chargers come with a standard Type 2 charging plug and can be used by most electric vehicles in the market, though Tesla is known to be working towards taking this option away through software and hardware updates. This option appears at surface level particularly attractive for businesses and for CNSWJO member councils, but risks creating confusion and frustration for EV users and charger hosts alike.

[11] Prices current as of December 2020

Tesla current and future charging network[12]



ChargeFox

The ChargeFox network claims to be the largest in Australia, consisting of over 1,100 plugs (rather than chargers, or locations), and including 22 kW, 50 kW and 350 kW chargers. All ChargeFox 350kW chargers are powered by 100% renewable energy.

According to their website, ChargeFox in NSW currently consists of 13 charging sites in NSW, though there is some ambiguity because they offer a charger installation and management service which means 51 charging locations are present on the plugshare.com site.

ChargeFox has focused heavily on servicing the extensive coastal road network along Queensland's coast through grant-funded chargers and has no chargers installed West of the Great Dividing Range in NSW (note: graphics in map imply otherwise, but this is not the case).

[12] Source: Tesla

ChargeFox current and future charging network[13]

Evie

Evie is an aggressive new starter in the Australian charging network providers. Evie offers no-cost 50 kW and 350 kW chargers to 'charging partners' operating suitable 24-hour businesses with appropriate amenities.

Evie promotes their chargers as a way to attract new customers, boost revenue streams and prepare a business for a sustainable future. There are currently 2 stations with 2 charging plugs per station in NSW, with 13 additional sites in NSW at various stages of development approval. While there are no charging stations in the Central NSW region, Evie has plans to install chargers in Lithgow, promising an effective, rapid charging service for those travelling West from Sydney.

It is noteworthy that Evie experiences development approval issues[14] with energy networks given the extreme power demands of their 350 kW chargers, especially as sites typically require multiple chargers. Evie has publicly been forced to back away from commitments to sites due to a lack of site serviceability by network providers.

[13] Source: ChargeFox
[14] https://www.theleader.com.au/story/6677632/power-shortage-sinks-ev-charging-station-plan/

Evie current and future charging network[15]

Where will "blackspots" be likely to occur

From the analysis in Schedule 1, and overlaid with the existing and planned charging infrastructure, the following is a list of potential "blackspots" where charging infrastructure will not be provided by the private sector, but will be required to ensure adequate regional coverage.

EV network charging blackspots in CNSWJO

Region	Detail
Bathurst	Blackspots: Hill End, Sofala
	Underserviced: Bathurst town (already for peak; from circa 2023 for typical)
Blayney	Blackspots: Blayney (no chargers)
Cabonne	Blackspots: All Cabonne (e,g, twin centres of Canowindra and Molong - no

[15] *Source: Evie*

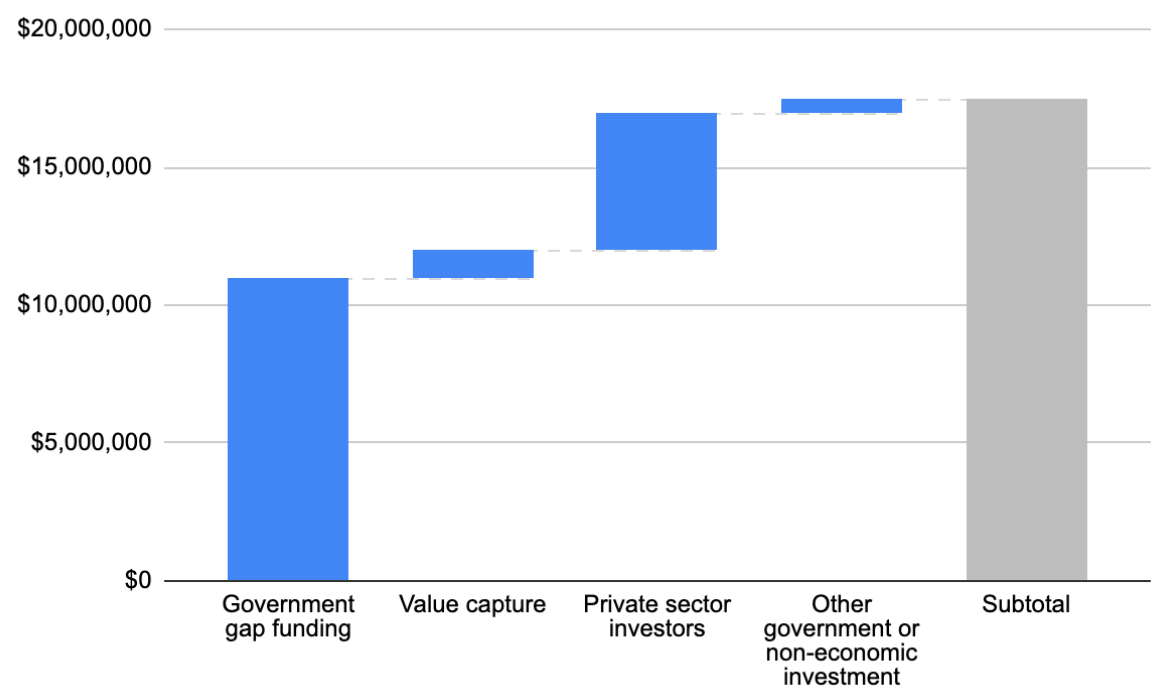
	chargers)
Cowra	Blackspots: None
	Underserviced: Already. Only one NRMA charger + one 22kW charger for Teslas. In and around town
Forbes	Blackspots: Forbes city - only one Tesla 22kW charger at a motor inn
Lachlan	Blackspots: All of Lachlan shire; e.g Condobolin, Lake Cargelligo, Tottenham
Oberon	Blackspots: Oberon, only on Tesla 22kW charger at visitor centre Underserviced: Jenolan caves (already)
Orange	Blackspots: None
	Underserviced: All of Orange, only one NRMA charger and one 22kW charger for Teslas. In and around town underserviced. Further pressure around food and wine festival peak as well as Bathurst motor racing peak
Parkes	Blackspots: None
	Underserviced: Only one NRMA charger in town and no more
Weddin	Blackspots: Grenfell, main centre of region; no chargers - also Weddin Mountains National Park destination charging

How to ensure that the region achieves an optimal charging network

As outlined above, there is likely to be a significant gap between the optimal network and the network provided by the private sector. The evolution of charging networks internationally has been a combination of private sector infrastructure investment, government grants and provision of charging by businesses who feel they can value-capture through dwelling EV drivers spending money while charging.

The following figure gives an example of how the market may evolve given some component of government funding (note these numbers are for illustrative purposes only).

Potential market evolution given some component of government funding



As outlined in the infrastructure map provided above, there will be far more chargers required than the potential grant funding will provide. As such a co-ordinated effort to encourage installations through a range of measures will get the best results. In simple terms, CNSWJO will achieve its objectives through a combination of:

1. Decide how councils want to participate in the value chain

2. Encouraging business to install chargers
3. Being grant- ready and being in a position where it is possible to take advantage of grant applications and with the capacity to deploy the grant funding in an efficient manner

CNSWJO has already developed the EV-Toolkit to address the first of these goals so the focus of this report is on the second two.

Decide how councils want to participate in the value chain

To ensure that network coverage is provided will require either a private sector operator to be attracted into the region to cover off on these sites through a combination of grants and equity, or the councils will need to be the lead proponent in developing the sites and accessing grants.

Globally councils have played both roles and the decision comes down to strategic and operational considerations.

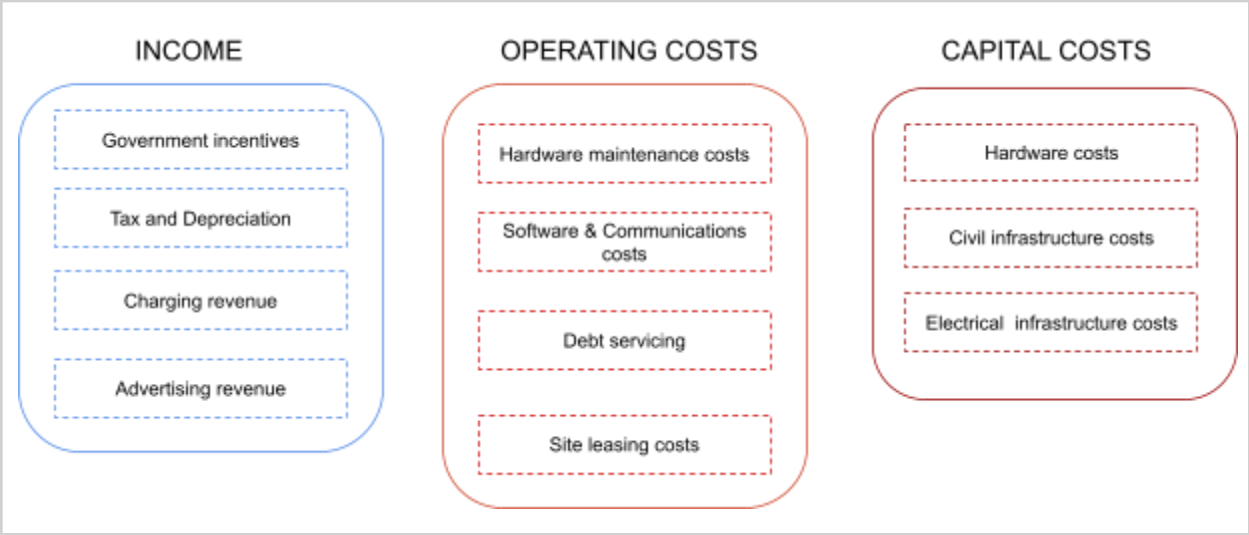
There are four core roles in providing charging infrastructure to consumers and fleets as outlined below[16].

Roles in provision of charging infrastructure			
Role	Description	Capabilities	Procurement approaches
Financier /Owner	Provides project finance. Responsible for ensuring the end to end economics of the project, so is therefore the "client" of the project	• Developing and evaluating the business case • Providing and accessing the lowest cost capital • Procurement of third parties	A financier is generally the procurer of the overall work packages
Installer	An installer will manage the entire process of ensuring that the charging hardware, electrical works and civil works are complete and tested	• Project management • Electrical engineering • Civil engineering • Charging station installation and testing • Communications installation and testing • Billing software implementation and testing (if required) • Signage and wayfinding • Liaison with electrical network company • Providing warranties around installation • If network augmentation is required a level 2 electrician is required Note that this role may involve several companies	Installers can be procured as a turnkey service or broken down into one or more services. For example the hardware supplier and electrical contractor can be separate entities
EVSE supplier	A hardware providers such as ABB or Tritium produces charging hardware	• Manufactures hardware • Complies with hardware related regulations • Delivers to installers	Procure directly from manufacturer or via installers

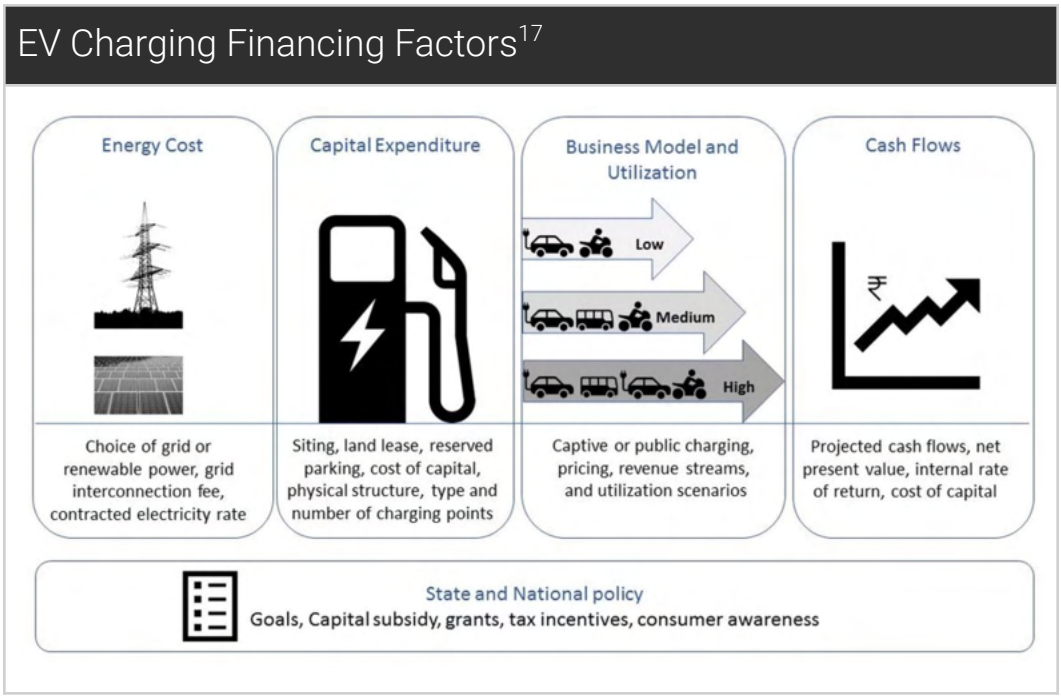
[16] From "Charging Gippsland for Future transport" - Evenergi report for Gippsland Regional Councils

		• Provides warranties	
Operator	A charger operator is responsible for mediating the interaction between the driver and the charging station. This role can be performed by the site owner/manager (commonly referred to as the host) or it can be outsourced to a third party service provider.	• User authentication (including Plug and Charge) • Billing services • Provision of data where required • Local energy management • Equipment monitoring and maintenance - hardware and communications primarily (proactive and reactive)	The billing service and data provision can be a separate package to equipment maintenance and monitoring
Site owner	A site owner provides the physical land that a charging station is located on	• Provides property for the installation of the charger, the parking of an electric vehicle while charging, and for any wayfinding required	Site owners may also be the financier/owner (in the case of shopping centres for example), or may be independent entities who provide a lease over the land.

From a purely financial perspective (and how a financier would view the transaction) the business case for a charging installation can be designated by the following diagram:



In reality there are more nuanced factors that impact on the finance-ability of a project as outlined by NRDC below. A key part is the potential for utilization of the asset - something that this document aims to facilitate to some extent.



For a site to get developed, it requires a lead proponent or ultimate owner. The following table adapted from work by the centre for climate and energy solutions[18], outlines where the various values (in green below) and costs (in red) typically fall.

Incentives of various parties to support charging infrastructure finance

	State Government	Local Government	Charging operator	Energy Network	Energy Retailer	Vehicle OEM	Local business & Tourism operator
Reduced environmental impact	✓	✓					✓
Local economic development from charger use	✓	✓					✓

[17] Source: NRDC
[18] http://leg.wa.gov/JTC/Documents/Studies/EV/FinalReport_EVChargingNetworksWEB.pdf

Increased electricity use			✓	✓	✓		
Increased EV sales		✓				✓	
Increased retail sales					✓*		✓
Long term economic benefits from lower fuel & operating costs	✓	✓					
Cost of subsidies to general public (including free/peppercorn site leases)		✓					
Negative grid reliability impacts				✓			
Uncertain impact of EV adoption on increased charging infrastructure	✓	✓		✓	✓	✓	
Uncertain impact of charging infrastructure on visitation and expenditure	✓	✓					✓

Ultimately the role that councils play will come down to the amount of time and in kind and cash contributions they will make to any charging infrastructure site development activity. The following table presents benefits and costs/risks associated with a number of options.

Benefits and costs/risks of various investment options		
Option	Benefits	Costs/Risks
Leave to private investors	• No risk to councils • Minimise operational involvement	• Lower control over open access • High cost of capital • Few private players willing to build at current risk • If councils do not source and provide sites projects may not be feasible • Only best sites are developed • Customer hostage • Potential for stranded assets in case of private sector insolvency or lost interest
Pure state or federal government delivery and funding	• Full control over standards, interoperability • Lowest cost delivery via competitive tendering, low cost of capital • Equitable access and optimal coverage • Certainty in budget requirements	• Not government core business • Impost on government budgets • Private sector complains of governments stepping in
Local government	• Will not have stranded assets • Can maximise value-capture from local economic uplift • Potential for local employment and skills development • Lowest cost of capital	• Requires buy-in and coordination of multiple councils • Private sector networks may come into the region in future (once there is enough traffic) and compete with local government provide assets making them less self sustaining

Recommendation : The recommendation of this report, based on an understanding of the capabilities and positioning of CNSWJO is that they should be the lead proponent on behalf of councils for "blackspot sites" and that councils should own the charging assets but outsource installation and operation to a single provider based on a tender process.

The main rationale for this recommendation is that:

1. With grant funding the actual council contribution may be be relatively small - if a site costs $60,000 for a fast charger it may only require in-kind contributions to secure almost full funding
2. CNSWJO has experience with applying for and administering such a grant
3. It is likely that providing coverage for blackspots will require participation from councils as well as some in kind contribution regardless of whether the site are owned by councils or a private operator
4. The long term operations of the sites is a wider social good for the region so the risks of "stranded assets" lies with the councils to a degree in any case
5. There may be synergistic benefits of owning the assets such as use with council fleets if electrified in the future
6. Councils will have access to the lowest cost of capital of any proponent most likely - making projects more feasible
7. There will be a greater degree of control on the economic co-benefits such as new skills and employment opportunities
8. It is also very important to note that the equity value of a charging network is similar to mobile phone networks, in that the sum of the total network can be larger than the individual nodes due to the strategic nature of the asset. Once developed councils may be able to sell the sites back to private sector at a profit

The following table outlines examples of councils' various levels of participation in site development.

Examples of Local Government commitments to EV charging					
Council	Description	User Pays	Business Model	Funding	Arguments used by council for investment
Bathurst Regional Council	6 Tesla Superchargers	Free or 52c/kWh	Host	Tesla	"The electric vehicle charging stations strengthen the city's reputation as a centre for innovation and is another way of encouraging people to
	1 Tritium 50kW DC NRMA network	Free	Host/ Operator	NRMA	

					visit our region" - Mayor Bobby Bourke
Cowra Shire Council	2 22kW Tesla Destination chargers	Free	Host/ Operator	Tesla/ Council	
	1 Tritium 50kW DC NRMA network	Free	Host/ Operator	NRMA	
Parkes Shire Council	1 Tritium 50kW DC NRMA network	Free	Host/ Operator	NRMA	"As a member of the Cities Power Partnership, we [Parkes Shire Council] are committed to doing our bit to tackle climate change and these charging stations are another way of encouraging the uptake of clean energy at a local level." - Parkes Shire Mayor, Cr Ken Keith OAM
Orange City Council	1 Tritium 50kW DC NRMA network	Free	Host/ Operator	NRMA	"...show(ing) the way forward when it comes to driving." - Councillor Stephen Nugent
Adelaide City, S.A.	40 22kW Schneider EVLink AC 2 Tritium 50kW DC Chargefox Network	AC: 20c/kWh DC: 30c/kWh	Host/ Operator	State Gov.	"Adelaide has a goal to become the world's first carbon neutral city by 2025" - Adelaide Lord Mayor Martin Haese, 2016
	4 Tesla Superchargers	Free or 52c/kWh	Host	Tesla	
City of Swan, W.A.	1 Delta DC Fast Charger ChargeStar Network	40c/kWh	Host/ Operator	Council	Support council EV fleet

City of Stirling, W.A.	EO Universal 22kW	Free	Host/ Operator	Council	"Sustainable development is a priority for the City" - Stirling Mayor Mark Irwin
City of Cockburn, W.A.	Tritium Veefil	Free	Host/ Operator	EVSE funded by donation. Install funded by council.	"facility for local residents and visitors and helped further advance sustainability practices in the City" - City of Cockburn Manager Infrastructure Services
Goulburn Council, NSW	8 Tesla Superchargers	Free to Tesla Owners	Host	Tesla	"... strengthens the image of this city as a leader in innovative use of alternative technologies" - Goulburn Council General Manager

Review of grant opportunities

Stage 1 of the Net Zero Plan sees the NSW and Commonwealth Governments having committed $1.07 billion over 10 years under a Bilateral agreement to support Energy Efficiency, Electric Vehicle Infrastructure and Model Availability, Primary Industries Productivity and Abatement, Coal Innovation, Clean Technology and Hydrogen programs.

The NSW Government is known to be developing an Electric Vehicle Infrastructure and Model Availability Program to fast-track the growth of the electric vehicle market in New South Wales, with this program potentially opening this year. The program is identified as a priority program for Bilateral funding. The investment will be targeted by running competitive funding processes that co-fund:

1. The deployment of fast electric vehicle charging infrastructure; or
2. The procurement of electric vehicles by vehicle fleet owners such as car rental companies, car share companies and local councils.

Evenergi understands the competitive funding process may be a reverse-auction process which will be finalised and launched during 2021. Depending on the scope and requirements of the final

process put in place by TfNSW, this process offers an opportunity for CNSWJO to prepare in the time available and gather the information required to tender a quality submission to the program.

Through the above analysis of NSW Government and TfNSW commitments, plans and strategies, the following grant opportunities were also identified:

Grant opportunities supporting regional charging infrastructure	
Pathway	Details
Transport for NSW - Electric Vehicle Infrastructure and Model Availability Program	Designed to fast-track the growth of the electric vehicle market in NSW, with this program understood to be opening this year with Bilateral funding. The investment will be targeted by running competitive funding processes that co-fund: Scope of funding is made up of the deployment of fast electric vehicle charging infrastructure and the procurement of electric vehicles by vehicle fleet owners such as car rental companies, car share companies and local councils. The competitive funding process may be a reverse-auction process which is scheduled to be finalised and launched during 2021. Depending on the scope and requirements of the final process put in place by TfNSW, this process offers an opportunity for CNSWJO to prepare in the time available and gather the information required to tender a quality submission to the program.
ARENA - Future Fuels fund[19]	A new $74.5 million Future Fuels package announced in September will help businesses and regional communities to take advantage of opportunities offered by hydrogen, electric, and bio-fuelled vehicles. Allocated into defined funding pools to support solutions for various technologies and challenges, the Future Fuels fund is set to see the imminent launching of a regional charging infrastructure fund to support projects enabling regional charging, especially targeted at those improving charging 'blackspots'. The fund is set to be managed by ARENA and is understood to be launching in January 2021.
Unsolicited approach to Destination NSW, TfNSW or other areas of the NSW	Unsolicited approach with a strategically aligned, clearly defined plan directly to Destination NSW, TfNSW or other areas of the NSW Government or elected leaders.

[19] https://arena.gov.au/funding/future-fuels-fund/

Government or elected leaders	
Country and Outback NSW Destination Network - Regional Tourism Fund	The Country and Outback NSW Destination Network offers a potential pathway to progress requests for funding via their $4.5 million Regional Tourism Fund. The alignment with a potential $500,000 funding stream councils in tourism marketing is viable if a project is put together seeking to maximise attraction of EV tourism. The challenge for this program is the requirement for matched funding and large scale projects. A cooperative project with local businesses as partners may be a strong fit.
Regional NSW Services and Infrastructure Plan - Place Based Plans	Designated key hubs including Bathurst, Forbes, Orange and Parkes are set to receive place-based plans through the Regional NSW Services and Infrastructure Plan. Coordination with the development of this plan may assist in prioritising funding streams or providing a platform to establish a requirement and raise requests for funding.
Regional NSW Services and Infrastructure Plan - Central West and Orana region	The Regional NSW Services and Infrastructure Plan calls out that a plan and vision will be prepared for the Central West and Orana region by TfNSW in conjunction with key stakeholders such as the local government and Department of Planning and Environment. This mechanism may be a key pathway for influence. Coordination and lobbying through this process may provide a genuine pathway to influence investment decisions.
ARENA[20]	If a novel project that involves grid integration can be developed then ARENA can be a source of funding. This would likely need the involvement of Essential Energy. An example would be trialling off-grid or remote charging applications using solar and storage.
NSW Government Sustainability Advantage[21]	NSW Government Sustainability Advantage provides assistance and funding for businesses to deliver sustainability related projects - with electric vehicles being a stream of the program.
Environmental Upgrade Agreements[22]	Environmental Upgrade Agreements (EUAs) provide owners or managers with access to loans to upgrade a commercial building to maximise the building's energy efficiency. The EUA mechanism, while not a grant, may be a means of funding charging infrastructure upgrades.

Recommendation : Focus on Transport for NSW Electric Vehicle Infrastructure and Model Availability Program and ARENA processes; however, documentation will be re-usable in multiple grant opportunities

[20] https://arena.gov.au/funding/
[21] https://www.environment.nsw.gov.au/topics/sustainable-business-and-government/sustainability-advantage
[22] https://www.business.gov.au/Grants-and-Programs/Environmental-Upgrade-Agreements-NSW

Being “grant ready”

There are several aspects of being grant ready. To do this councils and CNSWJO must decide how they would like to participate in this space - do they want to be a lead proponent, or support a private sector proponent.

In most cases grants will be merit based, and driven by a balanced understanding of :

1. The proponents demonstrated capabilities (note that this can include a partnership team)
2. The proponents cash and in kind contribution to the project
3. The degree to which the project is “grant ready” Grant bodies will typically want a submission that has sites selected, has high level costing and is as “shovel ready” as possible.

Grant readiness considerations	
Action	Details
Advocate within the member councils to adopt a model	CNSWJO should advocate for the benefits of being the network owner with councils
Identify final sites	Work with councils to finalise the list of sites. Sit evaluation matrix provided as part of the EV Toolkit should be used finalise sites
Gain a clearer cost for each site	Civil and electrical cost estimates should be sourced for the shortlist of sites

Charging infrastructure - technical overview

To fulfil the vision of developing a regional charging network, CNSWJO councils will need to have a shared understanding of charging infrastructure requirements. If grant funding ws to be received and channel via CNSWJO then the group would need to foster its existing skills (particularly in Bathurst and Blaney councils) to help manage the process.

This section covers:

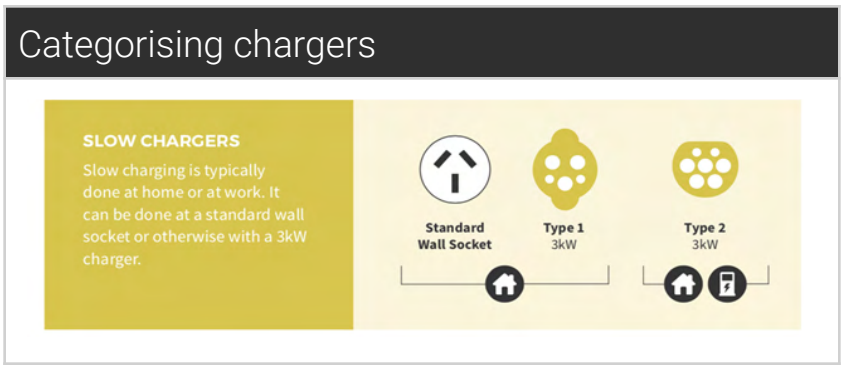
- What sort of charging infrastructure may be needed in a regional network
- How much will it cost to install and manage chargers
- What does it require to operate and maintain chargers
- What standards should be in place to ensure ease of use for consumers

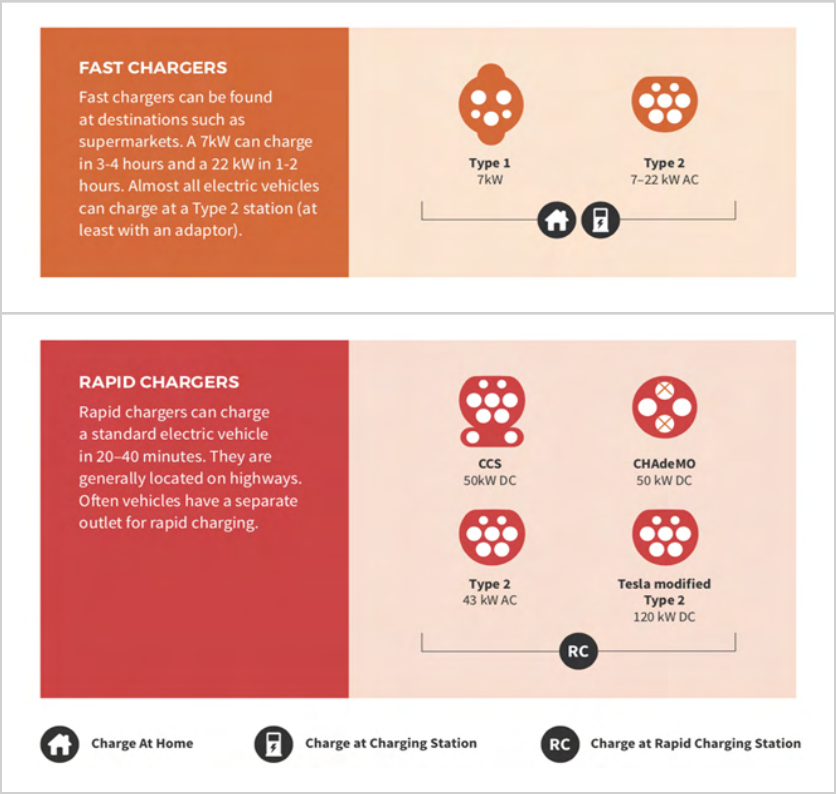
Charging infrastructure is an area that may be unfamiliar to many. Schedule 3 provides an overview of charging infrastructure concepts that may be required by readers who need a more detailed understanding.

An introduction to the the types of charging infrastructure

Electric vehicle charging infrastructure can be a daunting subject for those new to it. In this section we will provide an overview that identifies the types of charging that can be considered and where they are suitable for use in a public charging network.

In the broadest sense, we can classify chargers into 'slow' and 'fast' categories. This is outlined in the following diagram for simplicity:





The key difference between different types of chargers is the charging speed (power; commonly broken down into 'Levels') of the charger. A more powerful charger will deliver energy at a faster rate, and will generally charge an electric vehicle more quickly.

Charging types

Charging infrastructure refers to an arrangement of power supply and charging unit and the optimum design varies depending on the application. At a high level, charging infrastructure can be divided into "journey enablement" and "destination" charging applications. These are explored below.

Journey enablement

Journey enablement is most often used when drivers are moving inter-regionally on mid to long distances and often seeks to emulate the existing petrol station mentality of replenishing as much as possible in as short a period as possible. Journey enablement is also used in applications such as electric taxis or when people do not have charging facilities at home so need faster charging within their local area. Examples of journey enablement charging is provided below.

Inter-regional service station

Service station with multiple ultra-fast chargers. Co-located with restaurants, services and amenities for drivers as they wait to recharge. Services provide alternative revenue streams for the operator.

Located on major routes for trips that exceed electric vehicle range. These are currently made up for the most part of 50 - 100 kW chargers, but in the future chargers rated 150 kW or greater are likely to be sought after by EV users and come to dominate this type of charging service.

High voltage connection with 0.5 to 5 MW power requirement. Suitable for large battery installation to reduce load peaks and provide grid services.

Integrated solar charging station - remote location

Service station that is not supplied by high voltage network connection. Co-located with convenience stores and amenities that provide additional revenue for the operator.

Located on regional main roads.

Fast DC chargers (greater than 50 kW).

Low voltage grid connection with solar and battery to provide short bursts of high power required for fast chargers.

Urban service station or “hub”

Urban service stations with ultra-fast chargers greater than 50 kW in power. They may supplant existing petrol stations, utilising existing convenience stores and amenities that provide additional revenue for the

	operator. The location of urban charging hubs is heavily dependent on power supply. Located in urban areas with high thoroughfare of ex-urban traffic or low levels of off-street parking. Can support commercial applications of EVs that are in continuous use, such as taxis and delivery vehicles.

Destination charging

Destination charging is where drivers have arrived at a location and plan to say for a longer duration. This could be at home, or work or when visiting a shopping centre or tourist attraction. Unlike the current paradigm of petrol stations, destination charging often involves a “top up” mentality where drivers will take opportunities to add charge whenever a charger is available. Examples of types of destination charging are provided below.

Multi-storey car park	
	Multi-storey car parks are suitable for multiple slow chargers that can provide charging services while drivers are engaged in medium-stay (1 to 8 hour) activities such as shopping or working. Overhead cable routing and wall mounting enable low cost installation of EVSE. Wall mounted AC chargers (3.7 - 7.4 kW) Car parks are generally located at high capacity venues such as large workplaces, shopping centres and stadiums. These sites often have high voltage network connections that can be shared by the EV charging system.

Home charger

The home charger is the most ubiquitous form of charging. Smart chargers can integrate into the home energy system, shifting charge sessions to off-peak or utilising rooftop solar. EV owners with a home charger are unlikely to require local public chargers.

Non-commercial slow AC chargers (wall socket, 3.7 kW, 7.4 kW).

A fast charger (32 A) may require an upgrade to the switchboard.

Business charger

Many businesses will gain indirect revenue from the provision of EV charging services. Key markets include hospitality, tourism, retail and trade centres. Hospitality businesses are well placed to provide overnight charging services for tourists visiting the region. This will likely provide the bulk of charging services for visitors.

Commercial chargers, AC and DC (3.7-25 kW).

Power requirements are largely dependent on the number of chargers and their utilisation. Businesses with high power capacity are suitable candidates for charging systems, particularly large retailers and hotels. A load management system.

Public car park “hub”

Similar to an urban service station, the hub is situated within a retail precinct or town centre. However, there is no accompanying service station owned by the hub operator. The car park itself is typically public land.

The “hub” is implemented for the benefit of all user groups.

AC and DC fast 7.4 - 50 kW.

A public car park hub is likely to be a standalone load, requiring a dedicated electrical system.

Public kerbside destination charger - Urban centre, on public asset

These chargers are designed to fit seamlessly into light posts or bollards where on-street parking is most common. Street lighting is a council responsibility, but is complicated by the typically unmetered energy supply.

Due to the slow speed of these chargers, long charge sessions are necessary. This may cause congestion of prime parking spaces on main streets.

Typical charger types : 3.7 - 7.4 k

Integrated solar charging station - Urban location

Solar canopies can reduce the peak load of a charging station, while exporting emission free electricity to the grid when the chargers are not in use.

Key factors in selecting charging infrastructure in the region

Typical driver behaviour is likely to strike a balance between a number of considerations. These may include:

- The duration a driver is willing to take a necessary break;
- The minimum boost to driving range a driver is comfortable to take on;
- The value placed on ancillary amenities in the vicinity of the site;
- The cost of the charging service; and
- Whether faster charging opportunities exist on an alternative route or at their destination.

While it would be ideal to have a fast charger at every location, the reality is that this will not be affordable or necessary. The following table provides a high level overview of which infrastructure will be appropriate for different contexts.

Applying levels of EV chargers to types of sites[23]				
Level	Type	Where	kW (up to)	Time to add 100km of range*
1	Household power point and adapter	Anywhere there is a normal powerpoint	2.3	8.7 hours
2	Wall charger	Homes, hotels, workplaces	7.4	2.7 hours
	Wall charger	Shopping centres, public car parks, on-street parking	22	55 minutes
3	Fast charger	Intercity travel, petrol stations	50	24 minutes
	Fast charger	Faster capacity charging for intercity travel and petrol stations	120	10 minutes
	Ultra-rapid charger	Highways and long-distance travel	350	3-4 minutes

The focus for the region needs to be on coverage and lowest cost to the end user while maximising the user experience. Some key recommendations to achieve this are outlined below.

[23] Based on a vehicle with energy efficiency of 20kWh/100km

Leverage existing power supply when practical

20% of visitors staying overnight in the Central NSW region are staying with friends or relatives[24]. Overnight vehicle charging in these instances can be accommodated by plugging the EV into a domestic power socket. Slow charging is likely to satisfy the demands of this cohort of regional visitors.

Minimise spend where possible

Extended (8+ hour) parking available to users of overnight accommodation services means that a lower charging speed, lower cost charger is suitable for overnight charging. Charging speeds as low as 3.6 kW are not uncommon, though as charger prices continue to rapidly decrease, 7.2 kW and higher speed 11 kW and 16 kW chargers are becoming the norm for this purpose. This is accentuated by Tesla's popular offering of 16.5 and 22kW chargers at no cost to such businesses. Higher rate chargers can double-up as opportunity chargers for day-time visitors and may attract a new type of visitor to overnight accommodation facilities.

Future proof wherever possible

There are many examples of stranded charging assets. Standards are emerging that reduce this risk, but being mindful of interoperability requirements can mitigate this risk. The automotive peak body, Federal Chamber of Automotive Industries, recently announced[25] that FCAI member companies agreed to provide vehicles and Electric Vehicle Supply Equipment (EVSE) capable of operating with infrastructure which adopts the standards for EV charging from the following table on all new models introduced from 1st January 2020.

General IEC 61851-1	Electric Vehicle Conductive Charging System, General Requirements
AC Charging AS IEC 62196-2	Plugs, socket-outlets, vehicle connectors and vehicle inlets Configuration Type 2
DC Charging IEC 62196-3	Configuration AA CHAdeMO or Configuration FF CCS Type 2

[24] https://www.destinationnsw.com.au/wp-content/uploads/2020/08/central-nsw-fact-sheet-ye-mar-20.pdf
[25] https://www.fcai.com.au/news/codes-of-practice/view/publication/99

Despite the FCAI including CHAdeMO in their list of standards, CCS2 has emerged as the leading DC plug type, with Tesla (uniquely not an FCAI member) moving new models to CCS2 and Nissan recently announcing they will abandon the CHAdeMO standard and move to CCS2.

Be mindful of both the charger speed and the ability of the vehicle

Most current electric vehicles provide only around 7kW maximum AC charging speed, so from that perspective investing in higher power 11, 16 or 22 kW AC fast chargers does not increase the rate of charging for the driver.

The future is likely to be faster DC charging

The clear trend by automotive manufacturers is to increase battery size and the capacity to recharge the bigger batteries via ever-faster DC charging capacities. Some vehicles reaching the market have DC charging rates around 50x faster than those available to the same car through AC charging.

When providing journey enablement, faster is better

For those that need to charge quickly, the experience of petrol stations is the benchmark. The quality of surrounding amenities is likely to determine a driver's willingness to remain charging and their general charging experience.

Sites that are high traffic will be more likely to be profitable

When planning a network it is important to note that there will be some highly strategic sites where charging will be closer to economic and will therefore be able to support faster charging and provide opportunities for a return on investment.

Most charging sites will not be profitable

Beyond these strategic sites, most sites will be funded through adjacent revenue streams such as increased traffic.

What does it cost to install and manage chargers?

Installation costs

To understand the potential for a charging network to be available in the region, it is important to have a sense of the costs associated with each type of charger. The table below outlines the different charger speeds (power), their applications and potential costs.

Charger speeds, types, applications and potential costs				
Power Level	Common name	Power	Application	Cost per charge point
Level 1 (Wall socket)	Slow charging	2.3 kW	Home charging or emergency charging	-
Level 2 (AC)		3.6 kW	Overnight destination charging	$2,000 - $10,000
	AC fast charging	7.2 kW 11 kW 16 kW	Destination charging or scheduled duration charging	
		22 kW	Destination or opportunity charging	$8,000 - $20,000
Level 3 (DC)	DC fast charging or Rapid charging	25 kW		
		50 kW	Public journey enablement or Heavy duty opportunity charging	$40,000 - $100,000+
		100 kW		
	Tesla Super-charging	120 kW		
	Ultra fast charging	< 350 kW		
*For vehicle with driving energy efficiency of 20 kWh/100 km				

An in depth insight into the cost components and drivers of overall costs for design, procurement, construction, installation and commissioning of chargers can be found in Schedule 1.

Ongoing running costs

Ongoing running costs for charging infrastructure is an important consideration, and especially impactful in early years where charging infrastructure is not expected to have high rates of usage. The following table presents details of components of ongoing costs related to operating charging infrastructure.

Ongoing cost components of managing charging infrastructure	
Cost component	Component detail
Property Lease costs	Where land is not owned by the charging infrastructure owner a lease will usually be required. It is currently common for state or local governments to offer a peppercorn lease arrangement to facilitate private investment in charging infrastructure on public land.
Energy supply	Energy costs are composed of fixed and variable costs that are dependent on the energy supply and charger typology. Operators typically pay retail rates for electricity, with the charges broken down into fixed and variable charges and subcomponents thereof. Higher powered chargers can incur especially significant fixed supply charges. provides a detailed breakdown of considerations of running cost, including typical rates through Essential Energy for two connection sizes and use profiles.
Operational costs	Operational costs such as subscription to a broader network (such as ChargeFox) that facilitates status monitoring and automated billing needs to be considered. Schedule 3 provides a detailed breakdown of billing software costs. Other optional costs such as dedicated area lighting, cleaning and security are also considerations that need to be made.
Maintenance costs	Equipment maintenance requirements are ongoing and require the attention of a qualified and experienced electrician. Annual functionality and safety inspections are often recommended, while maintenance for graffiti and malicious cable-damage are known issues for charging stations.

Ongoing operations of charging equipment

For councils that chose to install their own charging infrastructure it is important to understand the key requirements for managing the equipment on-going. Generally in Australia third party operators provide services on behalf of charging system owners, where this type of service is desirable - generally with faster chargers.

Charger operator is responsible for mediating the interaction between the driver and the charging system, and may perform the following functions:

- User authentication via access card or cloud
- Local energy management

- Time of use controls
- Monitor charger status (in use/available)
- Monitor performance
- Report and aggregate usage data
- Update firmware
- Option: Handle billing for paid services

This role can be performed by the fleet or site manager (referred to as the host of the charging system) using standalone software, outsourced to a third party service provider, or wrapped together with other billed services such as general parking or access fees. Publicly accessible chargers can also be operated as part of a broader network.

A handful of charging management service providers (standalone or networked) are available in Australia and are usually associated with the major charger hardware distributors/installers. Listed below are a number of popular charging management service providers operating in Australia.

Examples of charging management service providers operating in Australia		
Hardware Distributor/Installer	Software	Network
Jetcharge	Jetcharge	ChargeFox
Everty	Everty	Everty
E-Station	Charge Star	Charge Star
Tesla	Tesla	Tesla
EVSE Aus.	eo System	Third Party
NHP	NHP	Third Party

Many public chargers are offered as free services. This is because the management software services can cost more than the revenue that they generate in the context of irregular use. This may change as EVs increase in number and chargers become more viable. The big winners from a free service are the EV drivers, who might be attracted to an area otherwise overlooked, so local businesses could benefit too.

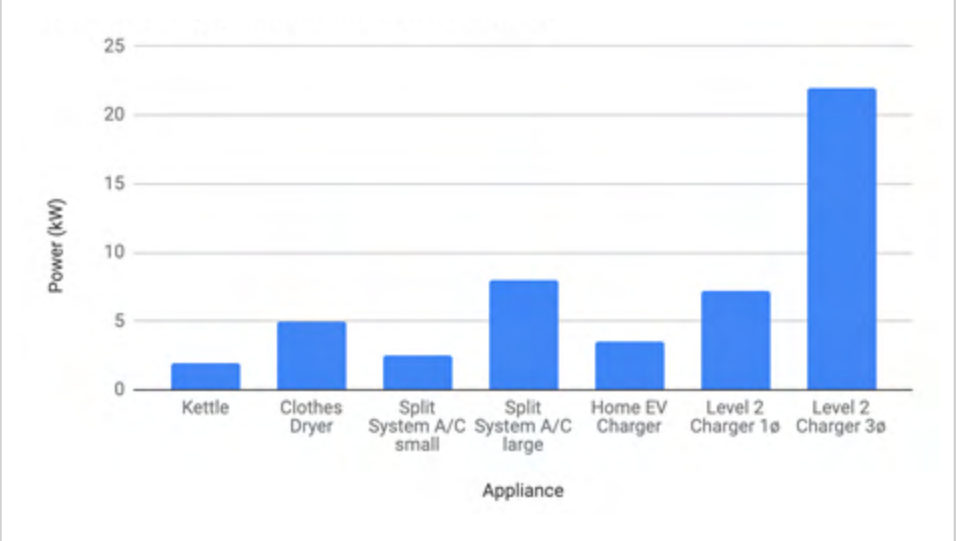
Integrating charging infrastructure into the Essential Energy Network

All the councils within CNSWJO region fall within the Essential Energy network. Electric vehicle charging places significant demand on the grid. Essential Energy will be very focused on the increased demand on their network and how they can work to manage this demand.

If we compare EV chargers to common household appliances, we can see that a single phase AC charger is on par with a split system air conditioner, while a 3 phase AC charger has a larger power draw than a typical household with all its appliances on.

The following table demonstrates the relative power draw between a number of common household appliances and Level 2 charging.

Common appliances and power draw



When multiple chargers are installed on a single site, or even more powerful DC Fast Chargers are installed, the site may require a special connection to the grid. Furthermore, the connection may trigger distribution network upgrades.

Insights from Essential Energy

The installation of EV charging equipment may require a new or upgraded connection to the grid. New connections greater than 4.6 kVA (~4.6 kW) must be negotiated with Essential Energy by the applicant.

Even small (7 kW) connections may trigger an upstream upgrade, especially in remote areas. However, major towns have sufficient network infrastructure to handle Level 2 AC charger installations. Placement of DC fast chargers can be guided by location of high voltage transformers.

In remote areas the installation of charging infrastructure may require expensive network augmentation, paid for by the entity requesting a new or upgraded connection.

Battery and solar integrated charger systems can be employed in remote areas to reduce the need for network upgrade/augmentation (e.g. Euroa Chargefox Ultra Rapid DC charge station). While these designs are more complicated than typical connections they may also provide a mutual benefit between the operator and the grid, and so a specialist team will manage these connections.

The current process for new or upgraded connections

The current process required by Essential Energy for new or upgraded connections is initiated via the Supply Proposal Request Form (on website).

- There are three categories of connection, managed by different teams:
    a. Connections up to 300 kW
    b. Connections over 300 kW
    c. Embedded network connections with on-site generation and/or storage

- Site-by-site estimates
    a. Preliminary site inspection is free
    b. If upgrade necessary, $550 fee for estimate

- Timeframes[26]
    a. 2 months for firm offer
    b. 3 month lead time for construction
    c. 6 month lead time for substation delivery, where required

- If no upgrade required
    a. Pole-to-pit connection takes 4 weeks
    b. Fee is negotiated

Implications for charger operators

- The most important consideration when planning the installation of EV chargers is ensuring that there is sufficient time in the project plan dedicated to the above process, which is often more drawn-out than applicants expect. It is important to initiate the process as soon as possible and to establish a working relationship with Essential Energy. This is especially true if a continuing roll-out of infrastructure is anticipated.
- If expensive network upgrades are necessary, solar-battery integrated systems may become cost effective, however, this requires a site specific feasibility study.

[26] Timing based upon the design being approved at first submission. Further iterations of design may delay firm offer

Sub-Transmission and Distribution Network

AREMI Map of Zone Substations

The Australian Renewable Energy Mapping Infrastructure tool does not give us definitive answers on the technical feasibility of charging infrastructure; however, map data layers provide some insights into the capacity of the grid to service electric vehicle charging infrastructure. An edited AREMI map in Schedule 6 provides details of the total and available capacity at key Zone Substations in Central NSW for 2020. This information is also provided in table-form below:

AREMI-sourced details of Zone Substations in Central NSW		
Zone Substation name	Total capacity (MVA)	Available capacity (MVA)
Bathurst	66	47.6
Blayney	22	12.8
Condobolin	4.4	0.1
Cowra	33	11.6
Forbes	33	18
Grenfell	5.5	0.1
Molong	4.4	0.1
Oberon	49.5	22.1
Orange Industrial	11	0
Orange North	0	0
Orange South	33	14.1
Orange West	33	17.7
Parkes	33	11.9

The interplay between project developer and DNSP is complex. Investment in managing long-term trends of increases in demand at a distribution substation and zone substation level is the responsibility of the DNSP, who engages in long-term load planning and budgeting exercises to fund infrastructure augmentation. DNSPs can in limited circumstances claim that a project is the cause of a requirement for augmentation and shift the burden of investment to a project

proponent, requiring the proponent to pay for such upgrades prior to receiving a connection agreement.

It can be seen in the table above that the Molong, Orange Industrial, Orange North and Grenfell Zone Substations have little remaining capacity at the Zone Substation level. While there is a chance Essential Energy would seek to offset these costs by on-charging a proponent that seeks to increase EV charging equipment within these Zone Substations, the fact they are projecting demand to exceed Zone Substation capacity over the next 5 years means they are responsible to upgrade this equipment through natural growth of demand.

Due to the complexity of differentiating between the load impact of a project and overall substation load variation caused for example by behind-the-meter solar installations, it is recommended to engage openly and consistently as a region with Essential Energy to seek fair and equitable attribution of EV charger impacts on the broader network.

AREMI Map of distribution transformers

The new Electric Vehicles component of the Australian Renewable Energy Mapping Infrastructure Project (AREMI)[27] shows the installed capacity and location for distribution transformers operated by Essential Energy in Central NSW. Analysis of data available through this map layer, in conjunction with the upstream Zone Substation data above, provides the best possible understanding of what technical limits there are to installing chargers.

Managing the impact of EV charging on the Essential Energy network

The electrification of transport will increase demand for energy and increase loads on the grid. The seasonality of tourism already contributes to coincidental demand, increasing the risk of overload. If poorly integrated, EV charging may increase incidences of load transfer or shedding. Also, home and depot charging is different to public charging when it comes to demand management or response to price signals. Performing demand management on public chargers (i.e. turning chargers down, or off during peak periods) results in EV drivers arriving and expecting to charge, but either not being able to charge at all or receiving a very slow rate of charge.

Fortunately, there are a suite of solutions to managing the impact of public chargers on the network:

- Careful planning and strategic placement of chargers at locations without grid constraints.
- Distributing charging infrastructure geographically across the distribution network and in doing so providing redundancy.
- Dynamic pricing incentivises customers to where or when they charge.
- Market-managed shaping of charging rates to facilitate network stability.

[27] https://www.nationalmap.gov.au/renewables/

- Future services EV users will be able to provide to the market such as opt-in shaping of charging demands or bidirectional grid connection to support the grid in return for commercial reward[28].
- Supplementing with solar or battery storage.

For overnight or longer duration charging such as hotels:

- Using smart chargers that can be scheduled to start charging at a set time outside of network peak periods.
- Connecting the chargers to a controlled load circuit[29].
- Vehicles capable of vehicle to grid (V2G) can discharge energy from their batteries into the network and actually provide support during high load periods.

Mitigating options can be so effective in fact that EVs and smart EV charging systems can present a net positive impact on grid reliability[30].

[28] https://arena.gov.au/knowledge-innovation/distributed-energy-integration-program/ev-grid-integration-workstream/
[29] Controlled loads are operated by the distribution network and will turn on/off based on their needs, therefore charging may be disrupted unexpectedly.
[30] "Managing the impacts of renewably powered electric vehicles on electricity distribution networks", Evenergi, 2019.

Schedule 1- Quantitative analysis of charging requirements

Aim of infrastructure analysis

The minimum electric vehicle charging infrastructure required to facilitate uninhibited access to Central NSW by tourists, transport through the region supporting critical industries, and for local residents and businesses requires the ability to understand both where and to what degree charging demand will occur.

This section seeks to present an understanding of the number, type and location of an optimised minimum charging infrastructure across the ten council regions that make up the CNSWJO member councils.

Data Availability

In order to come to the final methodology outlined below, the availability of data by councils and external agencies was an active consideration. The following table presents the data sources used in the development of the placement recommendations.

Data availability	
Category	**Datasets**
Regional geography	• NSW Tourism data and self-drive road trip maps • Google API for topography • Town data (ABS) • Regional tourism websites
Travel	• Road network map (Google) • Traffic volume - RMS traffic data • Peak road traffic (NSW RMS and member Councils around specific event data)
User stories	• Regional tourism market data (visitation, stop-overs and stay overs) • Journey to work data (ABS) • Localised EV model (adapted Energeia): Population, demographics, % of home ownership, vehicle type data
Electric vehicles (Evenergi supplied)	• EV performance data • EV uptake forecast • Plugshare locations of existing infrastructure

Electricity distribution network data	• Essential Energy partnership • AREMI map 'Electric Vehicles' update

Methodology

The following methodology has been used to provide insights and recommendations around key areas and site candidates for charging infrastructure. The approach was applied to each of the ten separate council areas individually. While the methodology below shows consideration of specific items, in general the following issues were considered:

- Regional tourism (Attractions, market, seasonality)
- Travel corridors (Ex-Sydney, inter-regional, intra-regional)
- Different types of road users (Tourists, commuters, local residents)
- Energy demand model for each EV user (Number of users by type, journey length)
- Geography (Population number and type of vehicles, retail and services, places of interest)
- Electricity network constraints (zone substation and distribution substations level)

Step-by-step methodology of analysis	
Step description	Step detail
STEP 1: Establish the key routes	Tourist personas were developed that informed the types of journeys being taken through Central NSW. Traffic volume data, tourism data, local commuting insights and council supplied local knowledge were analysed to identify routes through each council region that can be considered key routes.
STEP 2: Analyse key "journey enablement" sites for fast charging	To establish what demand there will be for journey enablement charging through a region, identified tourist personas were used, mapping distances from the most likely key departure points against the likely travel range of electric vehicles under various conditions. This was considered through the lens of traffic volume. Simulated journeys were completed for low, mid and high level EVs along key routes, determining the vehicle's state of charge and likely charge required to complete the journey. This data was used in combination with assumptions around driver charging behaviour, including insights provided by Bathurst Regional Council, to estimate the charge duration for different level chargers. With this information, existing and committed charger installations were mapped, such as the Tesla and NRMA networks, to determine the current service levels for current and future demand scenarios

	and identified any gaps.
STEP 3: Feedback from each council with potential points of interest and council land available for charging synthesised	Each of the ten participating councils was invited to provide insights into popular tourism locations within their respective regions, as well as points of interest that may be viable charging locations. These locations were supplemented by research using points of interest maps and a review of tourism information provided by each council's existing websites to form a cluster of potential sites.
STEP 4: Create a map of highway, opportunity, destination and stay-over charging to allay range anxiety for drivers	Taking the results from Step 2 and Step 3, the final cluster of potential sites for each council region was considered through the lens of the identified tourist personas to rank site suitability. This analysis takes a demand-side approach irrespective of existing chargers and committed future chargers before overlaying the results with existing and committed locations. To determine opportunity charging locations a classification matrix was developed that enabled selection of sites based on a weighting factor. Groupings were based on relative attractiveness as a standalone charging location and as a location's contribution to the broader charging network design.
STEP 5: Consider peak travel flows to understand the potential density of charging infrastructure placement	Using daily and hourly peak traffic flow data it was possible to understand the proportion of these flows that are predicted to be electric vehicles currently and out to 2030. This was synthesized with the types of trips that drivers were likely to be undertaking, their origins and destinations, to provide insight into the potential peak demand for charging infrastructure by 2030.
STEP 6: Create shortlist of sites and their optimised charger characteristics	With the quantity of chargers understood from the demand for chargers, and key potential sites known through the steps above, these were combined to create a shortlist of sites, their optimised charger characteristics, and key details of upstream infrastructure were made available.
STEP 7: Determine feasible charger ratings and quantities based on network capacity	Sites were individually analysed with respect to the available electrical infrastructure capacity upstream of the site. This determined the maximum theoretical ratings of chargers and enabled recommendations based on apparent upstream network constraints.

Important notes on methodology and assumptions for Step 7

It is important to first understand the charging mechanisms for network upgrades or augmentation. Distribution network service providers (DNSPs) such as Essential Energy, must plan and forecast natural load growth and publish this in annual planning reports. Any resultant network upgrade costs are borne by the DNSP. However, any unplanned or large increases in load are categorised as contestable works and are funded by the project developer.

The load on major infrastructure such as zone substations and power lines is monitored and data around installed and available capacities is obtainable. However, when looking at street level, the local distribution transformers that supply power to local homes and businesses are not monitored in any way and only the rated or installed capacity of assets is known.

What this means is that DNSPs can not immediately provide insights or determine if additional demand at street level will drive a need for street level transformer or distribution line upgrades. Depending on the scale of the new connection request, or if a site connection upgrade is required, the DNSP may need to undertake specific investigations of street level infrastructure, which bakes in significant time to the connection process.

The methodology to determine available capacity was a risk weighted approach based on available information through Essential Energy and the likelihood and magnitude of costly upgrades. For example, even connecting a small load in an area where forecasts are showing a zone substation constraint could trigger unplanned upgrades to that zone substation which can run into hundreds of thousands to millions of dollars.

At distribution level, the cost impact even in the worst-case scenario where upgrades are required is comparatively much lower. The assets at this level are designed with diversity factor buffers which allow for the fact that not every appliance connected behind that asset will be on at once.

The approach taken in determining the suitability of a site for charging infrastructure was as follows:

1. Check zone substation installed capacity and forecasts. Where there are constraints emerging, avoid adding large loads as the risk of triggering upstream upgrades is high.
2. Analyse installed capacities of street level distribution assets adjacent to identified sites. Assume that due to diversity of load 40% of installed capacity is available.
3. Recommend charger ratings and quantities within determined constraints.

Assumptions and constraints to model

Details of the core assumptions and constraints of the model used to undertake strategic placement of charging infrastructure can be found in Schedule 1.

Assumptions of charger use by user segment

1. While we have been provided with a large set of data and insights, the placement of charging infrastructure will be determined on the basis of two qualitative factors: Journey Enablement Charging infrastructure and Destination Charging infrastructure. Our analysis is organised around these primary functions:

    a. Journey Enablement infrastructure is the backbone of fast chargers that make inter-regional travel possible for electric vehicles. These are typically located within major towns, providing convenient charging services to the local population.
    b. Destination Charging infrastructure is the network of chargers located at places of interest, where charging typically occurs while the driver is engaged in activities such as tourism or shopping. Destination chargers are slower by design, however, they may still provide journey enablement services in many applications.

2. While it is possible to outline the best sites for journey enablement, the number of chargers of particular types on each site will be determined over time by the operator/owner of the infrastructure. It is likely that in line with best practice, core infrastructure would be in place for multiple chargers, with only one or two per site installed until volume demonstrates a requirement for additional chargers.

3. An ideal network of journey enablement chargers would provide adequate coverage for every user type. The user type with the greatest need for journey enablement charging is a day visitor who does not have access to charging at their accommodation. Journey enablement charging along the key routes should be located at intervals of 70 km to allay range anxiety and give flexibility to drivers. Providing these services at locations with the highest volume of traffic will provide the largest benefit to society and present the best business case to charging station operators.

4. Four levels of charger capacities are considered in estimating the number of charging plugs required based on the respective energy needs, potential locations and EV uptake, and these are presented below.

5. It is assumed that every 2.3 visitors will use one car.

6. It is assumed that 20% of the local EVs for each council will use the public chargers, while fulfilling 80% of their charging needs at the dedicated chargers installed at home or work.

7. It is assumed that 80% of the domestic and international night stay visitors will use the public chargers as they will spend most of their day away from the hotels/motels driving.

Charger types		
Capacity	Potential types of locations	Typical user-determined charging time
7.2 kW	hotels, motels, B&Bs, camping sites	6 hrs
22 kW	shopping centers, amusement parks, tourist attractions, museums	1.5 hrs
50 kW	shopping centers, amusement parks, tourist attractions, museums, journey enablement (short-term)	1 hr
150 kW	highways	0.5 hr

8. The passenger and light commercial vehicles data from ABS statistical area (SA2) is used to account for the proportion of local vehicles.

9. Based on the statistics from Central NSW visitor profiles;
    a. 36% of the domestic and 22% of the international night stay visitors, stay at their friends or relatives accommodations.
    b. 22% of the domestic and 11% of the international night stay visitors stay at hotels/motels.

10. 2% annual growth rate is assumed for the number of visitors, where the latest dataset was unavailable.

11. For route energy estimations, it is assumed that EVs will top-up charge up to a maximum of around 80% state-of-charge (depending on the charging need and battery capacity).

12. Route energy estimations are made for 50kWh, 75kWh and 100kWh battery capacities. Battery capacity can be interpreted in two ways:

    a. Short, medium and long range models; or
    b. What range does the average EV have today, in 2025 and in 2030?

Charging infrastructure meet the needs of different users, segmented as follows:

Segmented user group profiles	
Segment	Profile
Day Visitor	• A day visitor may have driven from Sydney and may have a low battery state of charge • These drivers may have a time constraint and prefer faster chargers • They must complete their round-trip using public chargers since they are not staying overnight • They will prefer tourist spots with charging facilities • They are most likely to experience range anxiety • They are most likely to be frustrated by poor service
Overnight Visitor	• An overnight visitor can rely on charging at their accommodation, therefore they may only require a top up charge • They are less dependent on public chargers • They may have more time to spend at rest stops or minor attractions
Locals	• They have similar use patterns to EV drivers in urban settings • They will incorporate charging into a weekly routine • They are least dependent on publicly accessible chargers
Commuters	• They have a daily routine • They are likely to charge at home or work

Electric vehicle energy efficiency and range assumptions

Electric vehicle range is improving all the time, with regular vehicle updates and new models and variants bringing solutions to market with better and more cost-effective performance. The range of an electric vehicle is impacted by speed, loads, driving patterns and extreme temperatures (and related use of cabin heating and cooling).

Charging is a relatively slow process, and this model assumes drivers will seek out appropriate charging opportunities once battery state of charge reaches 40%. In reality, this means charging stops would not be expected to be made before the battery has only 40% of charge remaining except in limited circumstances. Beyond 40% charge remaining, the next convenient charging location with suitable amenities would be sought out on-route until the battery reaches 20% state of charge. At this point, route-alterations and slower chargers would be considered to ensure sufficient driving range was available to successfully complete the journey.

Driver behaviour is considered to include taking rest-breaks around every 2 hours. This model assumes drivers will limit driving legs to a maximum of 200km, with existing charging infrastructure from the region to most capital cities shown to be already effectively placed geographically.

Vehicle range is an important consideration when determining the coverage of the charger network. When we forecast forward we have to make assumptions around the range of vehicles as it can determine the spatial allocation of infrastructure. Vehicle energy efficiency is also important - by understanding the amount of energy consumed between charges, we can determine the energy demand at each charger. We can then use this data to predict top up or full charge duration, and even estimate queue times at chargers during periods of high demand.

When we consider the placement of journey enablement chargers, we consider a typical mid-level EV taking the trip in extreme weather (under -6ºC or over 35ºC). This represents the expected range of EVs travelling along the route in current market conditions. We further consider the impacts of the changing market out to 2030, with the expected range of mid-level electric vehicles increasing by 100% over the period.

Results of analysis by region

The following sections detail findings for each council region from going through the above process.

Determining the "Key Routes"

For each region, determining 'key routes' involved consideration of the types of trips undertaken by the three identified key tourist personas; those being the retired couple, the active family and the young professionals. Trip origins identified include short day trips from within the region and from greater NSW, key cities such as Canberra and Sydney and travel from interstate. Analysis also considers more relaxed-pace exploring through the region.

Analysing key "journey enablement" sites for fast charging

Depending on the origin and direction of travel, those arriving into each region will arrive with differing charge levels remaining, having most recently recharged at locations that are driven by amenities, their driving needs, and their remaining levels of charge. Journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

To understand where drivers may seek to recharge and therefore where key journey enablement sites for fast charging exist, we considered travellers driving to each region from major centres of Adelaide, Melbourne, Canberra, Sydney and Brisbane. The results are presented by region below.

Creating a map of highway, opportunity, destination and stay-over charging

The information provided by each council was combined with locations identified through Point of Interest tools and regional tourism websites. A list of suitable sites was identified, with ideal

charger sizes for each site determined according to expected demand. This was further refined through an analysis of upstream constraints and a final recommended charger size/type for each site is presented by region below.

Considering peak travel flows to understand charging infrastructure density

Peak traffic flows and modelled inbound vehicle state of charge and related charging needs provide insight into the number of vehicles expected to seek charging within the region and the time spent charging. This informs the total number of charging plugs required to satisfy the demand for the various types of charging services.

Analysis of inbound traffic origins and existing and likely future charging locations results in an expected average amount of charging demanded by vehicles in each region. The results are presented in the following table and inform analysis of each region presented below.

Average charging required upon arrival in the region			
Region	Average (kWh)	Region	Average (kWh)
Bathurst	23	Lachlan	33
Blayney	27	Oberon	29
Cabonne	27	Orange	27
Cowra	26	Parkes	25
Forbes	25	Weddin	26

It is assumed that local usage of chargers is limited to an average of 3 kWh due to the typical duration of parking and their ability to charge in the convenience of their nearby home.

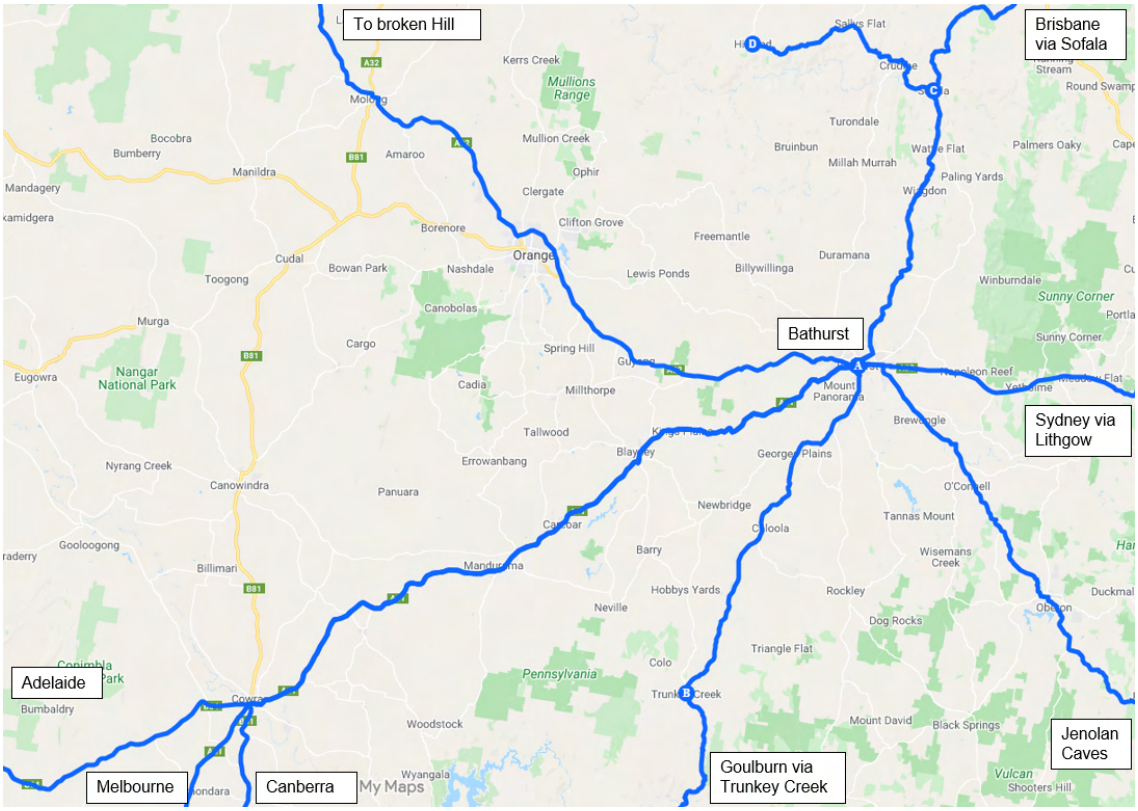
Bathurst

Identified key routes

The Sydney to Bathurst route via Lithgow is a popular tourist drive and a vital travel corridor across the Great Dividing Range for the Central NSW region. The Mid-Western Highway to Orange and beyond to Broken Hill, and Mitchell Highway to Cowra are important regional interconnectors for those travelling through Central NSW. Cowra is a key city connecting the region to Canberra, Melbourne and Adelaide.

Sofala Road is also a key regional connector to the North of the region and via Sofala to Queensland, while to the South key regional connectors include Rockley Road via Vale Road to Goulburn and O'Connell Road to Oberon. These routes are mapped below:

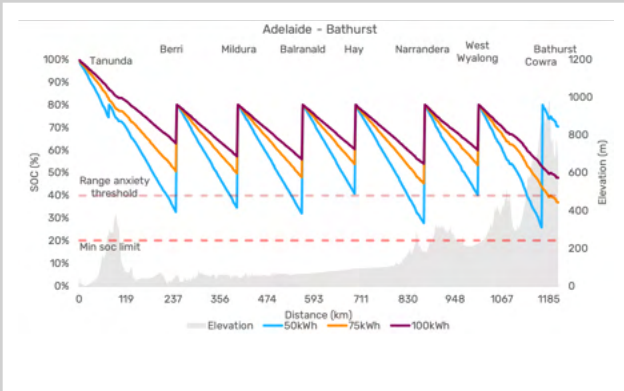
Map of key routes around Bathurst

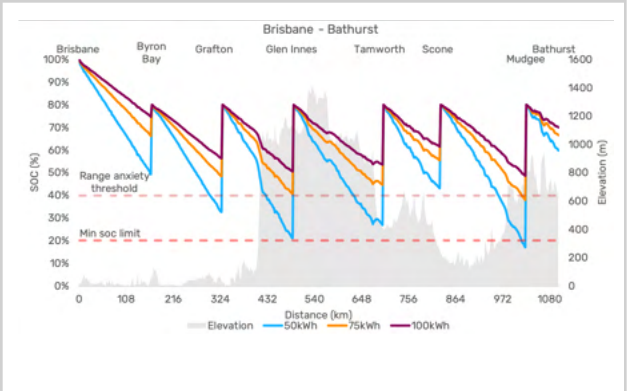


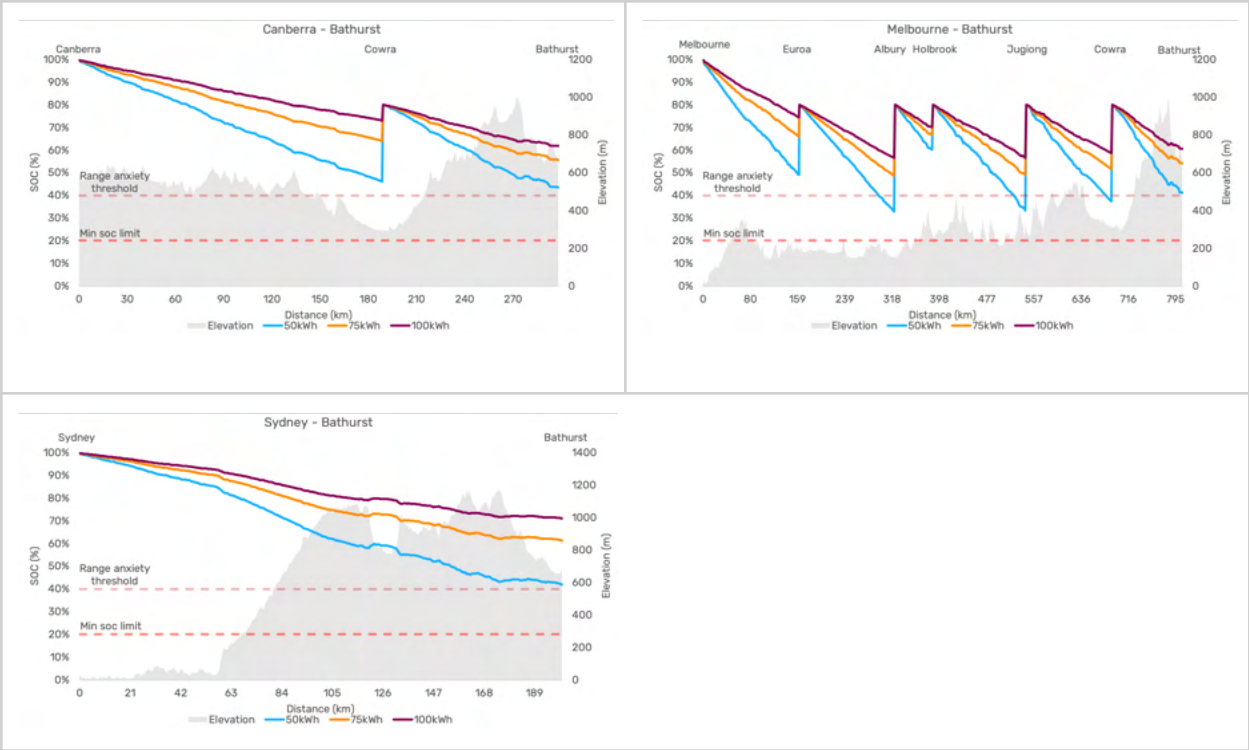
Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region







Key takeaways from this analysis include:

- Lithgow is likely an important location for drivers seeking to break up the journey West from Sydney over the Great Dividing Range and into Central NSW. For these drivers, a brief top up charge is likely before continuing the journey West.
- Top-up charging at Cowra is a key enabler of electric vehicles travelling into Bathurst from the South.
- Top-up charging at West Wyalong is a key enabler of electric vehicles travelling into Bathurst from the West.
- Travelling to Bathurst from the North in all but the highest range electric vehicles requires journey enabling charging in a smaller city such as Mudgee, Scone or another similar location to the North.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.
- Crookwell or Trunkey Creek are enablers of the journey South to Goulburn from Bathurst.
- Jenolan is a key location for destination charging and facilitation of the return journey through Central NSW.
- Sofala may be an ideal location for journey enablement charging, facilitating travel North of Bathurst and West to Hill End.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership#	Unconstrained charger specifications	Substation constraints[31]	Constrained charger specifications	Notes
Sofala Memorial Hall/Pioneer Park	Council	11-22kW 50-100kW	DS capacity available: ~ 40kVA ZS capacity available: 47.6 MVA	11-22kW	Warning: Chargers rated at 50kW and above are not economically viable for the site due to DS capacity constraints that would trigger payment of a DS upgrade. Site notes: Street light at the address.
Rail Museum	Council	11-22kW 50-100kW	DS capacity available: ~ 120kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Open 6 days per week, closes 4:30pm. Nearby facilities include a large parking space, town centre, parks, cafes and eateries, toilets, museum and train station.
Lions Club / Berry Park	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 47.6 MVA	11-22kW	Site notes: Nearby facilities include public toilets, public BBQ, shelter, lighting, skate park, playground, parks, and a showground.
National Motor Racing Museum	Council	11-22kW 50-100kW	DS capacity available: ~ 120kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW Facility assessed as able to install up to 22kW without significant upgrade	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Open 6 days, closes at 4.30PM. Nearby facilities include motel lodging, public toilets, Mount Panorama Motor Racing Circuit and cafes.

[31] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, via their connection request mechanisms prior to connecting EV chargers.

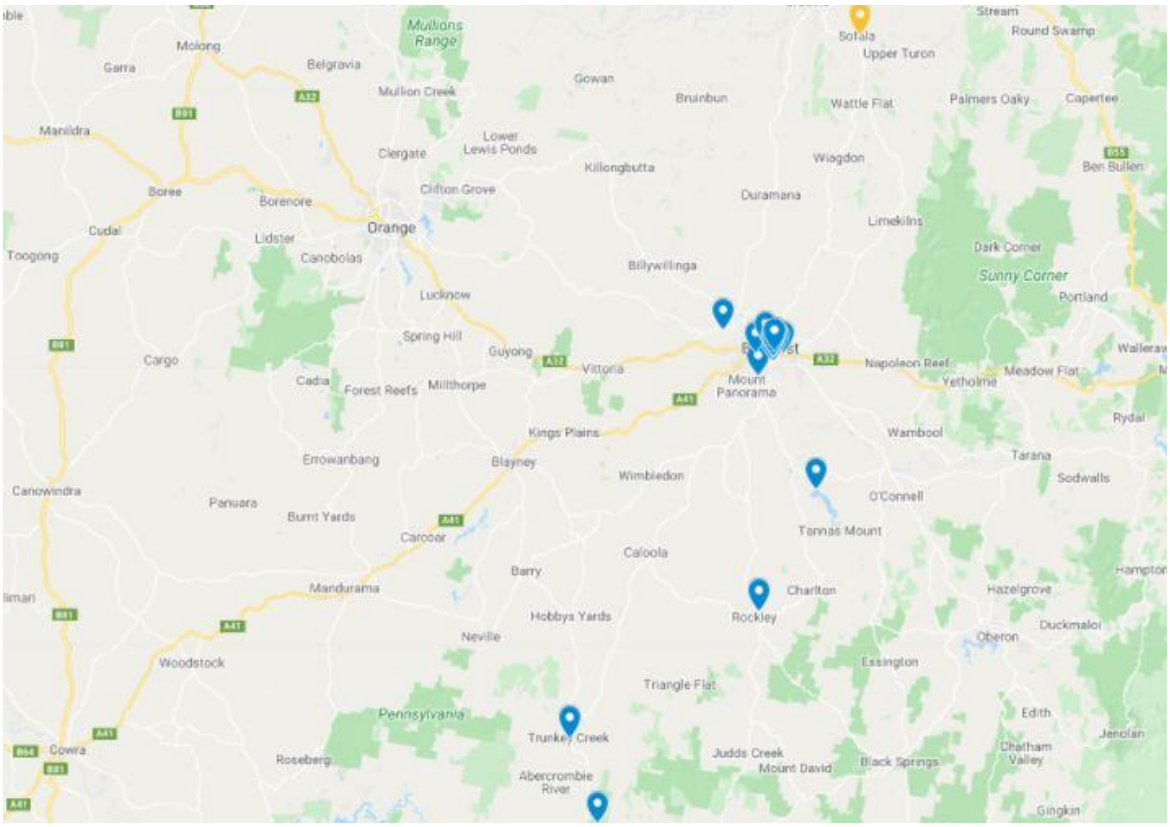
Bathurst Regional Art Gallery	Council	11-22kW 50-100kW	DS capacity available: ~ 240kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Open 6 days, variable hours. Nearby facilities include parking space, town centre, parks, cafes and eateries.
Bathurst Visitor Information Centre	Council	50-100kW Highway 150kW+ DC	DS capacity available: ~ 120kVA ZS capacity available: 47.6 MVA	50-100kW	Site notes: Nearby facilities include parking, cafe, EV fast charging, visitor information resources, and night lighting.
Bathurst Information Bay	Council	50-100kW	DS capacity available: ~ 60kVA ZS capacity available: 47.6 MVA	50-100kW	Site notes: Nearby facilities include flood lighting, parking, public toilets, playground and a park.
Australian Fossil and Mineral Museum	Council	11-22kW 50-100kW	DS capacity available: ~ 400kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Open 6 days. Nearby facilities include parking space, town centre, parks, cafes and eateries.
Trunkey Creek rest area	Council	11-22kW 50-100kW	DS capacity available: 1x40kVA ZS capacity available: 0.25 MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shelter, public toilets and a hotel.
Abercrombie Caves	NPWS	11-22kW	DS capacity available: 1x6kVA ZS capacity available: 0.25 MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shelter, public toilets, a cafe, caves, public BBQs and showers.

Steven's Park, Rockley	Council	11-22kW	DS capacity available: 1x40kVA ZS capacity available: 0.25 MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park, pub/accom.
McDonald's Council car park	Council	11-22kW 50-100kW	DS capacity available: 1x300kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a restaurant, aquatic centre, park and accommodation.
Bathurst Town Square	Council	11-22kW 50-100kW	DS capacity available: 1x600kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Nearby facilities include shopping, cafe, restaurants, service stations and a park.
Chifley Dam	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 47.6 MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include Bathurst Aqua Park, camping and a tourism destination.
Manning Aquatic Centre	Council	11-22kW	DS capacity available: 1x200kVA ZS capacity available: 47.6 MVA	11-22kW	Site notes: Open 7 days (6AM - 8PM). Nearby facilities include parking space, town centre, public toilets, parks, cafes and eateries.
Armada Bathurst Shopping Centre	Private	11-22kW 50-100kW	DS capacity available: 3x300kVA and 1x600kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Open 7 days, variable hours. Nearby facilities include parking space, town centre, shopping precinct, parks, cafes and eateries.

Bathurst Hotel / Motel x 19	Private	<11kW	DS capacity: Site by site variability ZS capacity available: 47.6 MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
Bathurst bed and breakfast, apartments, camping etc	Private	<11kW	DS/ZS capacity: Site by site variability	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
Bathurst Hospital	Private	11-22kW	DS capacity available: 2x600kVA & 1x126kVA ZS capacity available: 47.6 MVA	11-22kW	Site notes: Open 24 hours. Nearby facilities include parking, entertainment precinct, parks and a playground. Caution: Highly contested parking spaces.
ALDI Bathurst	Private	11-22kW 50-100kW	DS capacity available: 1x300kVA ZS capacity available: 47.6 MVA	11-22kW 50-100kW	Site notes: Open 7 days (8.30AM - 8 PM). Nearby facilities include parking space, town centre, shopping precinct, parks, cafes and eateries. Caution: Highly contested parking spaces.
Existing service stations	Private	50-100kW Highway 150kW+ DC	DS capacity and ZS capacity: Site by site variability ZS capacity available: 47.6 MVA		Site notes: Open 7 days. Nearby facilities include established amenities for vehicular visitation.
Historic tourist sites e.g. at Hill End	Private	11-22kW	ZS capacity: Site by site variability ZS capacity available: 47.6 MVA	11-22kW	Capacity varies across the numerous sites, but low power overnight chargers are recommended
Abercrombie House	Private	11-22kW 50-100kW	DS capacity available: ~ 6kVA ZS capacity available: 47.6 MVA	<11kW	Site notes: Closed Mon & Tues and has variable hours (9AM - 5PM). Nearby facilities include garden grounds.

[#] Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.
Note: DS refers to Distribution Substation and ZS refers to Zone Substation.

Shortlisted sites for Bathurst region



Note: Shortlisted sites in blue, orange for preferred sites

Peak traffic flows and resultant charging infrastructure density

The traffic flows for tourist vehicles and for local vehicles determine the demand for charging services in the region. The following table presents the peak traffic during an average day vs the peak traffic in peak season for Bathurst as well as its breakdown into its local and tourist components.

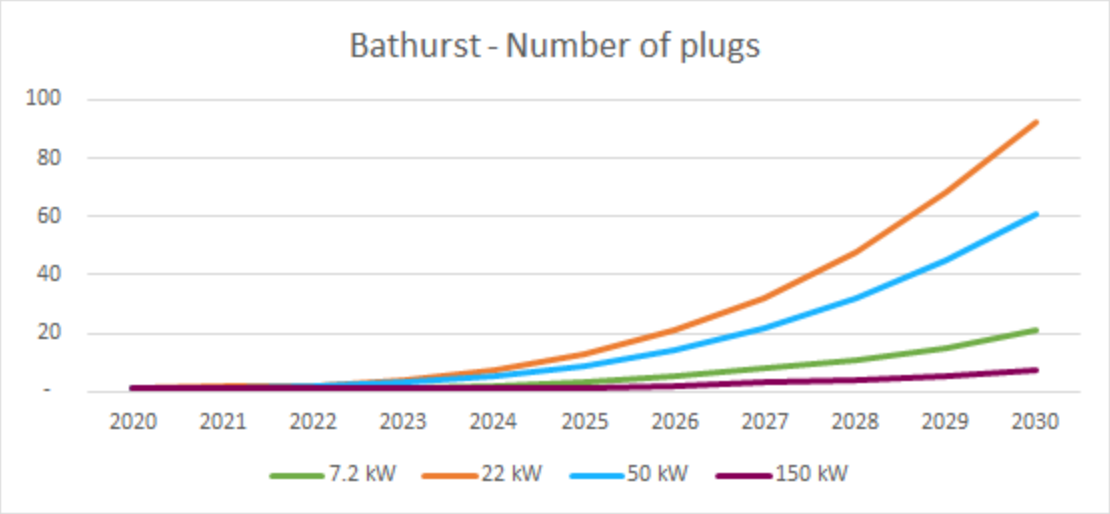
Peak traffic for Bathurst	
Traffic component	Peak hourly traffic
Estimated tourist vehicles	1,348
Estimated local vehicles	869
Total peak vehicles	2,217

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Bathurst in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	2	1	1	5
2022	1	2	2	1	6
2023	1	4	3	1	9
2024	2	7	5	1	15
2025	3	13	9	1	26
2026	5	21	14	2	42
2027	8	32	22	3	65
2028	11	48	32	4	95
2029	15	68	45	5	133
2030	21	92	61	7	181

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth of various charger types in terms of the number of charging plugs required for average energy consumption can be more clearly seen in the following graphs.

Number of charging plugs required for average charging needs



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

Mount Panorama attracts more than 200,000 visitors for the Bathurst 1000 annually, with the event attracting a peak of over 20,000 vehicles per day, more than 16 times higher than the peak number of visitors during other times of the year. This increase in the number of visiting vehicles will raise the demand for charging in the region. Based on the charging demand during the peak seasons it is estimated that there will be at least 2 times more charging plugs needed in total by 2030 to optimally satisfy demand for charging of electric vehicles and avoid long waiting times.

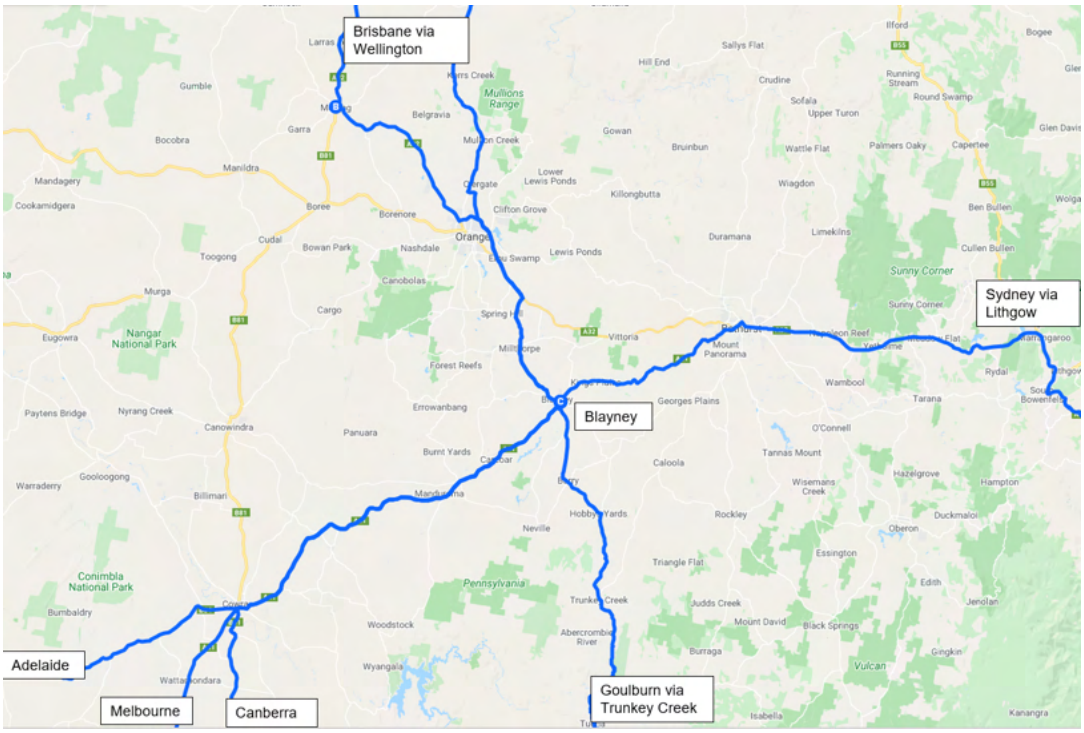
Blayney

Identified key routes

Blayney sits on the Mid Western Highway and is connected to all the major routes North, South, East and West via this link. The Mid Western Highway also connects Blayney to Sydney in the

East via Bathurst, to Melbourne, Adelaide and Canberra via Cowra to the South. Key inter-regional routes include Hobbys Yards Road South to Goulburn and Milthorpe Road to Orange via Milthorpe. These routes are mapped below:

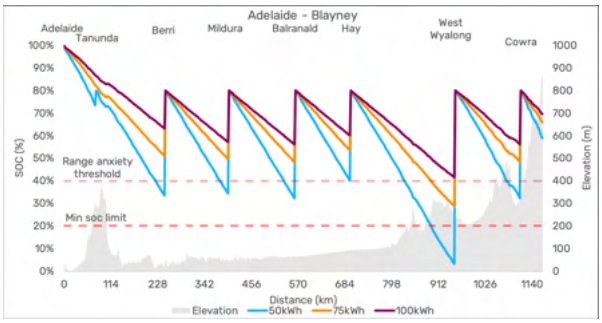
Map of key routes around Blayney

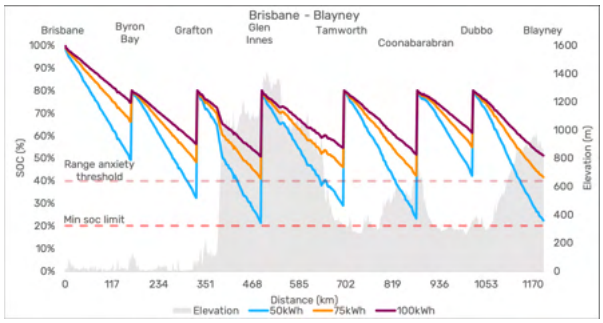


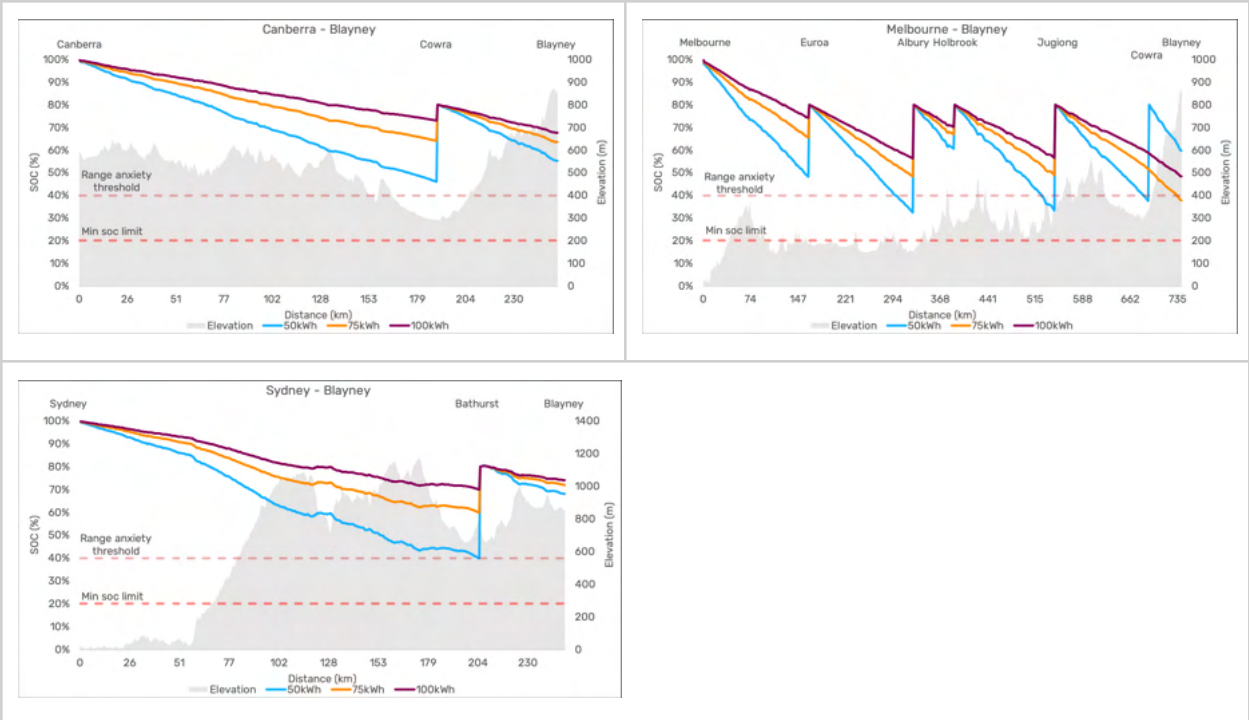
Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region







Key takeaways from this analysis include:

- The modest range EVs such as the currently popular Hyundai Ioniq and Nissan Leaf will be able to reach Blayney from Sydney or Canberra without needing to recharge, but are likely to take a rest-stop in Bathurst or Cowra respectively on the journey through.
- Electric vehicles approaching from the West will need to recharge at West Wyalong. While EVs from Melbourne will need top-up charging either at Cowra or Young (depending on the battery capacities).
- Travelling to Blayney from the North requires journey enabling charging stations at Dubbo and in smaller centres such as Coonabarabran or Tamworth.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership#	Unconstrained charger specifications	Substation constraints [32]	Constrained charger specifications	Notes
Blayney Visitor Information Centre	Council	11-22kW 50-100kW	DS capacity available: 1x120kVA ZS capacity available: 12.8 MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shopping, bakery, cafe, accommodation and pharmacy.
Millthorpe Main Street	Council	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 12.8 MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include accommodation, cafes, accommodation, post office and a library.
Kurt Fearnley Park, Carcoar	Council	11-22kW	DS capacity available: 1x40kVA ZS capacity available: 12.8 MVA	11-22kW	Site notes: Nearby facilities include shopping, accommodation, restaurant and accommodation.
Carcoar Recreation Ground	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 12.8 MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities at the site are minimal.
Blayney Train Station	Council	11-22kW	DS capacity available: 1x125kVA ZS capacity	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal

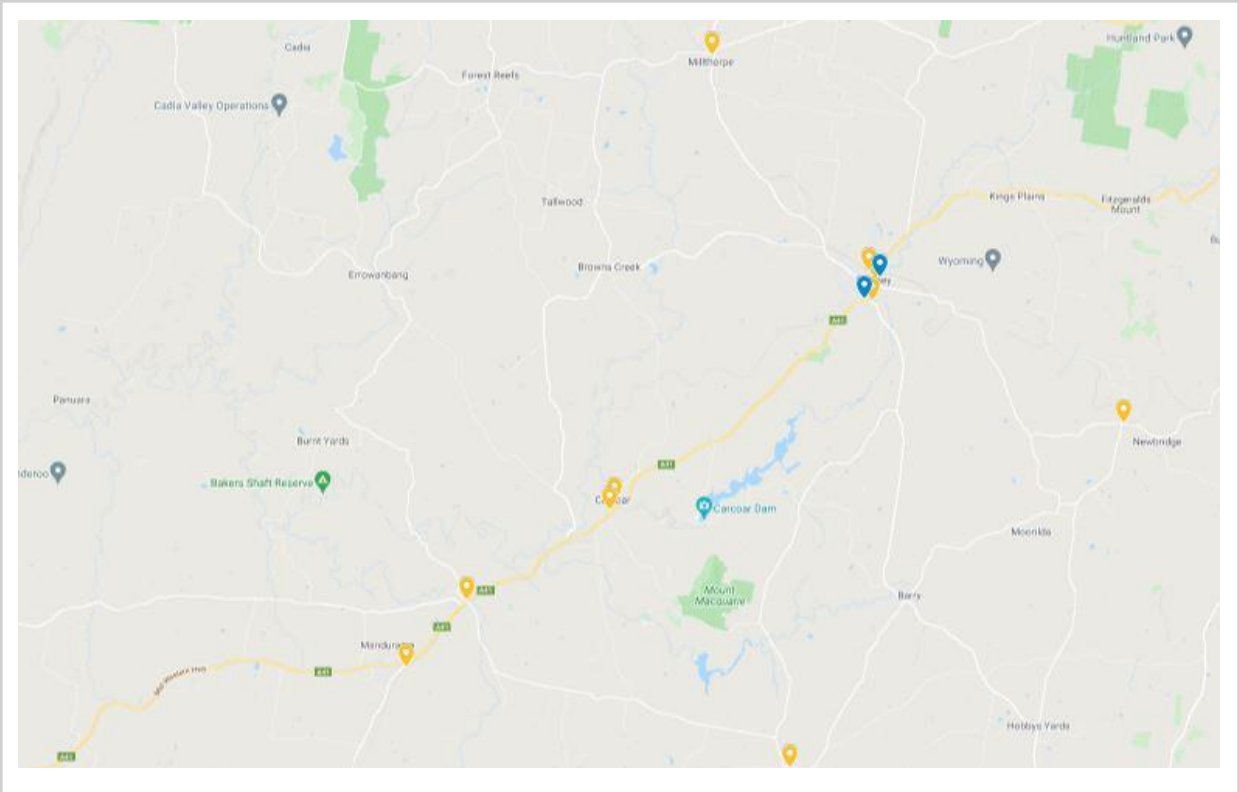
[32] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

			available: 12.8 MVA		request from site owner to firm up. Site notes: Nearby facilities include a service station, train station and food and drink options.
Heritage Park	Council	11-22kW 50-100kW	DS capacity available: 1x40kVA ZS capacity available: 12.8 MVA	11-22kW	Warning: Chargers above 22kW may not be economically viable due to DS capacity constraints and likely requirement to upgrade. Site notes: Open 24hrs. Nearby facilities include street lights, public toilets, playground, BBQ and police station.
Neville Siding	Council	11-22kW	DS capacity available: 1x40kVA ZS capacity available: 12.8 MVA	11-22kW	Site notes: Nearby facilities include a park, accommodation and tourist attraction.
Royal Hotel Mandurama	Private	<11kW	DS capacity available: 1x80kVA ZS capacity available: 12.8 MVA	<11kW	Site notes: Nearby facilities include a post office and accommodation.
Gladstone Hotel Newbridge	Private	<11kW	DS capacity available: 1x40kVA ZS capacity available: 12.8 MVA	<11kW	Site notes: Nearby facilities include a train station, art gallery and accommodation.
Royal Hotel Lyndhurst	Private	<11kW	DS capacity available: 1x40kVA ZS capacity available: 12.8 MVA	<11kW	Site notes: Nearby facilities include a park, food options and accommodation.
Blayney Hospital and Health Services	Private	11-22kW	DS capacity available: 1x126kVA ZS capacity available: 12.8 MVA	11-22kW	Site notes: Open 7 days, 9am-8pm. Nearby facilities include shelter, public toilets, food and cafe options.

Bernardi's Super IGA	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 12.8 MVA	11-22kW 50-100kW	Site notes: Open 7 days, 7am-8pm. Nearby facilities include a large parking area, sufficient network facilities, pharmacy, post office, service station.
Blayney Hotel / Motel x3	Private	<11kW	DS capacity and ZS capacity: Site by site variability ZS capacity available: 12.8 MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.

[#] Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.
Note: DS refers to Distribution Substation and ZS refers to Zone Substation.

Shortlisted sites for Blayney region



Note: Shortlisted sites in blue, orange for preferred sites[33]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

Peak traffic for Blayney	
Traffic component	Peak hourly traffic
Peak tourist vehicles	56
Peak local vehicle	139
Total peak vehicles	195

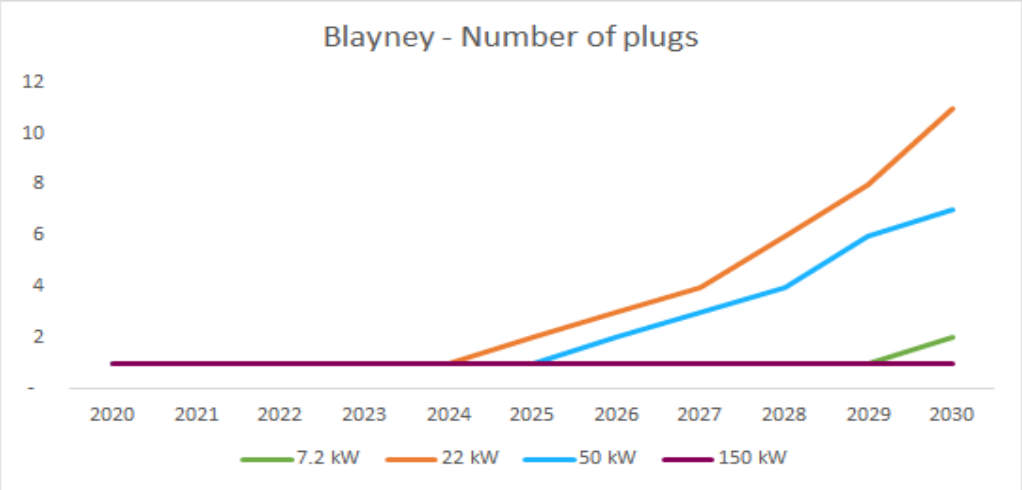
The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in

[33] The sites for Blayney Hotel/Motels are not reflected as they are too numerous.

many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Blayney in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	1	1	1	4
2024	1	1	1	1	4
2025	1	2	1	1	5
2026	1	3	2	1	7
2027	1	4	3	1	9
2028	1	6	4	1	12
2029	1	8	6	1	16
2030	2	11	7	1	21

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation

providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

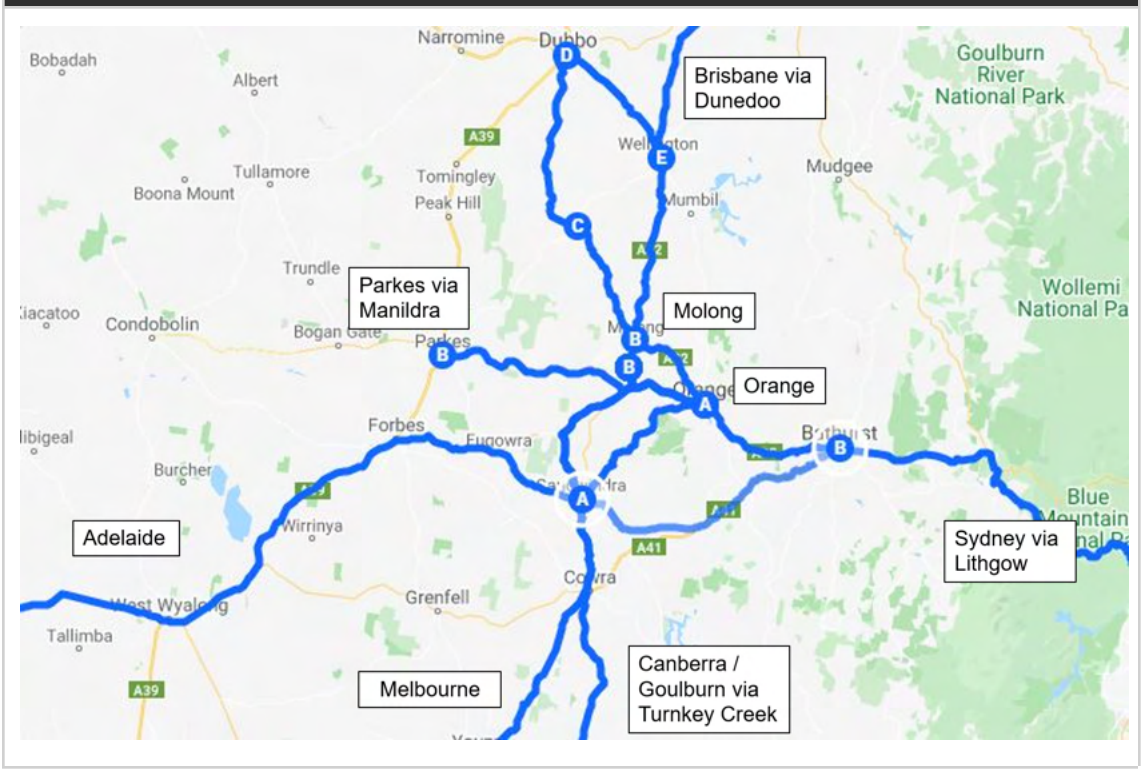
Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events. However, traffic in the region will increase due to large events in the neighbouring regions like Bathurst and Orange. This increase in traffic volumes will require some additional charging plugs to be installed to facilitate inter-regional travel and to optimally satisfy the charging demand of electric vehicles and avoid long waiting times.

Cabonne

Identified key routes

Key cities Molong and Canowindra within Cabonne are connected North, South and East via Peabody Road. Peabody Road connects with the Escort Way in the South and Mitchell Highway in the North. It also provides a link to connect inter-regional travel between Molong (North) and Cowra (South). These routes are mapped below:

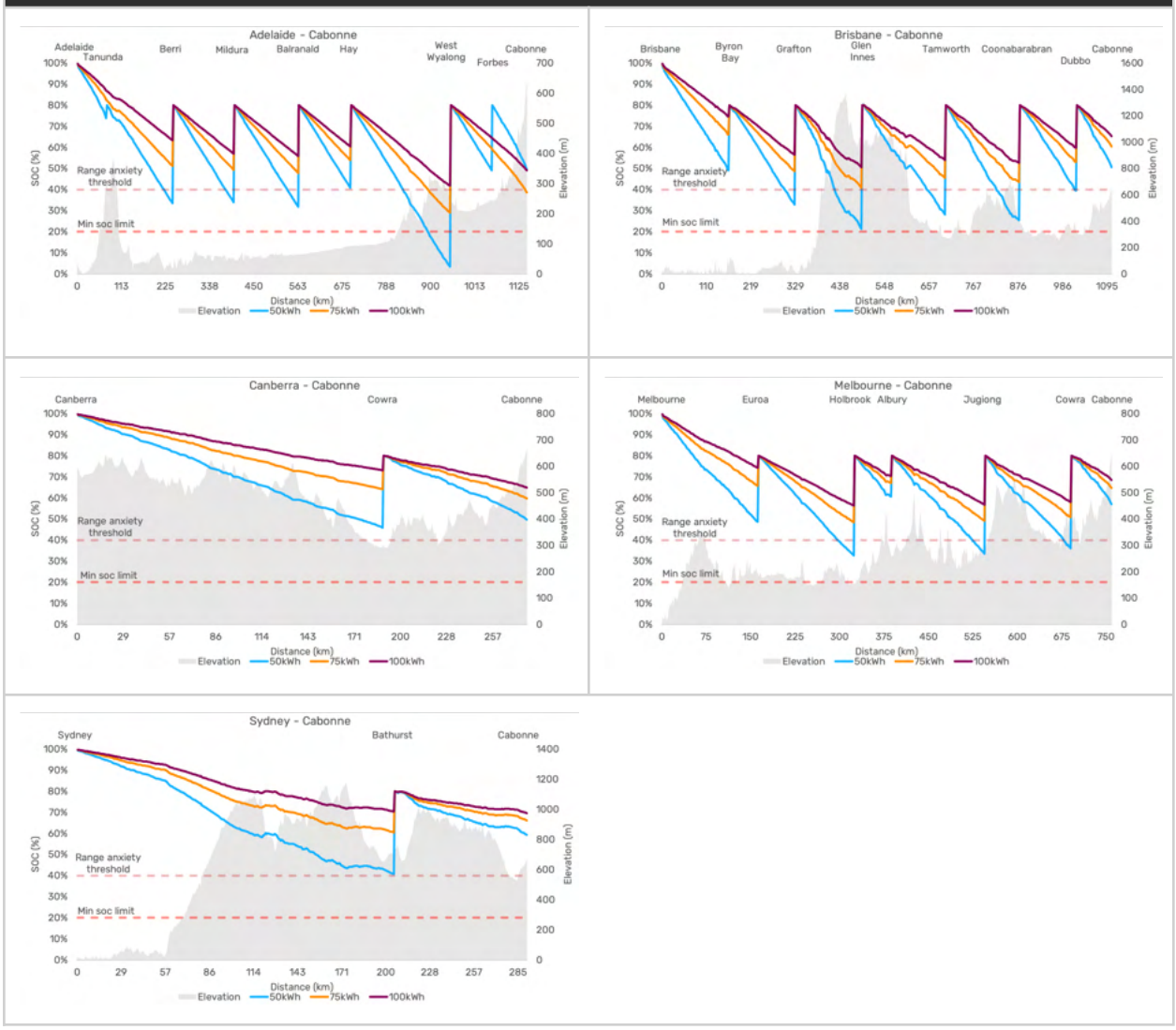
Map of key routes around Cabonne



Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region



Key takeaways from this analysis include:

- Cabonne from Sydney will be a challenge for vehicles with less than 50kWh batteries such as the currently popular Hyundai Ioniq and Nissan Leaf. It is likely those travelling from the East will opt for a rest-stop in Bathurst and take a charge-level boost.

- Lithgow and Orange are also likely journey enabling sites for travellers from the East heading into the West of Central NSW.
- While electric vehicle drivers will be able to reach Cabonne from Canberra without needing to recharge on the way, it is likely that most will stop at Cowra for a rest-stop and top up with charge.
- Drivers coming from the West to Cabonne will need to recharge at West Wyalong and those coming from South Eastern Australia are likely to take a rest-stop and recharge at Cowra on their way to Cabonne.
- Travelling to Cabonne from the North requires journey enabling charging stations at Dubbo and in smaller centres such as Coonabarabran.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership[#]	Unconstrained charger specifications	Substation constraints[34]	Constrained charger specifications	Notes
Molong Village Green	Council	11-22kW 50-100kW	DS capacity available: 1x100kVA ZS capacity available: 0.1MVA	11-22kW	Warning: ZS capacity constrained. Site capacity upgrades may trigger ZS upgrades. Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Nearby facilities include cafes, restaurants, a bakery and a park.
Canowindra Memorial Park	Council	11-22kW	DS capacity available: 1x126kVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the

[34] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

			ZS capacity available: 14.1MVA		site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park, museum and playground.
Lions Park, Canowindra	Council	11-22kW	DS capacity available: 1x125kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park and playground.
Age of Fishes Museum / Canowindra Historical Society & Museum / Canowindra Memorial Park	Council	11-22kW 50-100kW	DS capacity available: 1x80kVA* and 1x126kVA ZS capacity available: 15.6MVA	11-22kW 50-100kW	Warning: Chargers with rated power above 50kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Open 7 days, 10am-4pm. Nearby facilities include street lights, electrical services at the site, public toilets, park, Services & Citizens Club, pharmacy, bottle shop and a supermarket.
Molong Railway Train Station	Council	11-22kW	DS capacity available: 1x200kVA ZS capacity available: 14.1MVA	11-22kW	Site notes: Nearby facilities include shopping, roadside parking.
Cabonne Food & Wine Cultural Centre, Molong	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park, accommodation and a Community Centre.

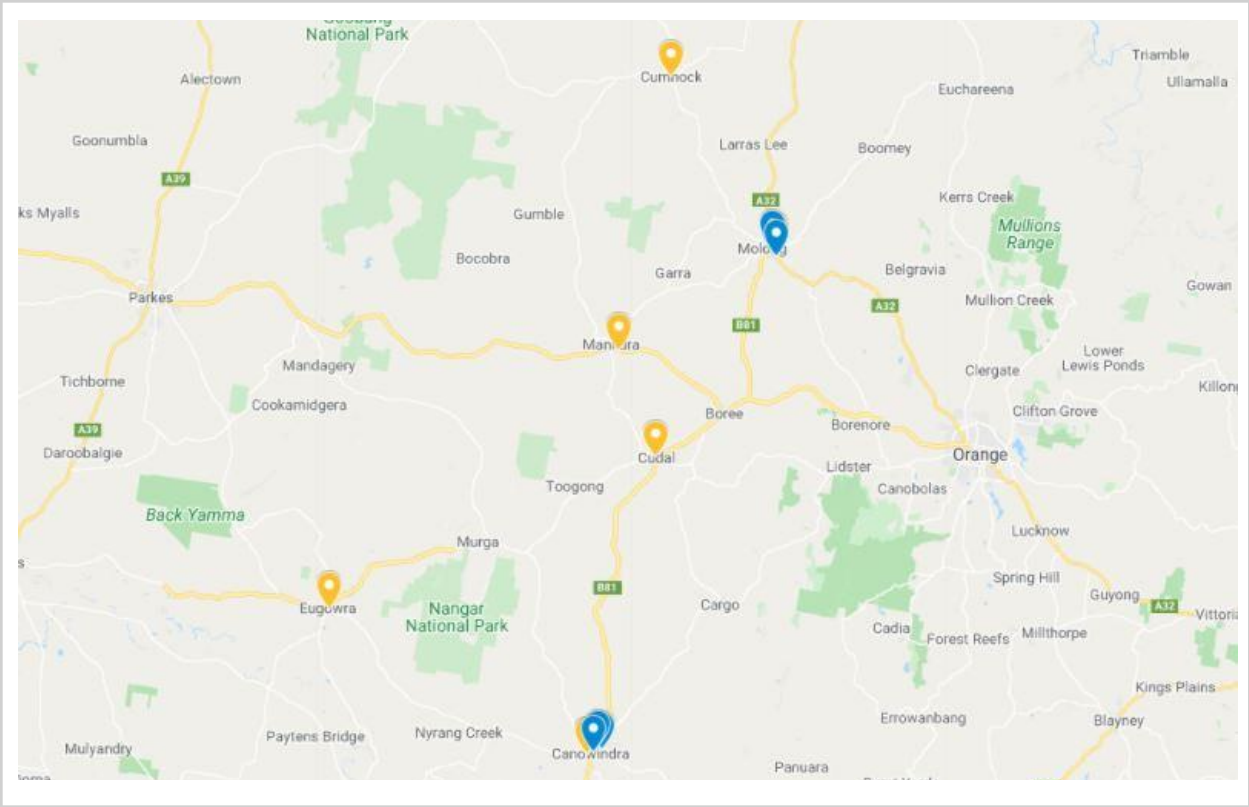
Cumnock War Memorial Park	Council	11-22kW	DS capacity available: 1x100kVA ZS capacity available: 0.75MVA	11-22kW	Warning: ZS capacity constrained. Site capacity upgrades may trigger ZS upgrades. Site notes: Nearby facilities include accommodation, Cumnock Bowling Club and a park.
Grevillea Avenue Park, Eugowra	Council	11-22kW	DS capacity available: Data unavailable ZS capacity available: 15.6MVA	11-22kW	Site notes: Nearby facilities include a park.
Molong Museum and Historical Society	Council	11-22kW 50-100kW	DS capacity available: 1x100kVA ZS capacity available: 0.1MVA	11-22kW	Warning: ZS capacity constrained. Site capacity upgrades may trigger ZS upgrades. Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Open on Tues and Thurs 11AM-4PM. Nearby facilities include a trade centre, public toilets, food and drink options.
Dr. Ross Memorial Recreation Ground, Molong	Council	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 0.1MVA	11-22kW	Warning: ZS capacity constrained. Site capacity upgrades may trigger ZS upgrades.[35] Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Nearby facilities include public

[35] Essential energy predicts capacity investment in the Annual Planning Report so this should be used as a mitigating argument by project proponents.

					toilets, a skate park, a bakery and a service station.
Rotary Park, Molong	Council	11-22kW 50-100kW	DS capacity available: 1x40kVA ZS capacity available: 0.1MVA	11-22kW	Warning: ZS capacity constrained. Site capacity upgrades may trigger ZS upgrades. Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Nearby facilities include street lights, public toilet and electrical services at site.
Canowindra Soldiers memorial Hospital	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 15.6MVA	11-22kW	Warning: ZS capacity constrained. Site notes: Open 24hrs. Public toilet, shelter, but minimal other amenities.
Canowindra International Balloons Challenge	Council	11-22kW 50-100kW	DS capacity available: 2x200kVA ZS capacity available: 15.6MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a tourist attraction, but minimal other facilities available.
Morris Park, Canowindra	Council	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 15.6MVA	11-22kW	Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Open 24hrs. Nearby facilities include public toilets, a park, car parking and public BBQs.

Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.

Shortlisted sites for Cabonne region



Note: Shortlisted sites in blue, orange for preferred sites

Note: DS refers to Distribution Substation and ZS refers to Zone Substation.

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

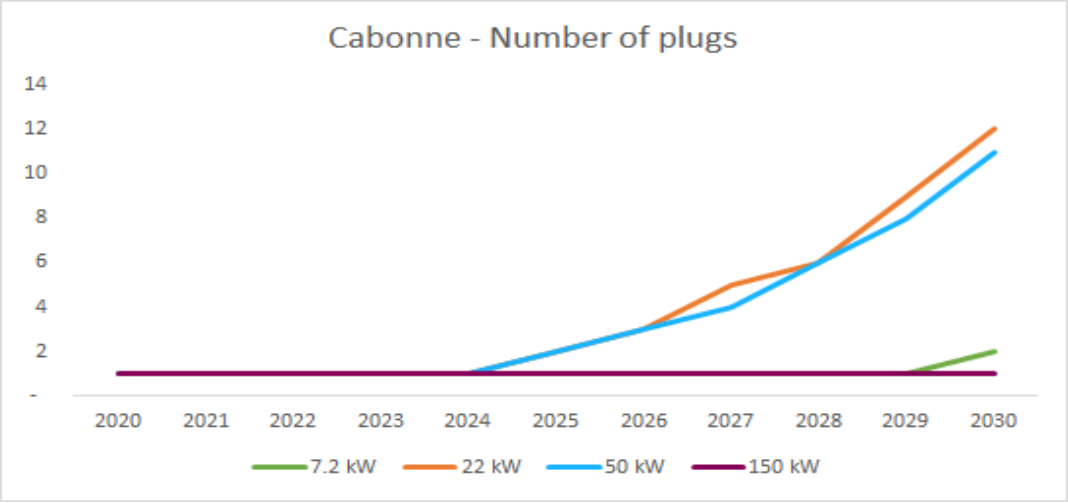
Peak traffic for Cabonne	
Traffic component	Peak hourly traffic
Peak tourist vehicles	69
Peak local vehicle	213
Total peak vehicles	282

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in

many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Cabonne in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	1	1	1	4
2024	1	1	1	1	4
2025	1	2	2	1	6
2026	1	3	3	1	8
2027	1	5	4	1	11
2028	1	6	6	1	14
2029	1	9	8	1	19
2030	2	12	11	1	26

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation

providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events. However, traffic in the region will increase due to large events in the neighbouring regions like Orange and Bathurst. This increase in traffic volumes will require some additional charging plugs to be installed to facilitate inter-regional travel and to optimally satisfy the charging demand of electric vehicles and avoid long waiting times.

Cowra

Identified key routes

The Sydney to Cowra route via Lithgow, Bathurst and Blayney is a popular tourist drive and a vital travel corridor across the Great Dividing Range for the Central NSW region, while Cowra is the connection point for travellers heading South towards Adelaide, Canberra and Melbourne.

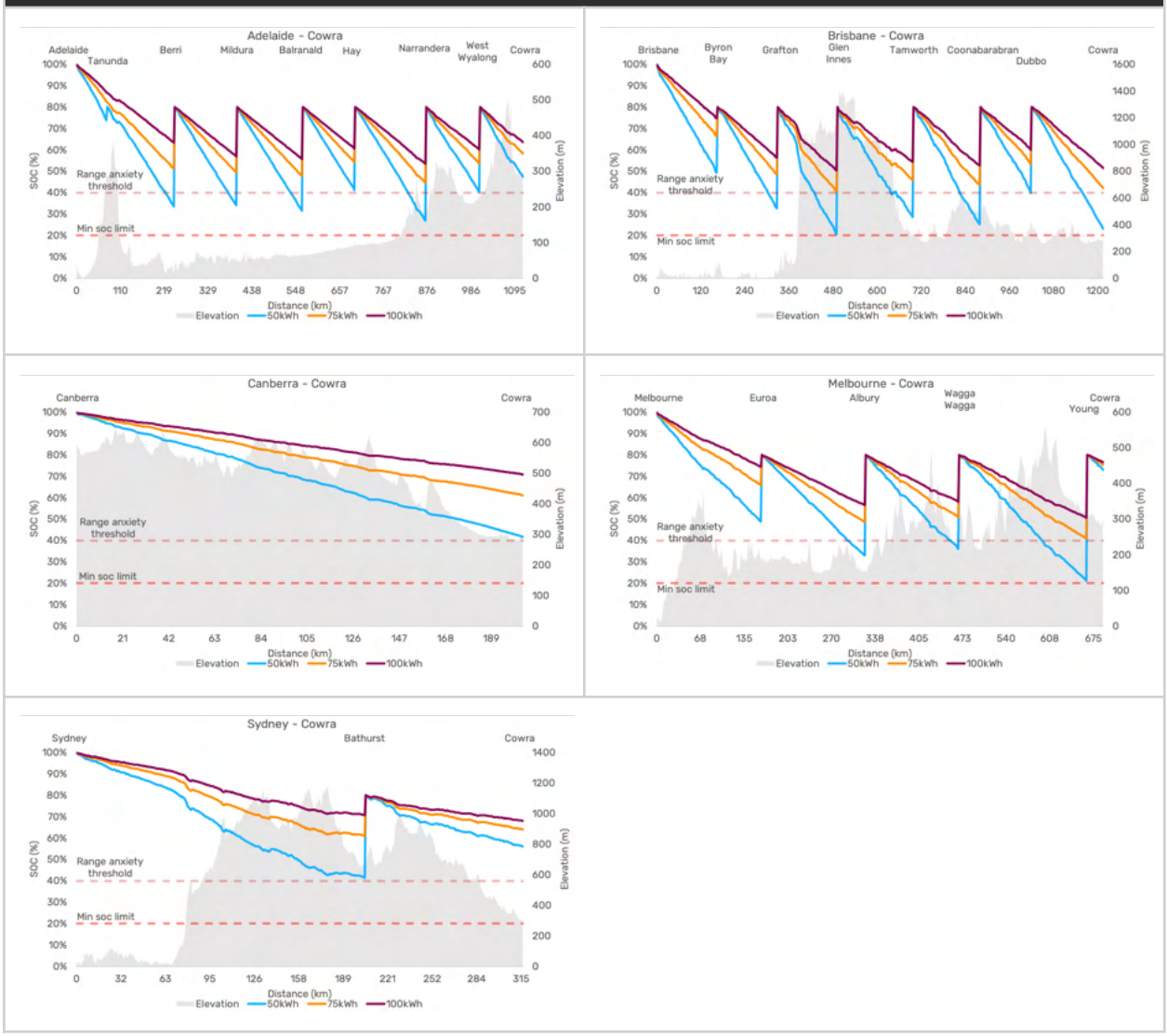
The Mid Wester Highway East towards Sydney and West towards Adelaide is a major cross-country route and pathway across Central NSW, Lachlan Valley Way connects South to Canberra and North to Parkes, and the Olympic highway connects travellers heading South towards Melbourne or North towards Sydney. Cowra is a critical hub for travellers in the South of Central NSW.

Map of key routes around Cowra

Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region



Key takeaways from this analysis include:

- Cowra from Sydney will be a challenge for vehicles with less than 50kWh batteries, which represents most electric vehicles on the market in 2020. Lithgow and Bathurst are likely important recharging locations for travellers heading West into Central NSW, especially those seeking to take a rest-stop.

- Travellers driving to Cowra from Canberra in electric vehicles are unlikely to need to recharge along the journey; however, Boorowa and Young are common rest-stop destinations for drivers making the journey.
- Electric vehicles travelling North-East from West of Central NSW to Cowra are likely to stop for a break and boost to battery charge at West Wyalong, with this city becoming an electric vehicle gateway to the region from the West.
- Travellers from Melbourne heading North to Cowra require journey-enabling charging at Wagga Wagga, and it is likely drivers will choose to take a rest-stop at Young, taking advantage of the opportunity to top up on charge.
- Travelling to Cowra from the North requires journey enabling charging stations at Dubbo and in smaller centres such as Coonabarabran.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership#	Unconstrained charger specifications	Substation constraints[36]	Constrained charger specifications	Notes
Cowra Japanese Garden & Cultural Centre	Council	11-22kW 50-100kW	DS capacity available: 1x40kVA ZS capacity available: 14.1MVA	11-22kW	Site notes: Nearby facilities include shopping, accommodation, cafes and food and drink options.
Wyangala Dam	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities are limited.
Cowra Visitor Information	Council	50-100kW	DS capacity available:	50-100kW	Site notes: Open 7days 9am-5pm. Nearby

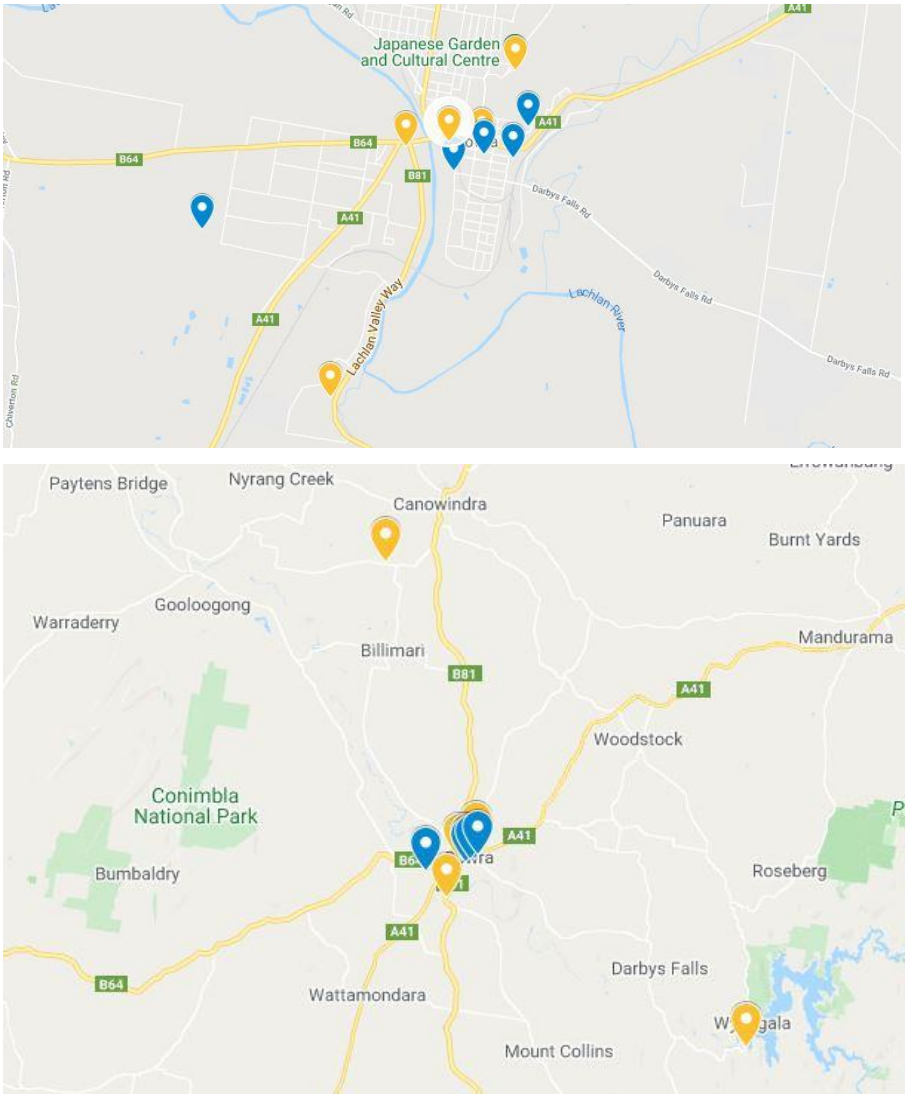
[36]Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

Centre			1x126kVA ZS capacity available: 11.6MVA		facilities include a service station, eateries and a Tesla Destination Charger.
Cowra Aquatic Centre	Council	11-22kW 50-100kW	DS capacity available: 1x120kVA ZS capacity available: 11.6MVA	11-22kW 50-100kW	Site notes: Open 7 days, close at 8pm (except on Tuesdays). Nearby facilities include a large parking space, a park and public toilets.
Cowra Japanese Garden	Council	11-22kW 50-100kW	DS capacity available: 1x20kVA & 1x40kVA ZS capacity available: 11.6MVA	11-22kW	Warning: Chargers with rated power above 22kW may not be economically viable due to DS capacity constraints that might lead to a requirement to pay for DS upgrades. Site notes: Nearby facilities include a car park, garden tourist attraction, cafe, public toilets and a park.
Rosnay Organic Farm	Private	11-22kW	DS capacity available: 1x4 kVA ZS capacity available: 14.1MVA	11-22kW	Warning: EV charger installation may not be viable for the site due to DS capacity constraints. Site notes: Nearby facilities include a wine cellar and accommodation.
Cowra Hotel / Motel x16	Private	<11kW	DS capacity and ZS capacity: Site by site variability. ZS capacity available: 11.6MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
The Quarry Restaurant & Cellar Door	Private	11-22kW	DS capacity available: 1x80 kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a restaurant and cellar door.

Kendal Street	Private	11-22kW	DS capacity available: 2x400 kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shopping, accommodation, cafes and food and drink options.
Cowra camping sites	Private	<11kW	DS capacity: Site by site variability ZS capacity available: 11.6MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
ALDI (Fitzroy Street)	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 11.6MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a large parking space, accommodation, shops and a service station.
Woolworths (Vaux Street)	Private	11-22kW 50-100kW	DS capacity available: 1x300kVA ZS capacity available: 11.6MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a large parking space, Service NSW, pharmacy, post office, restaurants, accommodation, Cowra Bowling and Recreation Club, Cowra Information & Neighbourhood Centre.
Cowra Airport	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 11.6MVA	11-22kW 50-100kW	Nearby facilities include a large parking space and a Rural Fire Service.
TAFE Carpark	Private	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 11.6MVA	11-22kW 50-100kW	Site notes: Open 5days, 8:30am to 6pm. Nearby facilities include a large parking space and Cowra Men's Shed.

Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.

Shortlisted sites for Cowra region



Note: Shortlisted sites in blue, orange for preferred sites[37]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

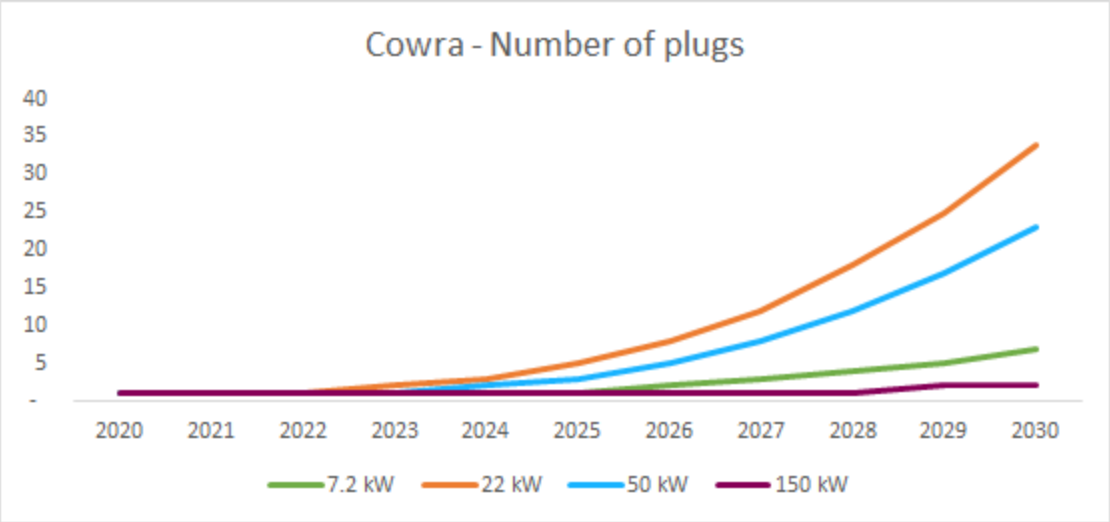
[37] The sites for Hotel/Motels, and Camping sites are not reflected as they are too numerous.

Peak traffic for Cowra	
Traffic component	Peak hourly traffic
Peak tourist vehicles	376
Peak local vehicle	283
Total peak vehicles	659

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Cowra in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	2	1	1	5
2024	1	3	2	1	7
2025	1	5	3	1	10
2026	2	7	5	1	15
2027	3	11	8	1	23
2028	4	17	11	1	33
2029	5	24	16	2	47
2030	7	32	21	2	62

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

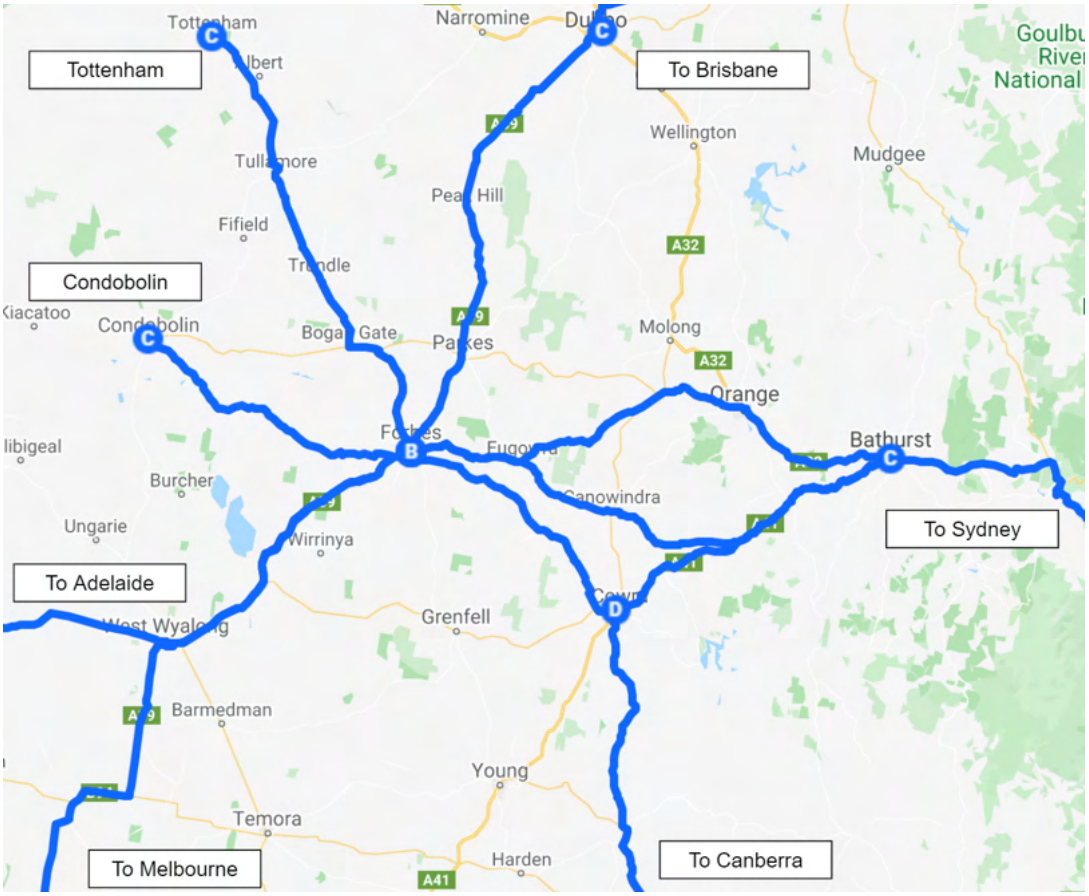
Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events. However, the Sydney to Cowra route via Lithgow, Bathurst and Blayney is a popular tourist route, while Cowra is the connection point for travellers coming from South towards Orange and Bathurst. The traffic in the region will increase due to large events in Orange and Bathurst. This increase in traffic volumes will require some additional charging plugs to be installed to facilitate inter-regional travel and to optimally satisfy the charging demand of electric vehicles and avoid long waiting times.

Forbes

Identified key routes

Forbes is a major junction between North/South and East/West traffic given its location on the Newell Highway, Escort Way and Lachlan Valley Way. The Newell Highway provides a link to connect inter-regional travel between Parkes and West Wyalong. Vehicles from the North and East approach Forbes through Parkes and from the South through West Wyalong. Identified key routes are mapped below:

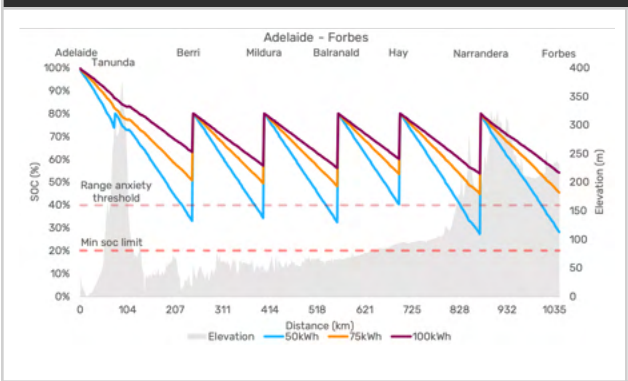
Map of key routes around Forbes

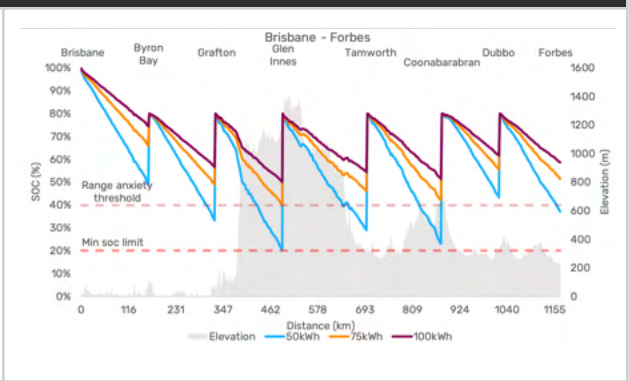


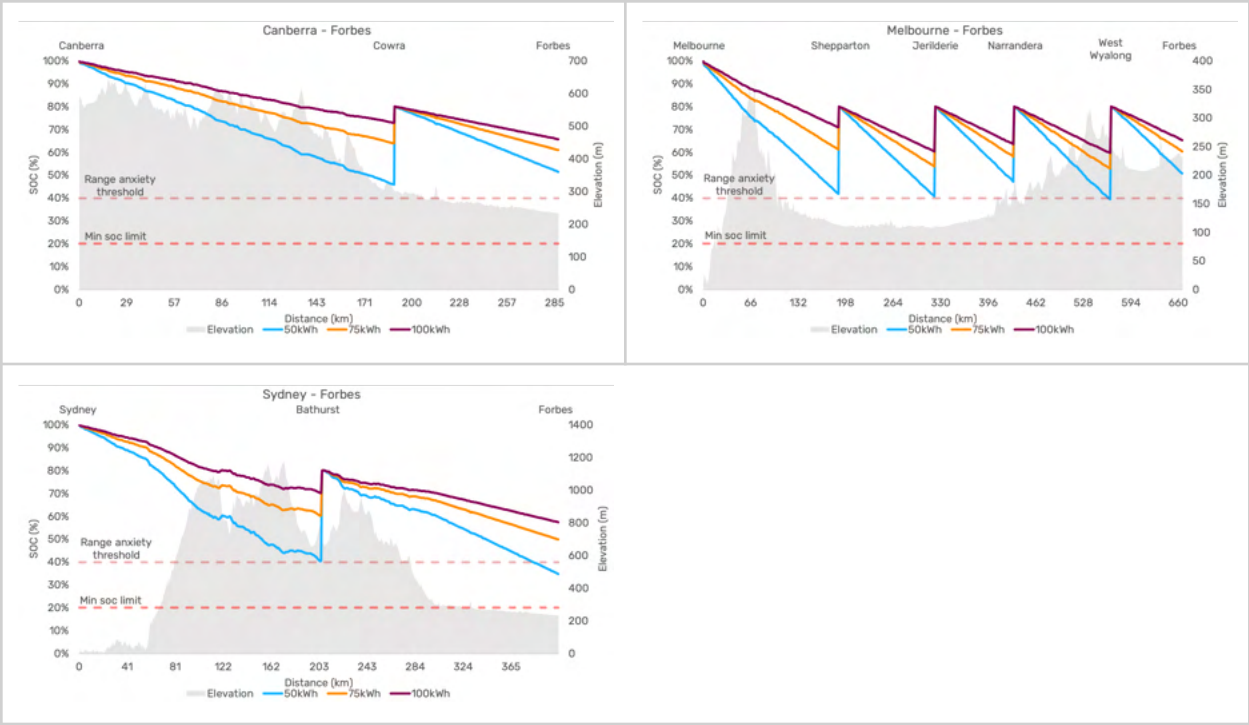
Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region







Key takeaways from this analysis include:

- Forbes is a major junction between North/South and East/West traffic given its location on the Newell Highway, Escort Way and Lachlan Valley Way and as such may be considered an important location to consider installing EV charging infrastructure.
- Forbes from Sydney will be a challenge for vehicles with less than 75kWh batteries. The vast majority of vehicles currently on the market will need to recharge at Bathurst.
- Bathurst is the most likely rest-stop for drivers heading West from Sydney to the West of Central NSW, though Orange and Blayney are also candidates for drivers taking the trip.
- Electric vehicles with less than 50 kWh such as the currently popular Hyundai Ioniq and Nissan Leaf will find it difficult to reach Forbes without stopping. For this reason, and for the sake of stopping for a rest-stop, Cowra is a very likely location travellers will recharge.
- Electric vehicles travelling North-East from Adelaide to Forbes are likely to stop for a break and boost to battery state of charge at Narrandera, as well as at Forbes if travelling through. Currently popular vehicles with less than 50 kWh are likely to also stop at West Wyalong to top up charge levels.
- Travelling to Forbes from the North requires journey enabling charging at Dubbo and in a smaller city such as Coonabarabran.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership#	Unconstrained charger specifications	Substation constraints[38]	Constrained charger specifications	Notes
Centre parking on Spring Street	Council	11-22kW	DS capacity available: 1x200kVA ZS capacity available: 18MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shopping, accommodation, cafes and food and drink options.
Junction Street free overnight camping area**	Council	<11kW	DS capacity available: 1x80kVA ZS capacity available: 18MVA	<11kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park.
Large car park on the Western side of Forbes CBD**	Council	11-22kW	DS capacity available: 1x126kVA ZS capacity available: 18MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shopping, bakery, car park, a park and cafes.
Stephan Field (park)	Council	11-22kW 50-100kW	DS capacity available: 2x200kVA	11-22kW 50-100kW	Site notes: Open 24hrs. Nearby facilities include street lights, skate park, netball fields, Woolworths,

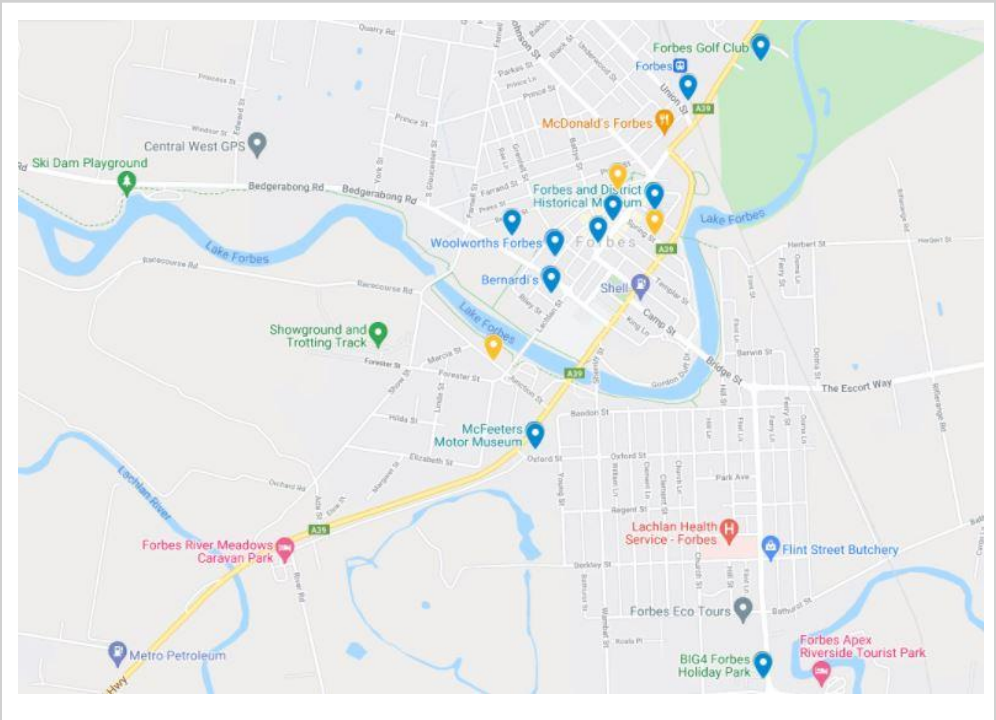
[38]Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

			ZS capacity available: 18MVA		shops, gym and a pharmacy.
Forbes Tourist Information Centre	Council	50-100kW	DS capacity available: 1x120kVA ZS capacity available: 18MVA	50-100kW	Site notes: Open 7 days per week. Nearby facilities include a McDonalds, truckstop, and accommodation.
Forbes and District Historical Museum	Council	11-22kW 50-100kW	DS capacity available: 1x100kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Open 7 days, 2pm- 4pm. Nearby facilities include accommodation, shops, and restaurants.
Bernardi's (shopping)	Private	11-22kW 50-100kW	DS capacity available: 2x126kVA and 1x200kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Open 7 days, 7am-9pm. Nearby facilities include shops, Forbes Sports and Recreation Club, library, Forbes Public School, and Woolworths.
Big4 Forbes Holiday Park	Private	11-22kW 50-100kW	DS capacity available: 1x20kVA and 1x80kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Nearby facilities beyond the holiday park itself are limited.
Woolworths Forbes	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Open 7 days, 7am-9pm. Nearby facilities include a large parking space, shops, Stephan Field, a gym, pharmacy, and Bernardi's supermarket.
McFeeters Motor Museum	Private	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Open 7 days, 9am-5pm. Nearby facilities include a hardware store.
Forbes Golf Club	Private	11-22kW	DS capacity available: 1x80kVA, 1x2kVA and 1x25kVA ZS capacity	11-22kW	Site notes: Open 7 days, 7am-6pm. Nearby facilities include accommodation.

			available: 18MVA		
Platypus Gallery	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Open 6 days. Nearby facilities include shops, hotels and restaurants.
Forbes Handicraft Centre & Art Gallery	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 18MVA	11-22kW 50-100kW	Site notes: Open 5 days, 9am-4pm. Nearby facilities include shops, a restaurant and accommodation. Parking is an issue.
Forbes Hotel / Motel x4	Private	<11kW	DS capacity: Site by site variability ZS capacity available: 18MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended
Forbes bed and breakfast, camping etc**	Private	<11kW	DS capacity: Site by site variability ZS capacity available: 18MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended

Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.
** The main form of protection from flooding of EVSE is elevation. Chargers should be installed above design flood levels using plinths or elevated platforms. Ideally if there are areas of the car park that are higher this should be the preferred location. Ordering the equipment with an IP rating of IP67 or greater. However this would be a custom order and may incur additional cost.

Shortlisted sites for Forbes region



Note: Shortlisted sites in blue, orange for preferred sites[39]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

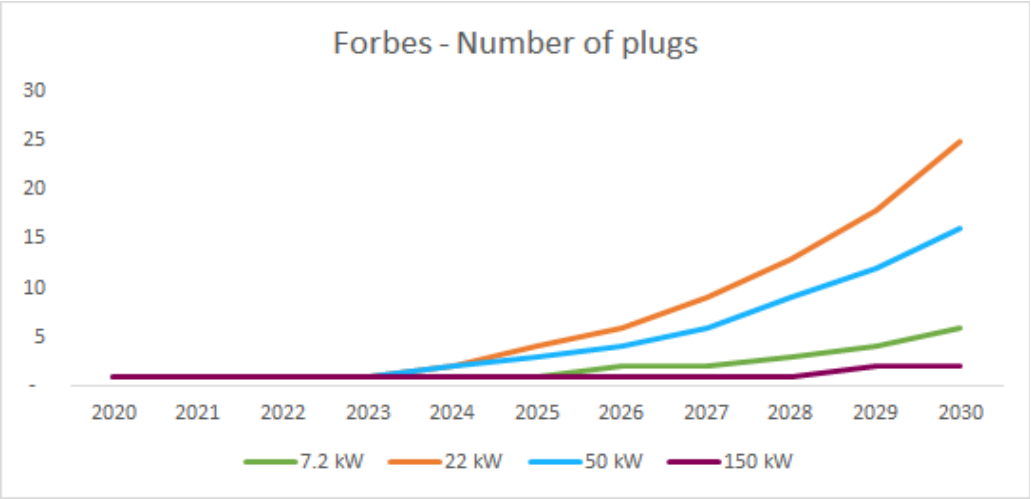
Peak traffic for Forbes	
Traffic component	Peak hourly traffic
Peak tourist vehicles	335
Peak local vehicle	200
Total peak vehicles	535

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

[39] The sites for Hotel/Motels, Bed and Breakfast, and Camping are not reflected as they are too numerous.

Demand-driven number of required charging plugs for Forbes in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	1	1	1	4
2024	1	2	2	1	6
2025	1	4	3	1	9
2026	2	6	4	1	13
2027	2	9	6	1	18
2028	3	13	9	1	26
2029	4	18	12	2	36
2030	6	25	16	2	49

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation

providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events.

Lachlan

Identified key routes

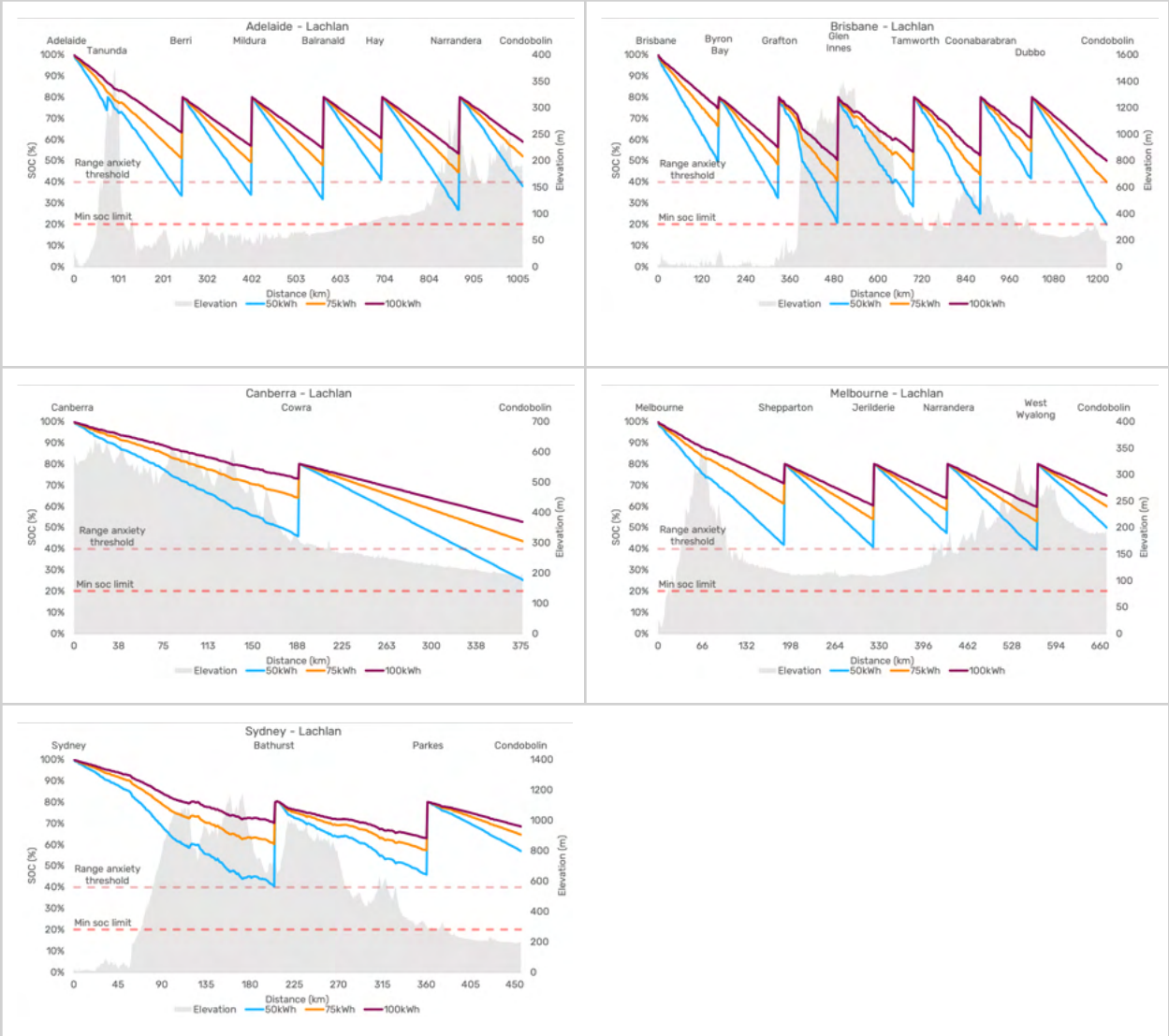
Lachlan is the council region most North-West amongst CNSWJO member councils. The major city within Lachlan is Condobolin, with the key routes around Lachlan being Henry Parkes Way East towards Parkes, The Gipps Way South towards West Wyalong and The Lachlan Valley Way towards Forbes. The trip from Lake Cargelligo to/from Griffith and the trip from Tottenham to/from Dubbo are also higher volume traffic routes through the region. These routes are mapped below:

Map of key routes around Lachlan

Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region



Key takeaways from this analysis include:

- Reaching the region of Lachlan from Sydney requires rest-stops in Bathurst and Parkes, with vehicles having less than 50 kWh batteries unable to complete the journey without stopping. Lithgow and Orange are alternative rest-stops where recharging may occur on the trip West from Sydney towards Condobolin.

- The currently popular Hyundai Ioniq and Nissan Leaf will need to recharge at Cowra and Forbes (or in Young and Forbes) in order to reach the region of Lachlan from Canberra. Those vehicles with 50 kWh or more are likely to stop in Cowra only. The alternate route via Young is viable currently only if drivers top up in Boorowa (Northbound) or Young (Southbound).
- Electric vehicles travelling North-East from Adelaide to Forbes are likely to stop for a break and boost to battery state of charge at Narrandera. Currently popular vehicles with less than 50 kWh may also stop at West Wyalong to top up charge levels.
- For many drivers heading East from Sydney towards the region of Lachlan Shire, Parkes will become a common location for seeking a boost to charge levels. It is likely this effect will be more substantial in earlier years and with vehicles that have lower driving range.
- Travelling to the Lachlan region from the North requires journey enabling charging stations at Dubbo and in a smaller city such as Coonabarabran.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership[#]	Unconstrained charger specifications	Substation constraints[40]	Constrained charger specifications	Notes
Tourism Precinct, The Gipps Way, Condobolin	Council	11-22kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities are limited.
Boating Club	Council	11-22kW	DS capacity available: DS capacity has not been mapped by the DNSP.	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request

[40] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

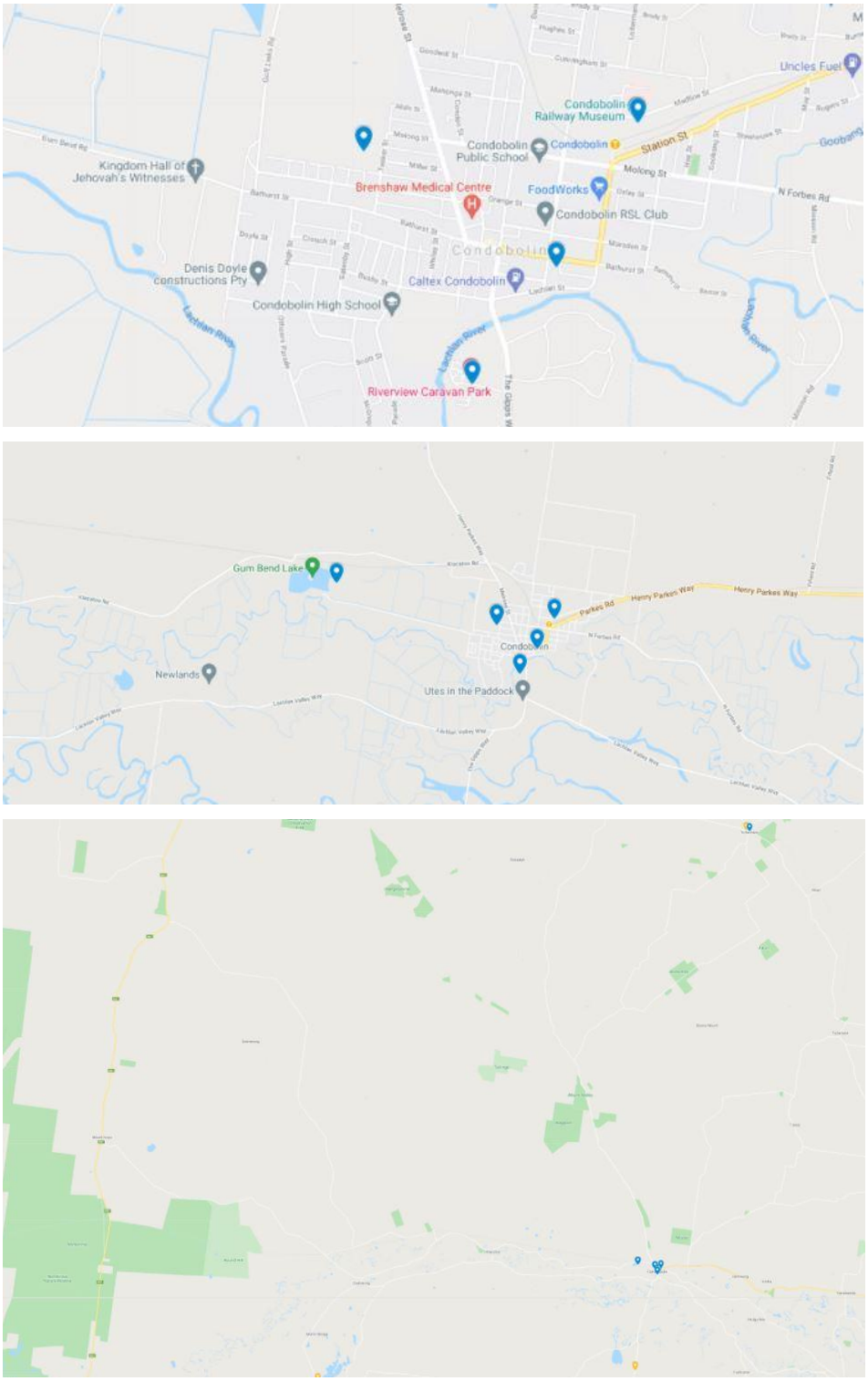
					from site owner to firm up. Site notes: Nearby facilities include a lake, recreational club and shopping centre, with public toilets a short walk away.
Tottenham War Memorial Hall	Council	11-22kW 50-100kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a supermarket, accommodation and a park.
Condobolin Railway Museum	Council	11-22kW 50-100kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW 50-100kW	Warning: Electrical capacity unable to be confirmed at DS level as the information remains unmapped by Essential Energy. Site notes: Nearby facilities include Condobolin Hospital
Freedom camping site – Gum Bend Lake	Council	11-22kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW	Warning: Electrical capacity unable to be confirmed at DS level as the information remains unmapped by Essential Energy. Site notes: Nearby facilities include picnic tables, Gum Bend Picnic Area, free BBQ's, kid's playground, toilet & shower facilities and free hot water, boat ramp, dedicated swimming area, free campground/caravan park, walking / cycle track into town
Lake Cargelligo Sports Club	Council	11-22kW	DS capacity available: DS capacity has not been mapped by the DNSP.	11-22kW	Warning: Electrical capacity unable to be confirmed at DS level as the information remains unmapped by Essential Energy.

			ZS capacity available: 3.2MVA		Site notes: Nearby facilities include sports club facilities, oval.
Condobolin Golf Club	Private	11-22kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW	Warning: Electrical capacity unable to be confirmed at DS level as the information remains unmapped by Essential Energy. Site notes: Nearby facilities beyond the golf course are limited.
IGA Condobolin	Private	11-22kW 50-100kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW 50-100kW	Warning: Electrical capacity unable to be confirmed at DS level as the information remains unmapped by Essential Energy. Site notes: Nearby facilities include shops and a museum.
Condobolin Hotel / Motel x2	Private	<11kW	DS capacity and ZS capacity: Site by site variability ZS capacity available: 3.2MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended
Condobolin camping sites (River View Caravan Park)	Private	<11kW	DS capacity and ZS capacity: Site by site variability ZS capacity available: 3.2MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended
Sporting Club	Private	11-22kW	DS capacity available: DS capacity has not been mapped by the DNSP. ZS capacity available: 3.2MVA	11-22kW	Warning: Electrical capacity unable to be confirmed at DS level as the information remains unmapped by Essential Energy.

Note: Distribution Substation data is not mapped by the DNSP for the region.

[#] Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.

Shortlisted sites for Lachlan region



Note: Shortlisted sites in blue, orange for preferred sites[41]

[41] The sites for Hotel/Motels are not reflected as they are too numerous.

Peak traffic flows and resultant charging infrastructure density

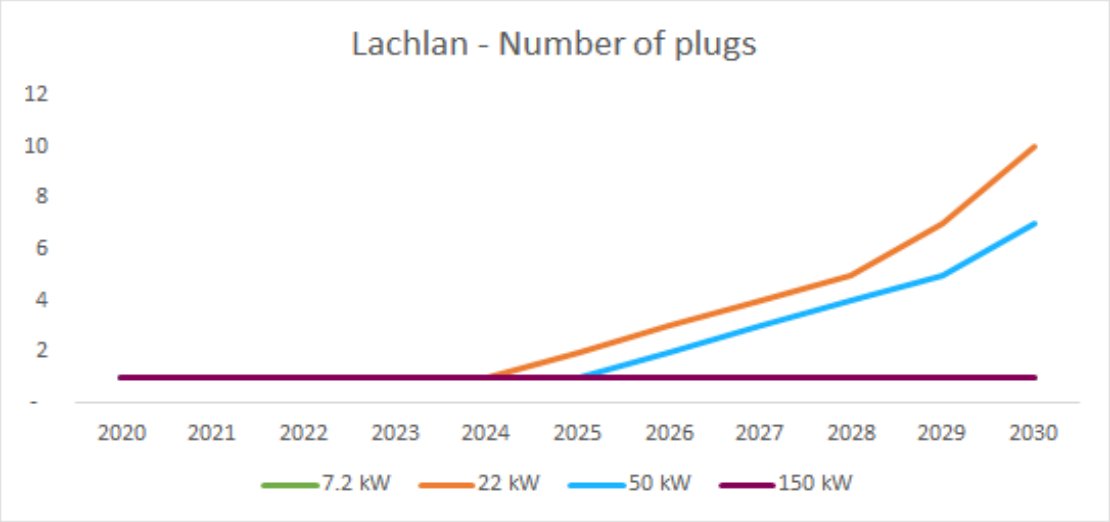
Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

Peak traffic for Lachlan	
Traffic component	Peak hourly traffic
Peak tourist vehicles	47
Peak local vehicle	99
Total peak vehicles	146

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Lachlan in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	1	1	1	4
2024	1	1	1	1	4
2025	1	2	1	1	5
2026	1	3	2	1	7
2027	1	4	3	1	9
2028	1	5	4	1	11
2029	1	7	5	1	14
2030	1	10	7	1	19

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

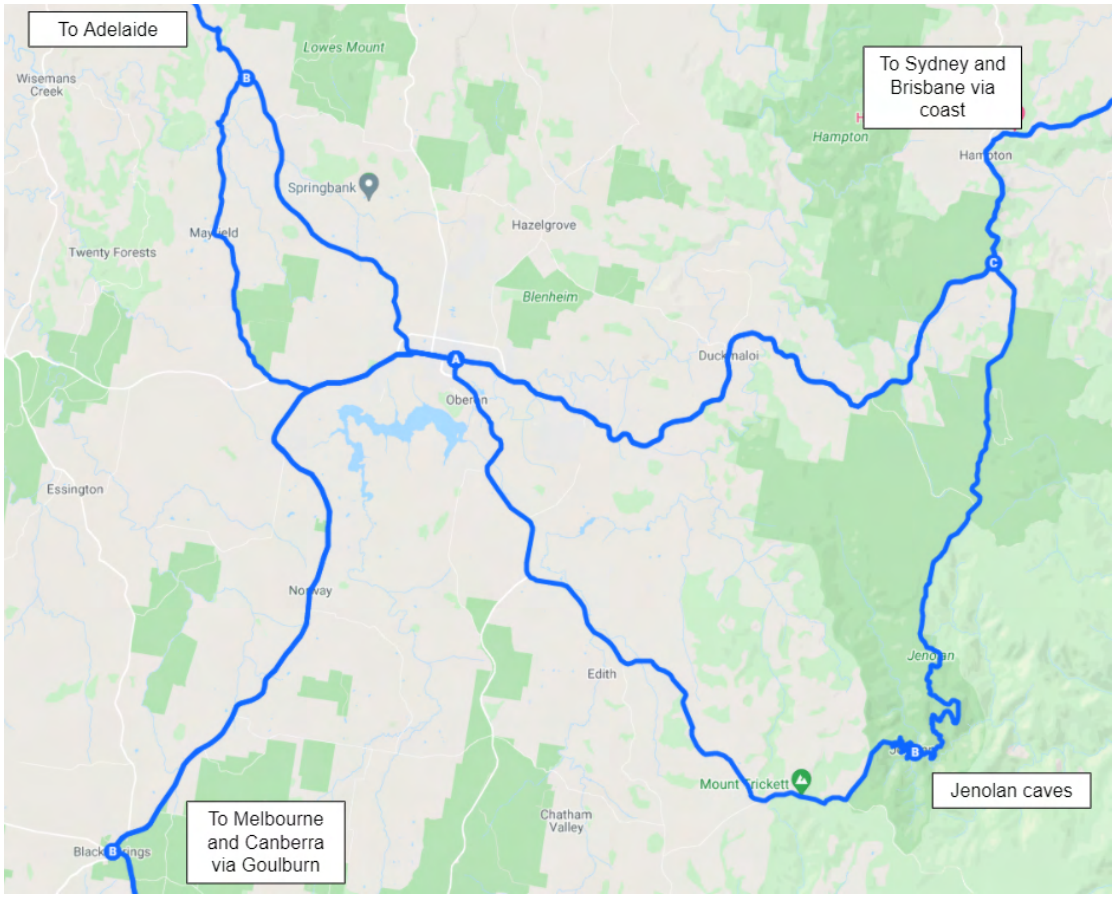
Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events.

Oberon

Identified key routes

The Duckmaloi Road connects Oberon with Lithgow in the North East, the O'Connell Road connects with Bathurst in the North West and Abercrombie Road connects with Goulburn in the South. Oberon is connected to the major cities via these routes. These routes are mapped below:

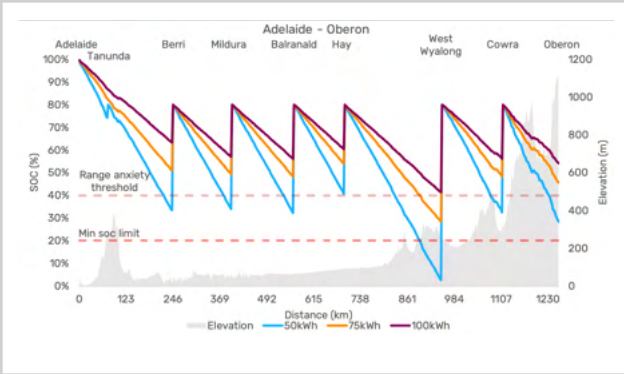
Map of key routes around Oberon

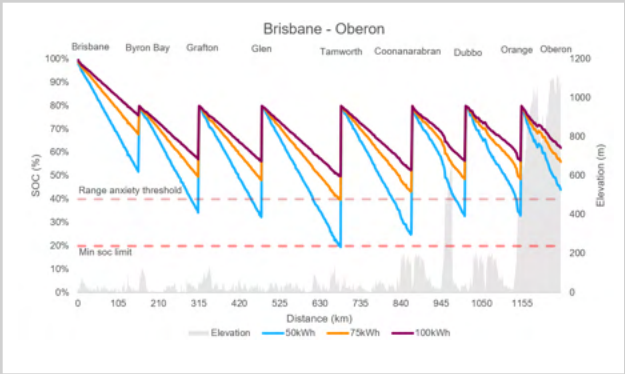


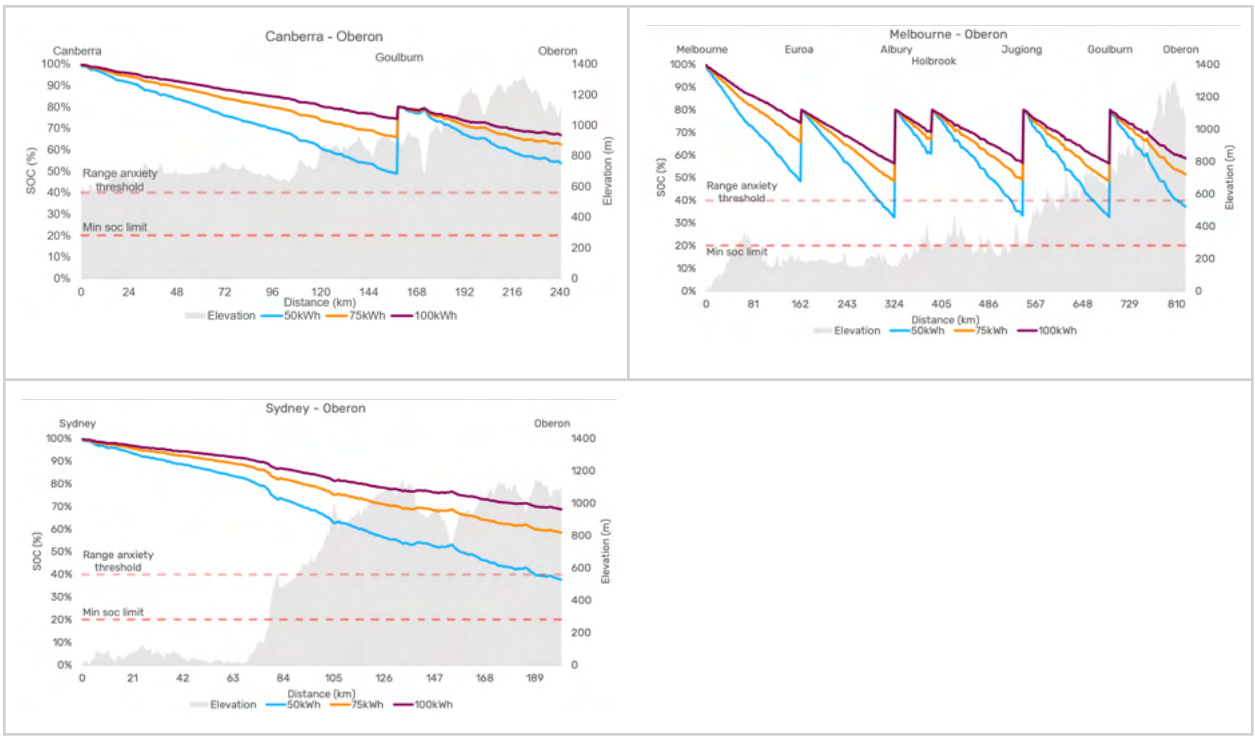
Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region







Key takeaways from this analysis include:

- Katoomba is likely an important location for drivers seeking to break up the journey West from Sydney over the Great Dividing Range and into Central NSW via the Great Western Highway. For these drivers, a brief top up charge is likely before continuing the journey West, with drivers approaching from further North via Lithgow potentially stopping at high powered chargers located in Lithgow.
- Top-up charging at Goulburn is a key enabler of electric vehicles travelling into Oberon from the South.
- Top-up charging at West Wyalong and Cowra is a key enabler of electric vehicles travelling into Oberon from the West, though as vehicle battery capacity increases over time it is viable that travellers will stop at Bathurst as an alternative option.
- Travelling to Oberon from the North via Mudgee or North-West via Dubbo in all but the highest range electric vehicles requires journey enabling charging en-route to facilitate arrival.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.
- Jenolan Caves and Mayfield Gardens are key locations for destination charging and facilitation of the return journey through Central NSW.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership[#]	Unconstrained charger specifications	Substation constraints[42]	Constrained charger specifications	Notes
The Oberon Common	Council	11-22kW	DS capacity available: 1x126kVA ZS capacity available: 22.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park and Visitor Information Centre.
The Oberon Common	Council	11-22kW 50-100kW	DS capacity available: 1x126kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Open 24hrs. Nearby facilities include a tourist attraction, public toilets, a public BBQ and a playground.
Oberon Visitors Information Centre	Council	50-100kW	DS capacity available: 1x120kVA ZS capacity available: 22.1MVA	50-100kW	Site notes: Open 7 days, 9:30am-5pm. Nearby facilities are limited.
Tallys Lane behind the Library	Council	11-22kW	DS capacity available: 1x120kVA ZS capacity available: 22.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shopping, cafes, library and food and drink options.

[42] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

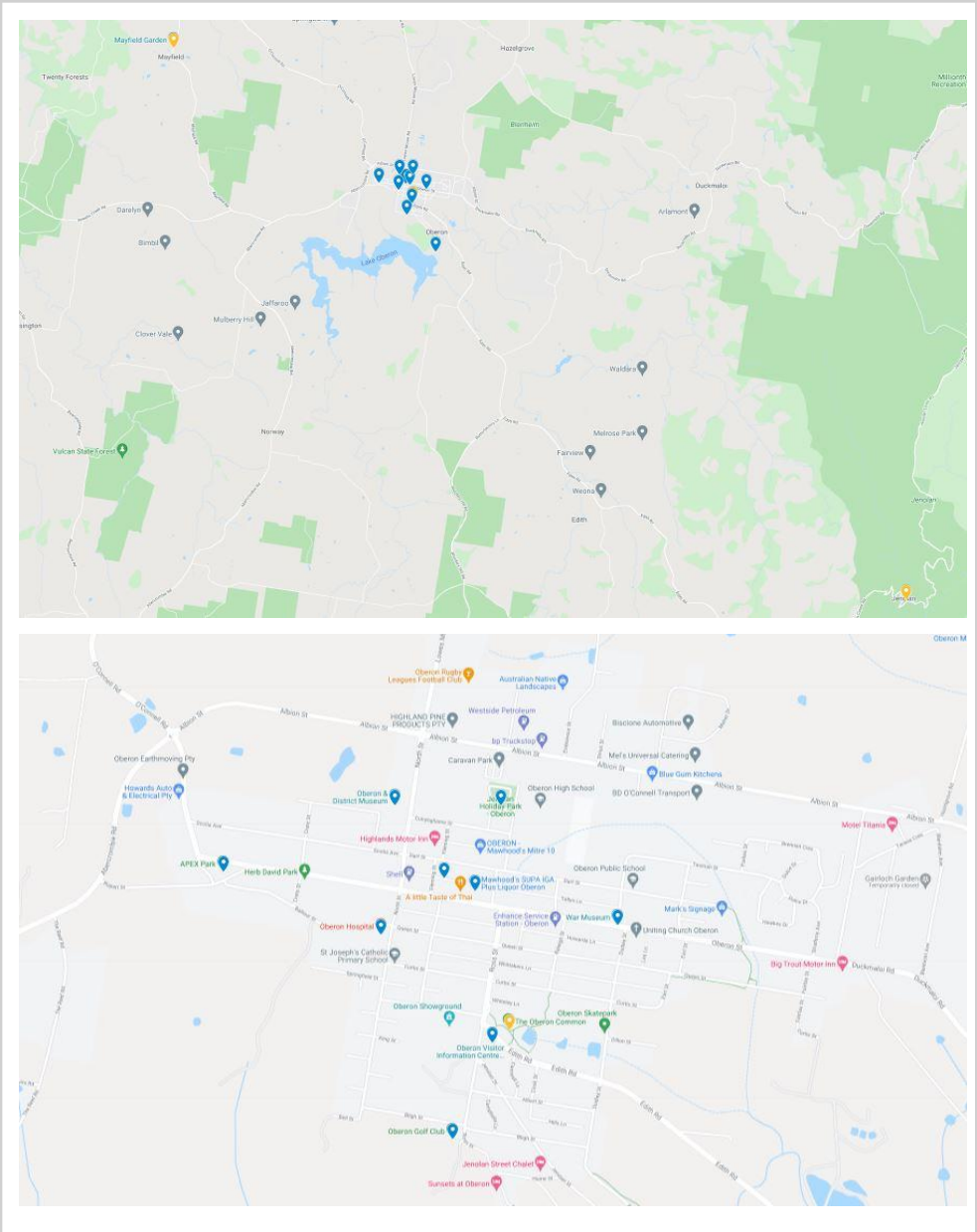
Oberon Dam	Council	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a tourist attraction.
APEX Park	Council	11-22kW 50-100kW	DS capacity available: 1x120kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a family park, public toilets, a public BBQ and gardens.
Jenolan Caves Trust	Private	11-22kW	DS capacity available: 1x25.2kVA ZS capacity available: 22.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a natural tourist destination, car park, accommodation and a restaurant.
Mayfield Gardens	Private	11-22kW	DS capacity available: 1x25.2kVA ZS capacity available: 22.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include garden walks and a cafe.
War Museum	Private	11-22kW 50-100kW	DS capacity available: 126kVA* and 1x120kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a tourist attraction, and Oberon RSL.
Oberon & District Museum	Private	11-22kW 50-100kW	DS capacity available: 1x126kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Nearby facilities are limited.
Oberon Hotel /	Private	<11kW	DS capacity	<11kW	Warning: Capacity varies

Motel x4			and ZS capacity: Site by site variability ZS capacity available: 22.1MVA		across the numerous sites, but low power overnight chargers are recommended.
Supa IGA	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Open 7days, 7:30am-8pm. Nearby facilities include a large parking space, shops, restaurants, and accommodation.
Oberon Golf Club	Private	11-22kW 50-100kW	DS capacity available: 1x120kVA ZS capacity available: 22.1MVA	11-22kW 50-100kW	Site notes: Open 7 days, 7am-6pm. Nearby facilities are limited.
Oberon Hospital	Private	11-22kW	DS capacity available: 1x120kVA ZS capacity available: 22.1MVA	11-22kW	Site notes: Open 24 hrs a day. Nearby facilities are limited.
Jenolan Holiday Park	Private	<11kW	DS capacity available: 1x126kVA ZS capacity available: 22.1MVA	11-22kW	Site notes: Nearby facilities include an indoor swimming pool.

[#] Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.

Note: Shortlisted sites in blue, orange for shortlisted Council owned sites

Shortlisted sites for Oberon region



Note: Shortlisted sites in blue, orange for preferred sites[43]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

Peak traffic for Oberon

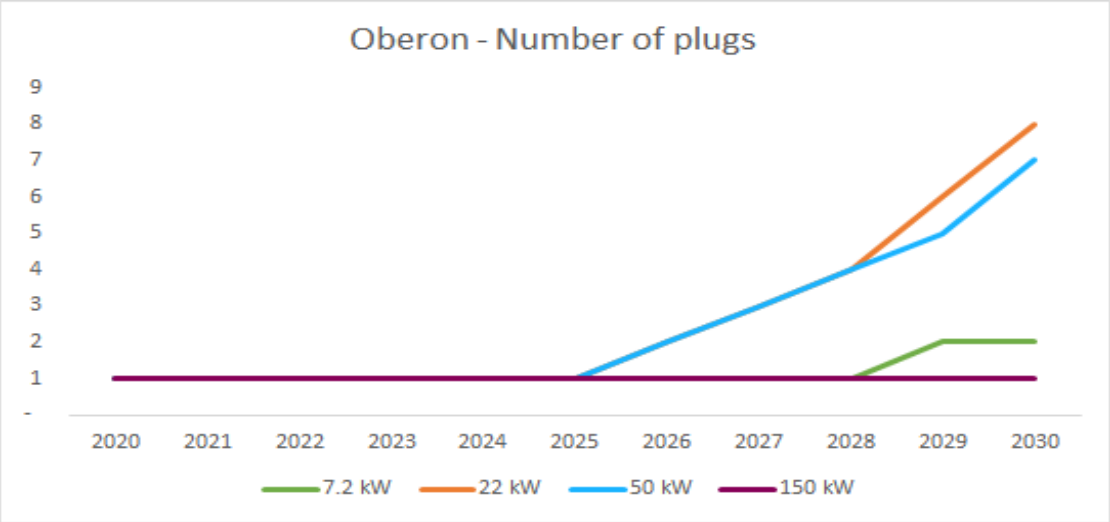
[43] The sites for Hotel/Motels are not reflected as they are too numerous.

Traffic component	Peak hourly traffic
Peak tourist vehicles	87
Peak local vehicle	88
Total peak vehicles	175

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Oberon in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	1	1	1	4
2024	1	1	1	1	4
2025	1	1	1	1	4
2026	1	2	2	1	6
2027	1	3	3	1	8
2028	1	4	4	1	10
2029	2	6	5	1	14
2030	2	8	7	1	18

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

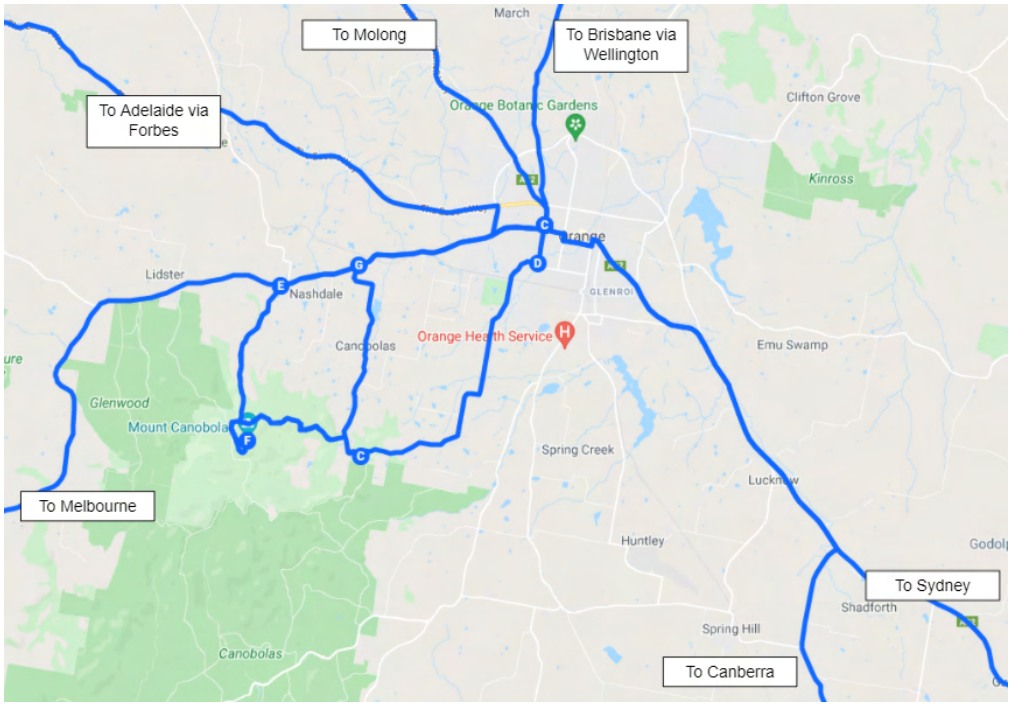
Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events.

Orange

Identified key routes

The Sydney to Orange route via Lithgow and Bathurst is a popular tourist drive and a vital travel corridor across the Great Dividing Range for the Central NSW region. Escort Way to Parkes and North Burrendong Way to Dubbo are important regional interconnectors for those travelling through Central NSW, as is Mitchell Highway South to Bathurst and North to Molong. Cowra is a key city connecting the region to Canberra, Melbourne and Adelaide, via Canowindra or Blayney. These routes are mapped below:

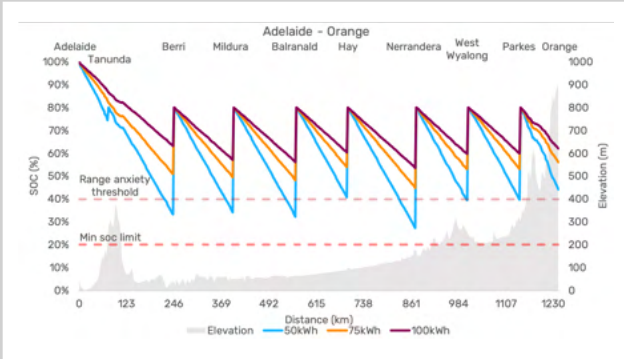
Map of key routes around Orange

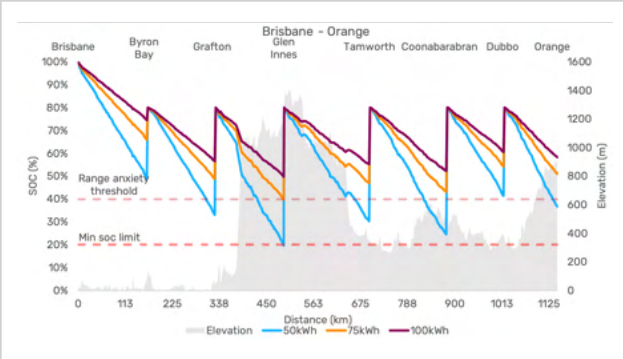


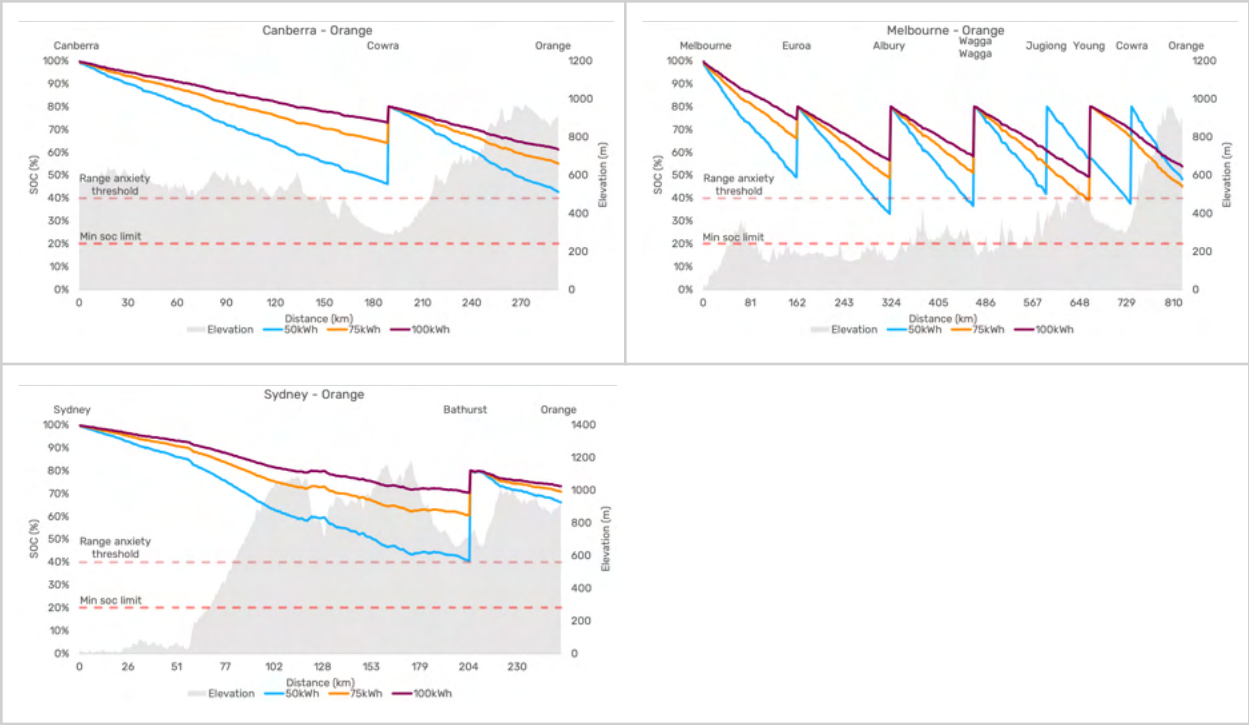
Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region







Key takeaways from this analysis include:

- Lithgow or Bathurst are likely important locations for drivers seeking to break up the journey West from Sydney over the Great Dividing Range and into Central NSW. For these drivers, a brief top up charge is likely before continuing the journey West.
- Top-up charging at Cowra is a key enabler of electric vehicles travelling into Orange from the South.
- Top-up charging to the Western gate of the region is a key enabler of electric vehicles travelling into Orange from the West. West Wyalong may be an obvious choice for drivers to recharge rather than Forbes, with likely benefits to the region available if communication materials promote Forbes for this purpose.
- Travelling to Orange from the North in all but the highest range electric vehicles requires journey enabling charging in Dubbo and Coonabarabran.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership#	Unconstrained charger specifications	Substation constraints[44]	Constrained charger specifications	Notes
Orange Airport	Council	11-22kW	DS capacity available: 1x126kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities beyond the airport are limited.
Orange Central Square / Orange City Centre	Council	11-22kW 50-100kW	DS capacity available: 1x400kVA, 1x800kVA, 1x880kVA and 1x1200kVA ZS capacity available: 14.1 MVA	11-22kW 50-100kW	Site notes: Open 7 days. Nearby facilities include a large parking space, shops, restaurants, hotels, accommodation and Robertson Park.
Orange Information/Library/Art Gallery	Council	11-22kW	DS capacity available: 1x600kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, a theatre, accommodation, cafes, a park and restaurants.
Orange Civic Center	Council	11-22kW 50-100kW	DS capacity available: 1x600kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Woolworths car park	Council	11-22kW 50-100kW	DS capacity available: 1x1200kVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the

[44] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

			ZS capacity available: 14.1MVA		site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Sale Street car park	Council	11-22kW	DS capacity available: 1x1200kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Little Summer St car park	Council	11-22kW	DS capacity available: 1x200kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a restaurant and a service station
Botanical Gardens	Council	11-22kW 50-100kW	DS capacity available: 1x126kVA ZS capacity available 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include parks, car parks, cafes and a playground.
Cook Park	Council	11-22kW 50-100kW	DS capacity available: 1x120kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park, cafe, restaurant and public toilets.
Council/ Business car park	Council	11-22kW	DS capacity available: 1x400kVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the

			ZS capacity available: 14.1MVA		site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a library, gallery, car parking and VIsitor Information Centre. Solar at the nearby council building and gallery.
Robertson Park	Council	11-22kW	DS capacity available: 1x1500kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a library, gallery, car parking and VIsitor Information Centre.
Summer Centre Shopping Centre	Council	11-22kW 50-100kW	DS capacity available: 1x400kVA and 2x 600 kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Orange Aquatic Centre	Council	11-22kW	DS capacity available: 1x400kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include Orange City Bowling Club.
Spring Hill Park	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities are limited.
Bloomfield grounds	Council	11-22kW	DS capacity available:	11-22kW	Warning: 50kW and above chargers may not be

			1x400kVA 1x200kVA ZS capacity available: 14.1MVA		economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include cafes and a restaurant.
Sir Jack Brabham Park	Council	11-22kW	DS capacity available: 1x80kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities are limited.
Glenroi Oval	Council	11-22kW	DS capacity available: 1x120kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include residential areas.
Sporting Oval (PCYC)	Council	11-22kW	DS capacity available: 1x300kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include park, hospital, church.
Orange Regional Museum	Council	11-22kW 50-100kW	DS capacity available: 1x600kVA ZS capacity available: 14.1 MVA	11-22kW 50-100kW	Site notes: Open 7 days, 9am-4pm. Nearby facilities include a tourist attraction, Orange Civic Theatre, Orange Regional Gallery, and Robertson Park.
Banjo Patterson's Birthplace	Council	11-22kW 50-100kW	DS capacity available: 1x200kVA and 1x126kVA ZS capacity available: 14.1 MVA	11-22kW 50-100kW	Site notes: Open 24 hrs a day. Nearby facilities include a tourist attraction, botanic gardens, a playground and a cafe.
Wade Park	Council	11-22kW	DS capacity	11-22kW	Warning: 50kW and above chargers may not be

			available: 1x800kVA ZS capacity available: 14.1MVA		economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include train station, shopping, cafe, a park and accommodation.
McNamara Lane	Council	11-22kW	DS capacity available: 1x800kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include train station, shopping, cafe, a park and accommodation.
Railway Station	State	11-22kW	DS capacity available: 1x800kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include train station, shopping, cafe, a park and accommodation.
Orange Base Hospital	NSW	11-22kW	DS capacity available: 1x300kVA 1x120kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include TAFE, cafes and a restaurant.
Waratahs Oval	NSW	11-22kW	DS capacity available: 1x60kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include cafe, shopping centre.
Department of Primary	NSW	11-22kW	DS capacity available:	11-22kW	Warning: 50kW and above chargers may not be

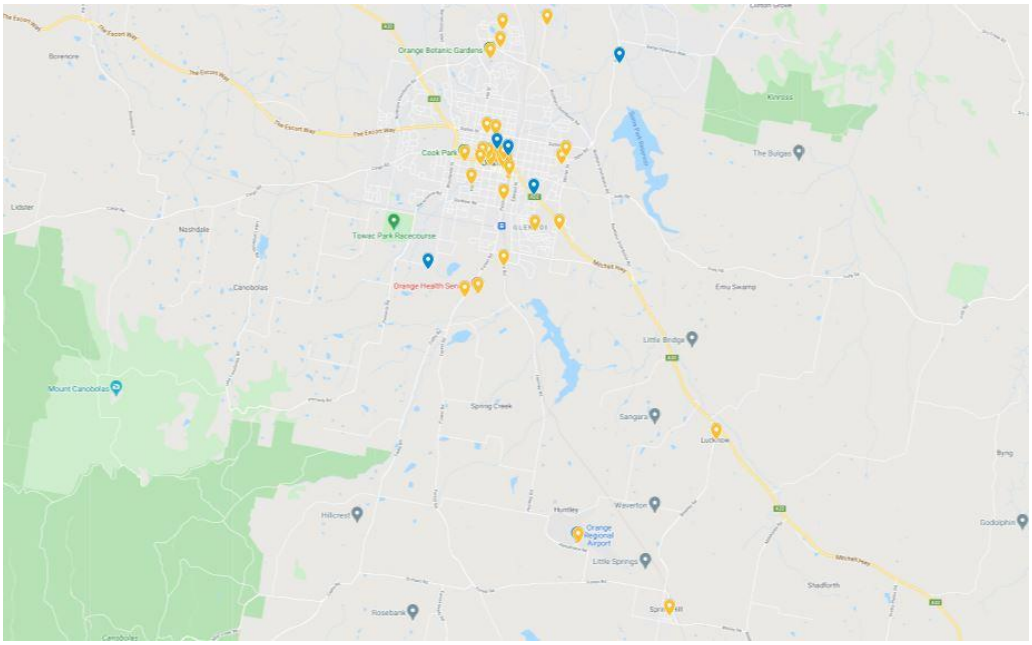
Industries new site (ex Orange Base Hospital site in Prince Street)			1x300kVA 1x120kVA ZS capacity available: 14.1MVA		economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include cafes and a rest area, TAFE,
Orange Main Street	Various	11-22kW 50-100kW	DS capacity available: 1500kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Lucknow, NSW	Various	11-22kW 50-100kW	DS capacity available: 1x80kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include public toilets and a cafe.
Peisley Street	Private	11-22kW	DS capacity available: 1x400kVA ZS capacity available: 14.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Woolworths North Orange	Private	11-22kW 50-100kW	DS capacity available: 1x400kVA 2x200kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include shopping, restaurants, car parks and cafes.
Woolworths (Telopea Way)	Private	11-22kW	DS capacity available:	11-22kW	Site notes: Nearby facilities include a large parking

		50-100kW	1x400kVA 2x200kVA ZS capacity available: 14.1 MVA	50-100kW	space, and a McDonald's restaurant.
Charles Sturt University	Private	11-22kW	DS capacity available: 1x300kVA ZS capacity available: Exceeds capacity, Essential Energy expected to upgrade	11-22kW	Warning: ZS capacity constrained. Site capacity upgrades may trigger ZS upgrades; however Essential energy reports this ZS urgently requires replacement, so this should be used as a mitigating argument by project proponents. Site notes: Open 5 days, 8am-5pm. Nearby facilities include a parking space.
Orange Homemaker Centre	Private	11-22kW 50-100kW	DS capacity available: 1x900kVA 1x200kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Site notes: Nearby facilities include shopping center
Orange Central Square Shopping Centre	Private	11-22kW 50-100kW	DS capacity available: 1x1500kVA and 1x400kVA ZS capacity available: 14.1MVA	11-22kW 50-100kW	Warning: 50kW and above chargers may not be economically viable for the site due to DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include hotels, shopping, accommodation, cafes, a park and restaurants.
Orange Hotels / Motels (approx. 17 sites)	Private	<11kW	DS capacity: Site by site variability ZS capacity available: 14.1 MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
Orange bed and breakfast, apartments, camping etc (numerous sites)	Private	<11kW	DS capacity and ZS capacity: Site by site variability ZS capacity available: 14.1 MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.

Bloomfield Hospital	Private	11-22kW	DS capacity available: 1x200kVA ZS capacity available: 14.1 MVA	11-22kW	Site notes: Open 24 hrs a day. Nearby facilities include a large parking space.
Dudley Private Hospital	Private	11-22kW	DS capacity available: 1x200kVA ZS capacity available: 14.1 MVA	11-22kW	Site notes: Nearby facilities include a large parking space and ANZAC Park.
Orange Medical Centre	Private	11-22kW	DS capacity available: 1x300kVA and 1x400kVA ZS capacity available: 14.1 MVA	11-22kW	Site notes: Open 6 days. Nearby facilities include Town Square Motel (with Tesla Destination Charger).
Philip Shaw	Private	11-22kW 50-100kW	DS capacity available: 1x10kVA ZS capacity available: 14.1 MVA	11-22kW	Warning: Chargers with power above 10kW chargers may not be economically viable due to DS capacity constraints likely requiring upgrade. Site notes: Nearby facilities include a tourist attraction.
Shopping (Bathurst Road)	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA and 1x900kVA ZS capacity available: 14.1 MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a large parking space, shops, restaurants, hotels and accommodation.

Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.

Shortlisted sites for Orange region



Note: Shortlisted sites in blue, orange for preferred sites[45]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

Peak traffic for Orange	
Traffic component	Peak hourly traffic
Peak tourist vehicles	1440
Peak local vehicle	903
Total peak vehicles	2343

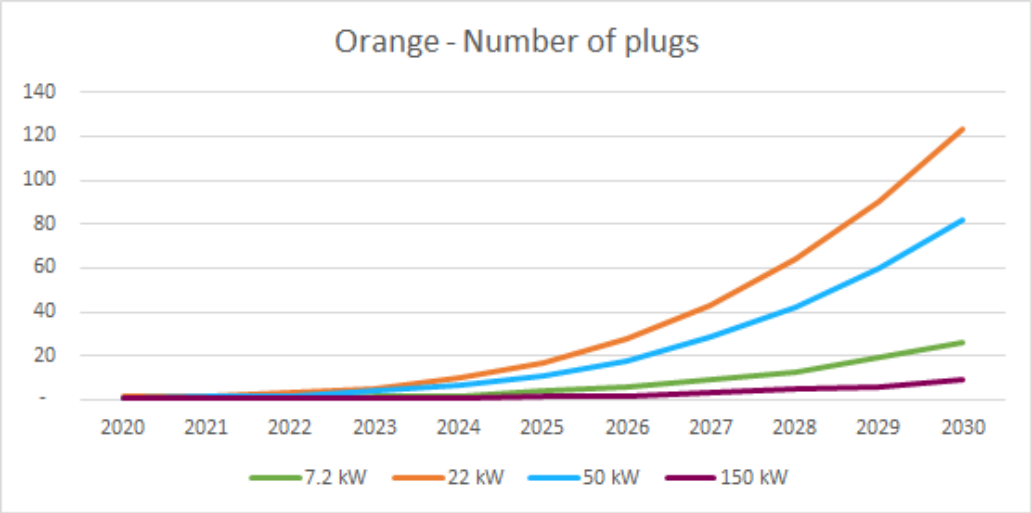
The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in

[45] The sites for Hotel/Motels, Bed and Breakfasts, and Camping are not reflected as they are too numerous.

many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Orange in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	2	1	1	5
2021	1	2	1	1	5
2022	1	3	2	1	7
2023	2	5	3	1	11
2024	2	9	6	1	18
2025	4	16	10	2	32
2026	6	26	17	2	51
2027	9	40	26	3	78
2028	13	59	39	5	116
2029	19	84	55	6	164
2030	26	114	75	9	224

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

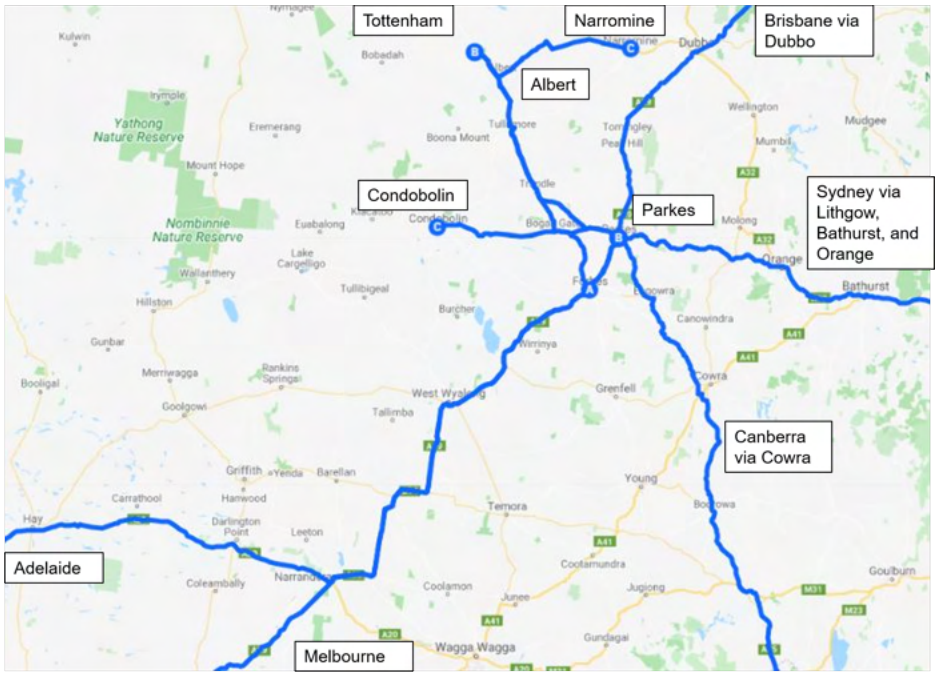
The number of vehicles visiting Orange per day increased by 83% during the peak season e.g. in March, April, June, September and October. This increase in the number of visiting vehicles will raise the demand for charging in the region. Based on the charging demand during the peak seasons it is estimated that there will be 49% more charging plugs needed in total by 2030 to optimally satisfy demand for charging of electric vehicles and avoid long waiting times.

Parkes

Identified key routes

The Henry Parkes Way East towards Sydney via Lithgow, Bathurst and Orange is a popular tourist drive and a vital travel corridor across the Great Dividing Range for the Central NSW region, while Parkes is the connection point for travellers heading South towards Adelaide, Canberra and Melbourne. The Newell Highway North towards Brisbane via Dubbo and South towards Melbourne and Adelaide via West Wyalong is a major cross-country route and pathway across Central NSW. These routes are mapped below:

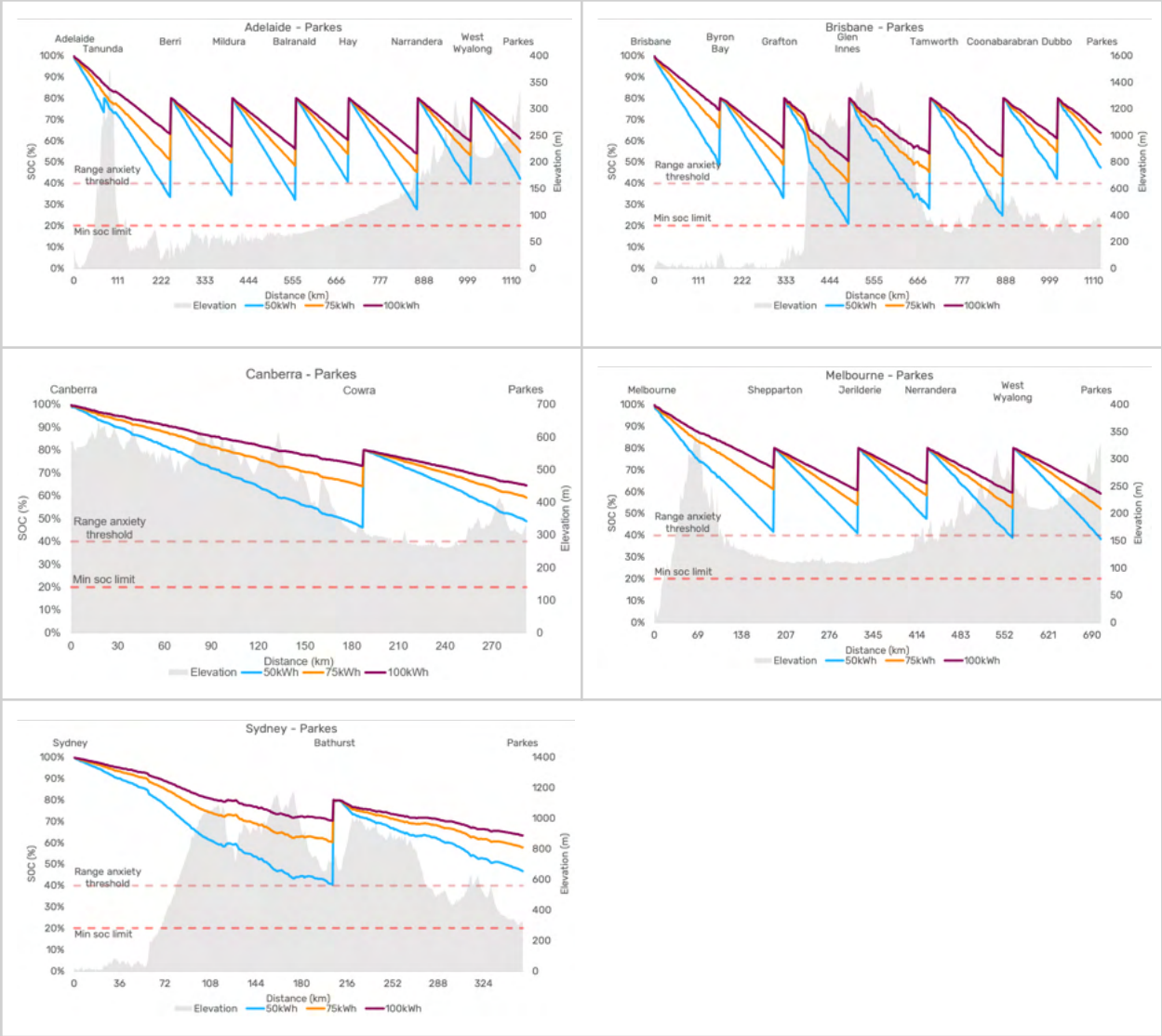
Map of key routes around Parkes



Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region



Key takeaways from this analysis include:

- Lithgow or Bathurst are likely important locations for drivers seeking to break up the journey West from Sydney over the Great Dividing Range and into Central NSW. For these drivers, a brief top up charge is likely before continuing the journey West,
- Top-up charging at Cowra is a key enabler of electric vehicles travelling into Parkes from the South.

- Top-up charging at West Wyalong is a key enabler of electric vehicles travelling into Orange from the West as well as from Melbourne, with Forbes also likely a key recharging point on the trip East to Forbes through the region.
- Travelling to Orange from the North in all but the highest range electric vehicles requires journey enabling charging in Dubbo and Coonabarabran. Completing the round-trip to Mudgee in the North would require substantial recharging at Mudgee in order to make the return trip viable.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership#	Unconstrained charger specifications	Substation constraints[46]	Constrained charger specifications	Notes
Parkes Visitor Information Centre/ Henry Parkes Centre	Council	11-22kW 50-100kW	DS capacity available: 1x126kVA ZS capacity available: 11.9 MVA	11-22kW 50-100kW	Site notes: Nearby facilities include accommodation, restaurant, parks, car parking and visitor resources.
Peak Hill town centre - adjacent to Commercial Gardens	Council	11-22kW	DS capacity available: 1x126kVA ZS capacity available: 11.9 MVA	11-22kW	Site notes: Nearby facilities include shelter, public toilets, and a cafe.
Trundle town centre (Forbes Street)	Council	11-22kW 50-100kW	DS capacity available: 1x11kVA ZS capacity available: 2 MVA	<11kW	Site notes: Nearby facilities include post office, service station and accommodation.

[46] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

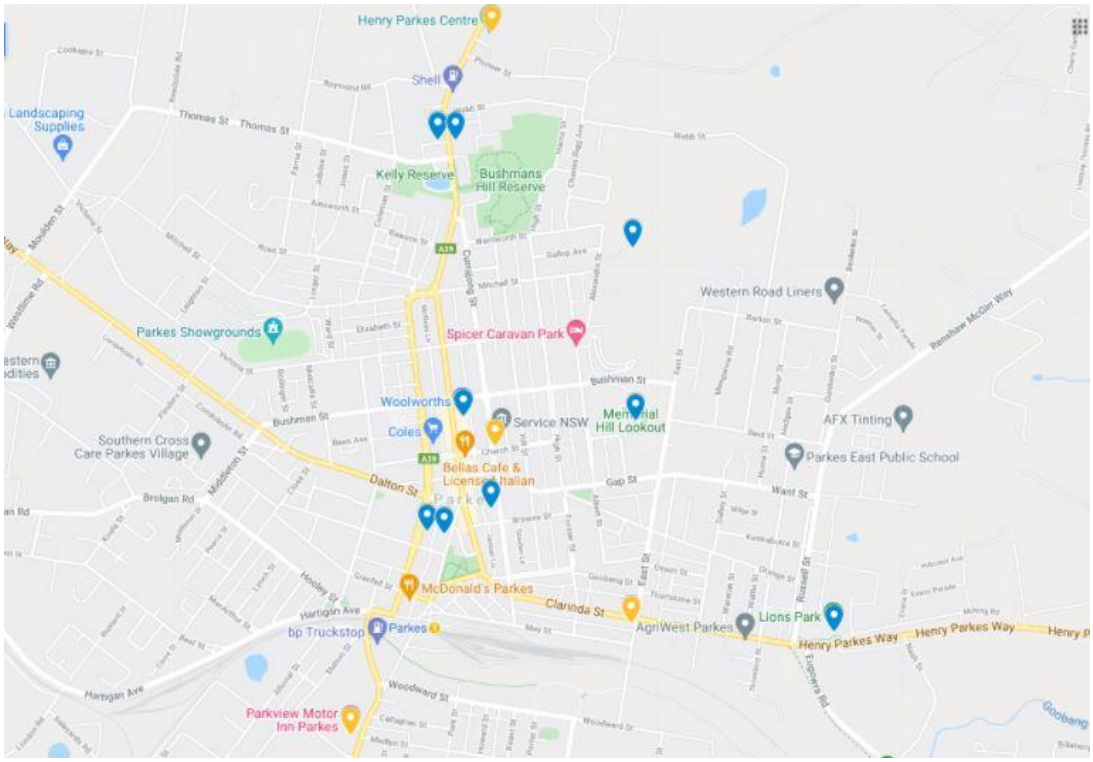
Parkes CBD Council car park - Church Street	Council	11-22kW	DS capacity available: 1x135kVA ZS capacity available: 11.9 MVA	11-22kW	Site notes: Nearby facilities include a post office, car parks, accommodation, restaurants and Parkes League Club.
Parkes Visitor Information Centre / Henry Parkes Museum / Parkes Motor Museum	Council	11-22kW 50-100kW	DS capacity available: 1x126kVA ZS capacity available: 11.9 MVA	11-22kW 50-100kW	Site notes: Open 7 days (weekdays 9am-4pm, weekends 10am-3pm). Nearby facilities include a large parking space and accomodation.
Parkes camping sites etc	Council	<11kW	Varied ZS capacity available: Up to 11.9 MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
Lions Memorial Park	Council	11-22kW 50-100kW	DS capacity available: 1x20kVA ZS capacity available: 11.9 MVA	11-22kW	Warning: Chargers with rated power above 20kW may not be economically viable due to DS capacity constraints requiring upgrade of the DS. Site notes: Nearby facilities include public toilets and a public BBQ.
Parkes War Memorial	Council	11-22kW 50-100kW	DS capacity available: 1x200kVA, 1x80kVA and 1*40kVA ZS capacity available: 11.9 MVA	11-22kW 50-100kW	Site notes: Nearby facilities are limited.
Spicer, Pioneer and North Parkes Oval	Council	11-22kW 50-100kW	DS capacity available: 1x200kVA, 3x80kVA and 1x40kVA ZS capacity available: 11.9 MVA	11-22kW 50-100kW	Site notes: Open 5 days, 8:30am-5pm. Nearby facilities include a large parking space, and a caravan park.
Council library	Council	11-22kW	DS capacity available: 1x120kVA	11-22kW	Site notes: Nearby facilities include cafes, supermarkets, restaurants and public toilets.

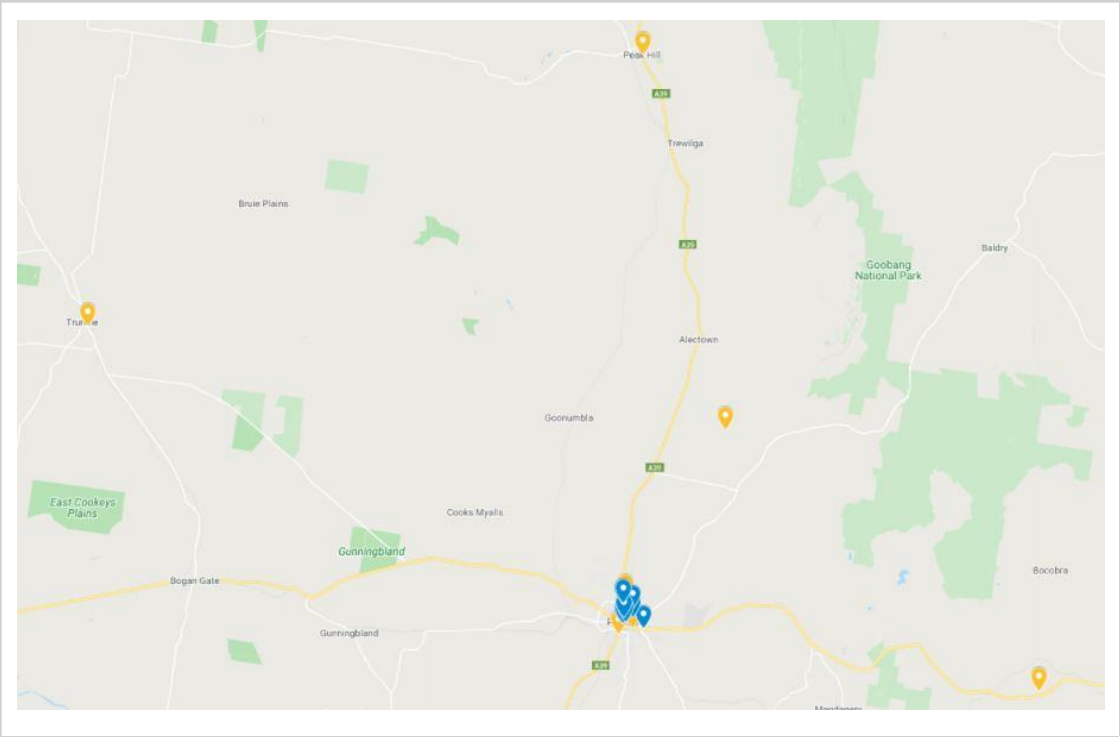
			ZS capacity available: 11.9 MVA		
CSIRO Parkes Radio Telescope	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 10MVA	11-22kW 50-100kW	Site notes: Nearby facilities include a tourist attraction, visitors centre, cafe and public toilets.
Twisted River Winery	Private	11-22kW	DS capacity available: 1x6.4kVA ZS capacity ZS capacity available: 15.6 MVA	<11kW	Site notes: Nearby facilities include a tourist attraction, cellar door, public toilets and car parking space
Memphis Motor Inn	Private	<11kW	DS capacity available: 1x126kVA ZS capacity available: 11.9 MVA	<11kW	Site notes: Nearby facilities include accommodation.
Parkview Motor Inn	Private	<11kW	DS capacity available: 1x80kVA ZS capacity available: 11.9 MVA	<11kW	Site notes: Nearby facilities include a large car park, shopping and a park.
Parkes Post office	Private	11-22kW 50-100kW	DS capacity available: 2x400kVA ZS capacity available: 11.9 MVA	11-22kW 50-100kW	Site notes: Open 5 days, 9am-5pm. Nearby facilities include a large parking space, shops, accommodation, restaurants and Parkes Leagues Club.
Big W (Jansen Lane)	Private	11-22kW 50-100kW	DS capacity available: 1x200kVA ZS capacity available: 11.9 MVA	11-22kW 50-100kW	Site notes: Open 7 days. Nearby facilities include a large parking space, shops and restaurants.
Coles / Woolworths (Jansen Lane)	Private	11-22kW 50-100kW	DS capacity available: 1x400kVA and 1x80kVA ZS capacity available:	11-22kW 50-100kW	Site notes: Open 7 days. Nearby facilities include a large parking space, shops, restaurants, accommodation and a hotel.

			11.9 MVA		
Bushmans Motor Inn/ International Motor Inn/ Spanish Lantern	Private	<11kW 11-22kW	DS capacity available: 1x80kVA, ZS capacity available: 11.9 MVA	<11kW 11-22kW	Site notes: Nearby facilities include park, public toilets, food and drink options, car park and accommodation.
Parkes Hotel / Motel	Private	<11kW	Varied ZS capacity available: Up to 11.9 MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended.
18-32 Peak Hill Rd			DS capacity available: 1x80kVA, ZS capacity available: 11.9 MVA		Site notes: Nearby facilities include park, and petrol station.

[#] Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.
Note: Shortlisted sites in blue, orange for shortlisted Council owned sites

Shortlisted sites for Parkes region





Note: Shortlisted sites in blue, orange for preferred sites[47]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

Peak traffic for Parkes	
Traffic component	Peak hourly traffic
Peak tourist vehicles	403
Peak local vehicle	269
Total peak vehicles	672

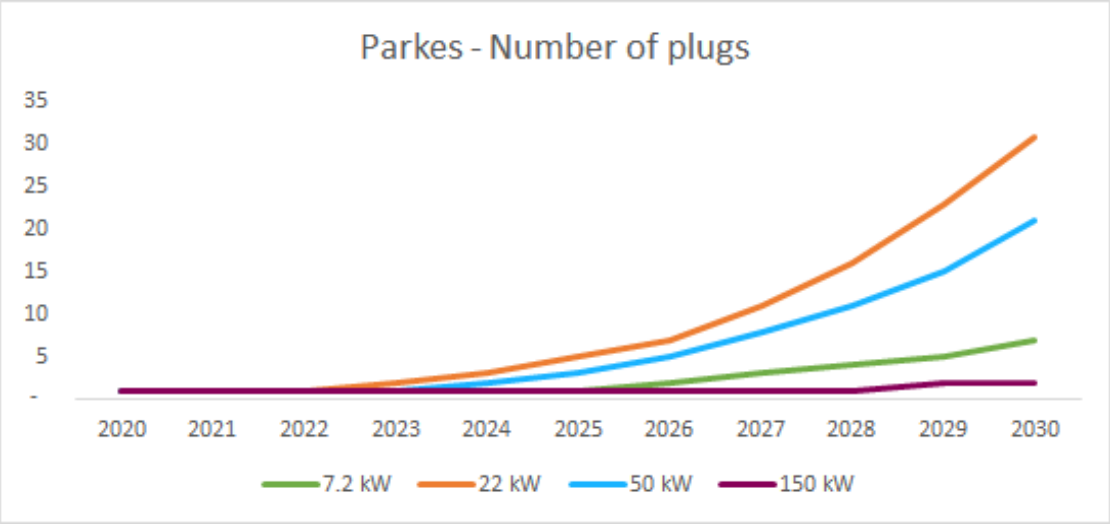
The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in

[47] The sites for Hotel/Motels, and camping sites are not reflected as they are too numerous.

many cases have more than one charging plug. Schedule 1 provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Parkes in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	2	1	1	5
2024	1	3	2	1	7
2025	1	5	3	1	10
2026	2	7	5	1	15
2027	3	11	8	1	23
2028	4	16	11	1	32
2029	5	23	15	2	45
2030	7	31	21	2	61

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

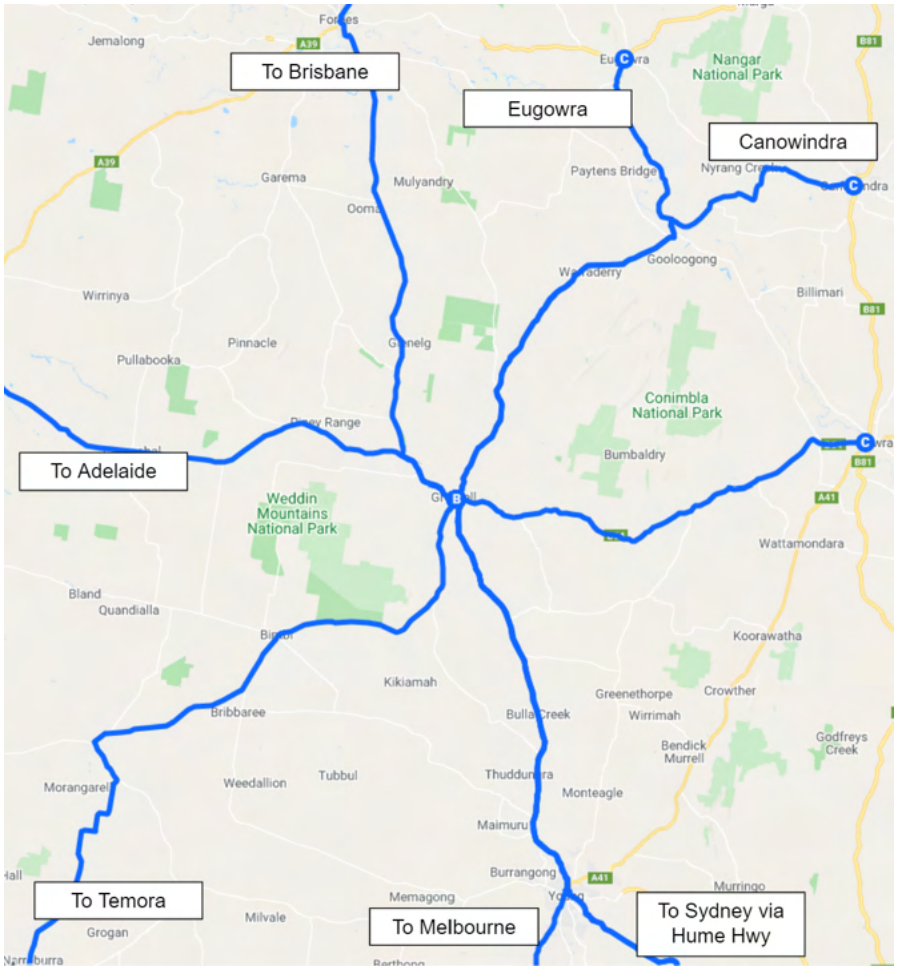
Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events. However, traffic in the region will increase due to large events in the neighbouring regions like Bathurst and Orange. This increase in traffic volumes will require some additional charging plugs to be installed to facilitate inter-regional travel and to optimally satisfy the charging demand of electric vehicles and avoid long waiting times.

Weddin

Identified key routes

The major town of the Weddin Shire Council is Grenfell which is connected to all the major cities through the Mid Western Highway. Other important routes include Gooloogong Road in the North, Henry Lawson Way and Mary Gilmore Way in the South. Grenfell also serves as the inter-regional travel link between Cowra and West Wyalong via Mid Western Highway. These routes are mapped below:

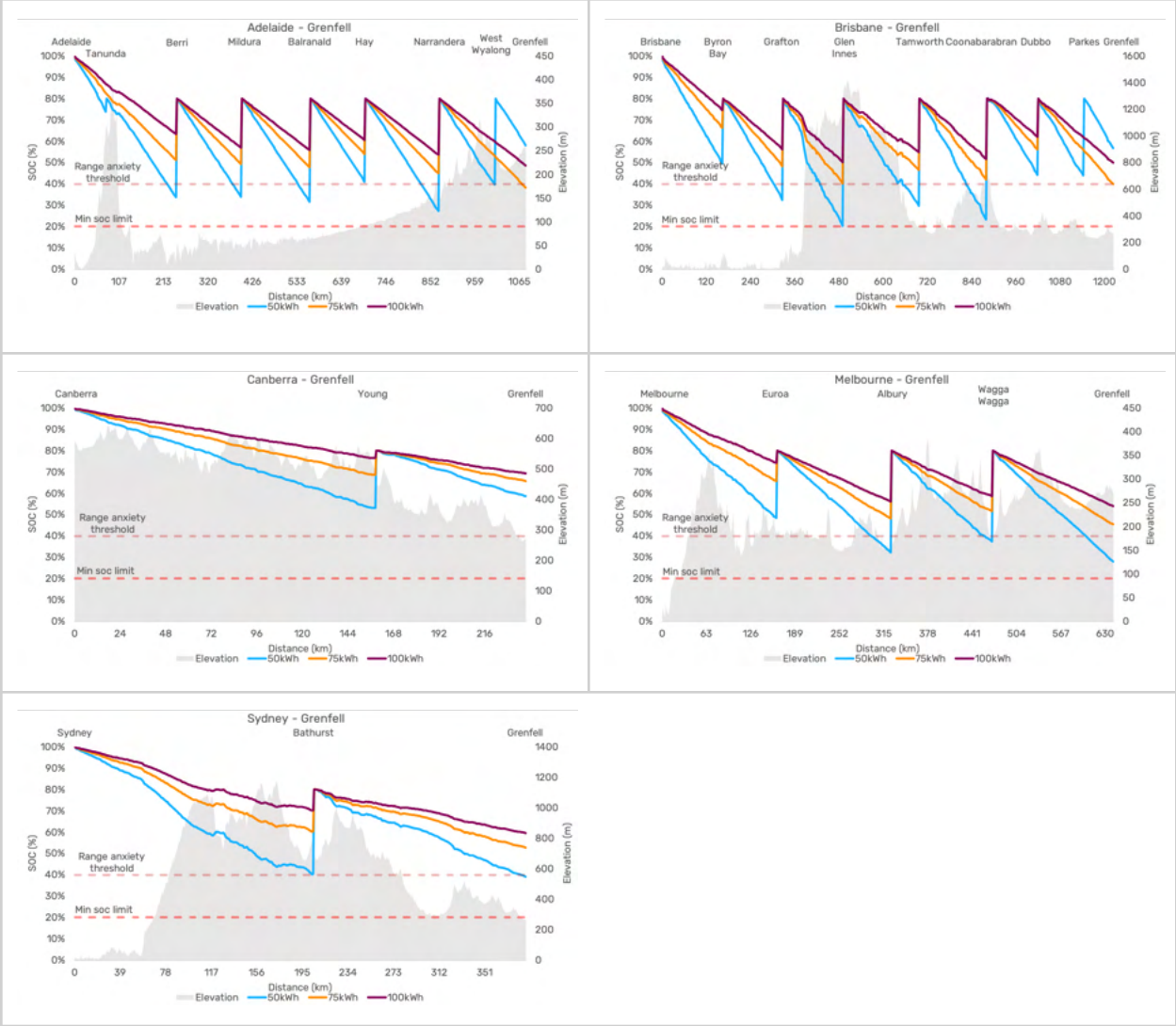
Map of key routes around Weddin



Key "journey enablement" sites for fast charging

The results of analysis through Evenergi's modelling software can be found below. Note that journey routes have been determined by the routes private/public charging station investors have chosen as priority routes.

Expected re-charging locations on key routes into the region



Key takeaways from this analysis include:

- Travelling to the Weddin region from Sydney will be a challenge for vehicles with less than 50kWh batteries, which represents most electric vehicles on the market in 2020. Lithgow and Bathurst are likely important recharging locations for travellers heading West into Central NSW, especially those seeking to take a rest-stop.
- Travellers driving to the Weddin region from Canberra in electric vehicles are unlikely to need to recharge along the journey; however, Young is a very likely rest-stop enabling the trip, with drivers seeking top up charge at that location.
- Electric vehicles travelling North-East from West of Central NSW to the Weddin region are likely to stop for a break and boost to battery charge at West Wyalong, with this city becoming an electric vehicle gateway to the region from the West.

- Travellers from Melbourne heading North to the Weddin region require journey-enabling charging at Wagga Wagga, and it is likely drivers will choose to take a rest-stop at Young, taking advantage of the opportunity to top up on charge.
- Travelling to the Weddin region from the North requires journey enabling charging stations at Dubbo and in smaller centres such as Coonabarabran. It is also likely that drivers will take a rest-stop at Parkes on their journey from the North, taking the opportunity to recharge at the location.
- There are many key charging locations along major routes from major Australian centres that require additional charging infrastructure to support effective journey enablement into the region going forwards.

Shortlist of highway, opportunity, destination and stay-over charging in the region

The following table presents the identified charger locations, strategic charger sizes and types, upstream constraints identified, recommended charger sizes in consideration of identified constraints, and finally notes about why the site is proposed for shortlisting.

Shortlist for highway, opportunity, destination and stay-over charging					
Location	Site ownership[#]	Unconstrained charger specifications	Substation constraints[48]	Constrained charger specifications	Notes
Grenfell Railway Station	Council	11-22kW	DS capacity available: 1x40kVA ZS capacity available: 0.1MVA	11-22kW	Warning: 50kW and above chargers may not be economically viable for the site due to ZS/DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities are limited.
Grenfell Visitors Information Centre / Grenfell Art gallery	Council	11-22kW 50-100kWh	DS capacity available: 1x40kVA ZS capacity available: 0.1MVA	11-22kW	Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Open 7 days. Nearby facilities include shops, accommodation, restaurants and a supermarket.

[48] Distribution substation constraints are best-practise estimates. Advice should be sought from local distribution network service provider, Essential Energy, prior to connecting EV chargers.

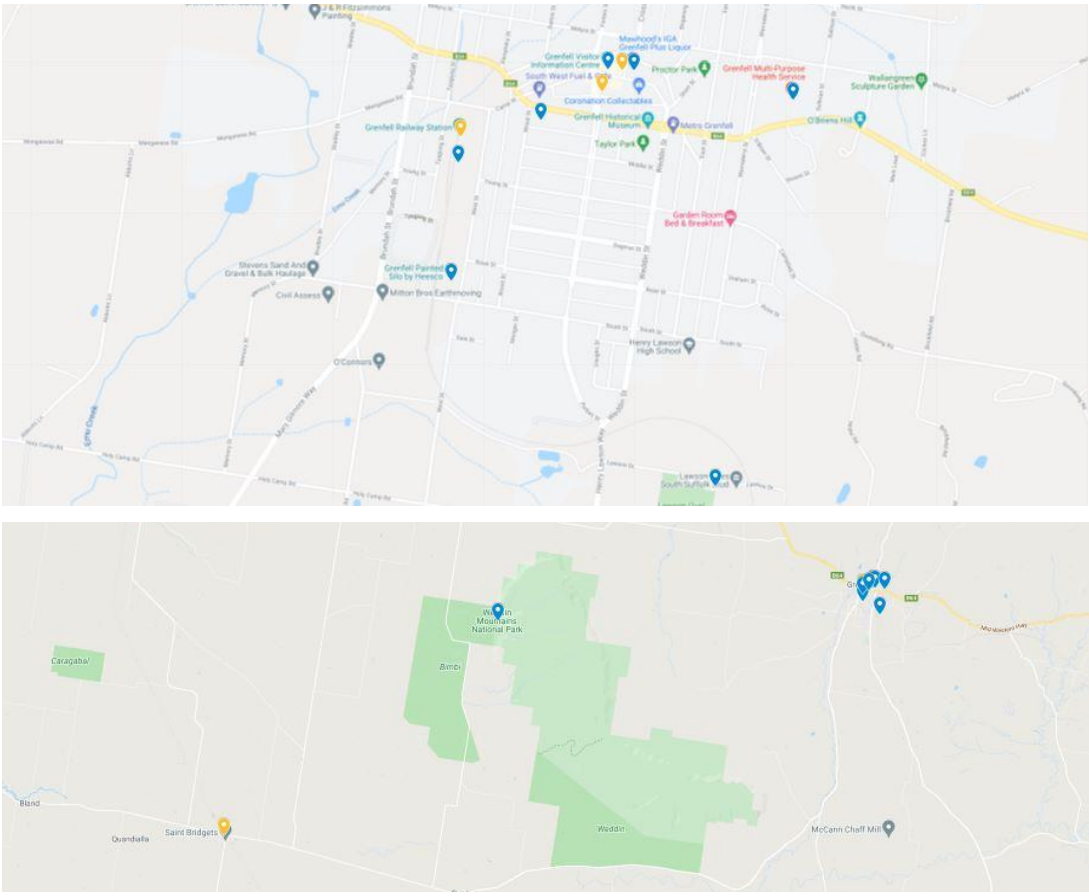
Parking area near Grenfell Visitors Information Centre	Council	11-22kW 50-100kWh	DS capacity available: 1x120kVA ZS capacity available: 0.1MVA	11-22kW 50-100kWh	Warning: Chargers with rated power above 100kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Open 7 days. Nearby facilities include shops, accommodation, restaurants and a supermarket.
Criterion Hotel	Private	<11kW	DS capacity available: 1x120kVA ZS capacity available: 0.1MVA	<11kW	Warning: 50kW and above chargers may not be economically viable for the site due to ZS/DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include cafes, a restaurant, car parking and accommodation.
Bland Hotel	Private	<11kW	DS capacity available: 1x40kVA ZS capacity available: 0.1MVA	<11kW	Warning: 50kW and above chargers may not be economically viable for the site due to ZS/DS capacity constraints. Requires formal request from site owner to firm up. Site notes: Nearby facilities include a park, cafe, service station and a post office.
Henry Lawson birthplace	Private	11-22kW 50-100kW	DS capacity available: 1x40kVA and 1x20kVA ZS capacity available: 0.1MVA	11-22kW	Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Nearby facilities are limited beyond the tourist attraction.
Grenfell	Private	11-22kW	DS capacity	11-22kW	Site notes: Open 24 hrs.

Commodities Silo Artwork		50-100kW	available: 1x126kVA ZS capacity available: 0.1MVA	50-100kW	Nearby facilities are limited beyond the tourist attraction.
The Big Pick n Pan / Grenfell Historic Railway Station	Private	11-22kW 50-100kW	DS capacity available: 1x40kVA ZS capacity available: 0.1MVA	11-22kW	Warning: Chargers with rated power above 22kW may not be economically viable due to DS constraints. The likelihood of being required to upgrade the DS increases the expected project costs. Site notes: Open 24 hrs. Nearby facilities include a tourist attraction, public showers, toilets and camping facilities.
Mawhood's IGA	Private	11-22kW 50-100kW	DS capacity available: 1x120kVA ZS capacity available: 0.1MVA	11-22kW 50-100kW	Site notes: Open 7days, 7:30am-7:30pm. Nearby facilities include accommodation, shops and restaurants.
Grenfell Multi-purpose Health Services	Private	11-22kW	DS capacity available: 1x126kVA ZS capacity available: 0.1MVA	11-22kW	Site notes: Nearby facilities are limited.
Grenfell Hotel / Motel	Private	<11kW	DS capacity and ZS capacity: Site by site variability ZS capacity available: 0.1MVA	<11kW	Warning: Capacity varies across the numerous sites, but low power overnight chargers are recommended

[#] Site ownership is per the best estimate of Evenergi and may not in all cases reflect actual site ownership.

Note: Shortlisted sites in blue, orange for shortlisted Council owned sites

Shortlisted sites for Weddin region



Note: Shortlisted sites in blue, orange for preferred sites[49]

Peak traffic flows and resultant charging infrastructure density

Overall peak traffic flows for tourist vehicles and for local vehicles determine demand for charging services in the region. The following table presents peak traffic for the region as well as its breakdown into its local and tourist components.

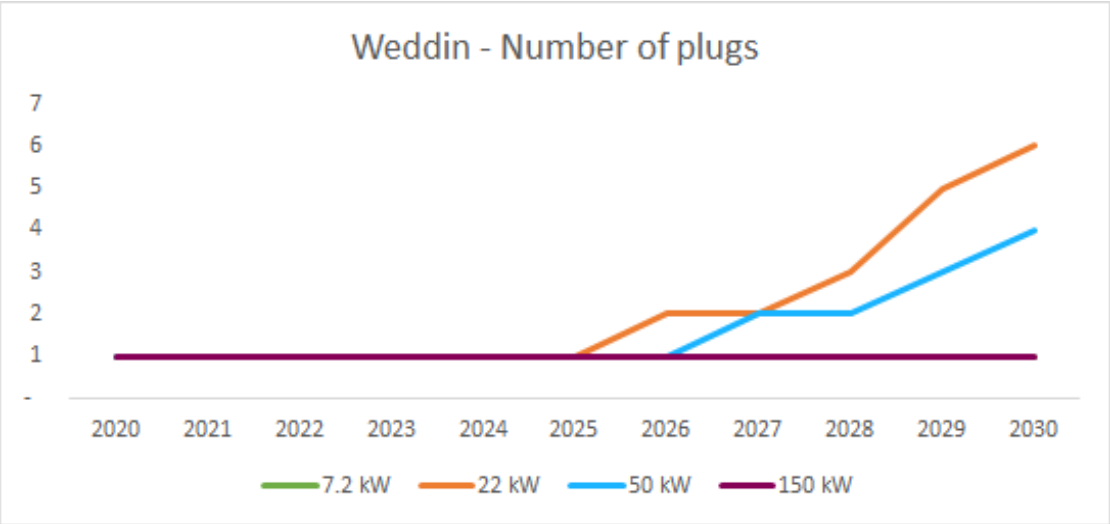
Peak traffic for Weddin	
Traffic component	Peak hourly traffic
Peak tourist vehicles	36
Peak local vehicle	72
Total peak vehicles	108

[49] The sites for Hotel/Motels are not reflected as they are too numerous.

The following table presents the number of individual charging plugs (whereas a charging station may include more than one plug that can function simultaneously) required during peak traffic times to optimally satisfy demand for charging of electric vehicles and avoid long waiting times. The analysis assumes electric vehicle penetration according to CSIRO's model in the year 2030. These numbers do not represent the minimum number of charging sites required, as sites will in many cases have more than one charging plug. Schedule 1provides details of assumptions that underlie this model.

Demand-driven number of required charging plugs for Weddin in 2030					
Year	7.2 kW	22 kW	50 kW	150 kW	Total
2020	1	1	1	1	4
2021	1	1	1	1	4
2022	1	1	1	1	4
2023	1	1	1	1	4
2024	1	1	1	1	4
2025	1	1	1	1	4
2026	1	2	1	1	5
2027	1	2	2	1	6
2028	1	3	2	1	7
2029	1	5	3	1	10
2030	1	6	4	1	12

As this model is based on an optimisation algorithm that assumes at the peak in demand all electric vehicle drivers will be able to find and connect to an available charger, the actual number of charging plugs required may be higher. Appropriate signage, parking rules, and ease of operation are important considerations. The growth in the number of required charging plugs can be more clearly seen in the following graph.



This approach takes a demand-side view and does not account for chargers that may be installed to attract clients, such as those installed by hotels, B&Bs and other overnight accommodation providers. It is expected that supply of these lower powered AC chargers will continue to far exceed demand, at least as far as overnight accommodation is concerned.

Peak tourism events and impact on demand for charging

Peak relative to non-event driven travel through the region was presented. No further data was available for this region relating to specific peak travel/tourism events. However, traffic in the region will increase due to large events in the neighbouring regions like Bathurst and Orange. This increase in traffic volumes will require some additional charging plugs to be installed to facilitate inter-regional travel and to optimally satisfy the charging demand of electric vehicles and avoid long waiting times.

Notes on policies and narratives in support of grants bids

The following potential policy positions and narratives may be helpful to consider in the development of a grant approach:

- The lower running costs and net lower cost (potential) of electric mobility should be equitably available and fully functional for those that commit to it.
- It is inequitable for employment opportunities to only exist for those with combustion engine vehicles and a robust regional charging infrastructure will not only connect key regional centres, but open employment and tourism access to EV drivers.
- Attracting tourists through infrastructure supporting eco-tourism and bespoke EV-centric regional travel experiences is a key avenue for securing new revenue sources.
- Lower regional transport costs lower barriers to access to national and international markets.

- The highlighted regional NSW customer outcomes in the Future Transport Strategy 2056 align strongly with the outcomes of investing in robust regional charging infrastructure.
- The Central Orana Regional Economic Development Strategy shows that the importance of tourism is relatively consistent amongst the top three economic opportunities for council members of the Central NSW Joint Organisation. Another clear takeaway is the importance of Agriculture, Transport and Logistics, Manufacturing and Mining. These economic verticals can be well served through transport electrification, with a competitive advantage to be enjoyed by regions and countries that can optimise the electrification timeframe.
- Progress in the area of freight electrification has the opportunity to take further advantage of TfNSW investment in connecting the region to key 'Global Gateway Cities', lowering the barriers to global competitiveness for local export such as agricultural produce.
- Infrastructure to support freight electrification such as Hydrogen refuelling and ultra-fast charging can come with high up-front costs. As such, the issue of freight electrification becomes a strategic discussion, and it is recommended that CNSWJO seeks to raise and sustain this topic through all relevant pathways of influence, including through the TfNSW Section responsible for the Freight and Ports Plan 2018-2023.
- Experience in Bathurst demonstrates that effective charging infrastructure networks attract a new type of experience-based tourist to the region.
- The Regional NSW Services and Infrastructure Plan proposes to take a flexible, agile investment approach. This is consistent with a receptiveness to unsolicited requests for funding where the requests align with the overall customer outcomes captured in the Plan.
- The Regional NSW Services and Infrastructure Plan specifically calls out that a plan and vision will be prepared for the Central West and Orana region by TfNSW in conjunction with key stakeholders such as the local government and Department of Planning and Environment. This mechanism may be a key pathway for influence.
- Early planning in preparation for TfNSW and Commonwealth Government regional infrastructure investment programs will position the region competitively relative to other regions who may not have undertaken the same level of prior consideration.

Key network linkages outside of CNSWJO

To ensure that the CNSWJO regional charging network is fully integrated into a wider national charging network, it is important to engage with neighbouring councils to facilitate the development of key network linkages.

The following table summarises these key journey enablement locations outside of the CNSWJO area.

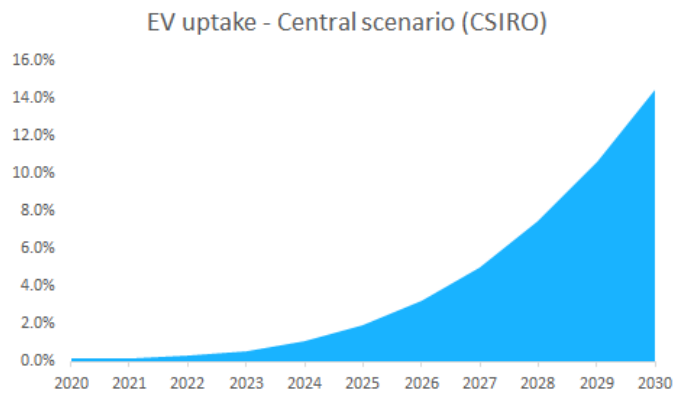
Key network linkages

Location	Links to	Council
West Wyalong	Adelaide, Melbourne	Bland Shire Council
Narrandera	Adelaide, Melbourne	Narrandera Shire Council
Hay	Adelaide	Hay Shire Council
Balranald	Adelaide	Balranald Shire Council
Mildura	Adelaide	Mildura Rural City Council
Berri	Adelaide	The Berri Barmera Council
Tanunda	Adelaide	The Barossa Council
Jerilderie	Melbourne	Murrumbidgee Council
Shepparton	Melbourne	Greater Shepparton City Council
Young	Melbourne	Hilltops Council
Jugiong	Melbourne	Hilltops Council
Wagga Wagga	Melbourne	Wagga Wagga City Council
Euroa	Melbourne	Strathbogie Shire Council
Holbrook	Melbourne	Greater Hume Shire
Albury/Wodonga	Melbourne	City of Albury/Wodonga City
Dubbo	Brisbane	Dubbo Regional Council
Scone	Brisbane	Upper Hunter Shire Council
Mudgee	Brisbane	Mid-Western Regional Council
Coonabarabran	Brisbane	Warrumbungle Shire Council
Tamworth	Brisbane	Tamworth Regional Council
Glen Innes	Brisbane	Glen Innes Severn Shire Council
Grafton	Brisbane	Clarence Valley Council
Byron Bay	Brisbane	Byron Shire Council

Schedule 2 - Assumptions underlying the charger quantity model

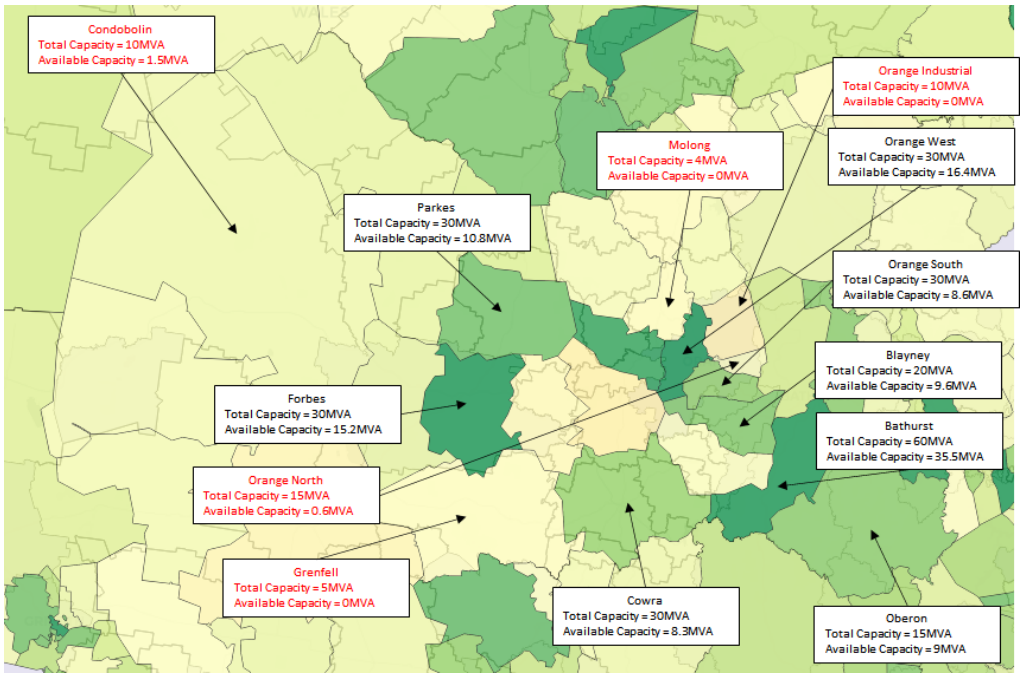
The following table presents the CSIRO EV uptake model underpinning this analysis:

CSIRO EV uptake model



The following map presents network capacity at zone substation level using AREMI map service:

Network capacities at zone substation level using AREMI[50]



[50] https://nationalmap.gov.au/renewables/

Route Energy Model

The origin and destination are identified for each route under assessment. The coordinate details (i.e. latitude and longitude) are fed into the route analysis model which provides the distance between the origin and destination along with the elevation profile of the route.

The rate of energy consumption of an EV (i.e. kWh/km) is significantly dependent on the elevation profile of the route. The distance and elevation profile information is then fed into the trip analysis model along with the EV specifications, defined in the 'Table - model inputs'.

The trip analysis model evaluates the route energy requirements, including regenerative braking due to variations in elevation profile and also the energy consumption due to auxiliaries (i.e. aircon/heater). The trip analysis model produces the state-of-charge (SoC) profiles of the EVs along the route at approximately 1km intervals. These SoC profiles are utilized to identify the charging needs along the route.

The following inputs have been used to model vehicle performance along the identified routes:

Model Inputs		
Variable	Value	Units
Total vehicle mass	1680	kg
Rolling resistance coefficient	0.015	n/a
Aerodynamic drag coefficient[51]	0.3	n/a
Air density	1.1839	kg/m^3
Frontal area	2.25	m^2
Inverter efficiency	95%	n/a
Power transmission efficiency	95%	n/a
Energy recovery efficiency	50%	n/a
Max motor power capacity	110	kW
Wheel efficiency	99%	n/a
Final drive efficiency	98%	n/a
Motor efficiency	88%	n/a

[51] Intended as a slightly conservative estimated average of SUV/Passenger vehicles

Battery efficiency	98%	n/a
Accessories average power	0.8	kW
Max acceleration (0-100 km/h in seconds)	7.9	s
Average speed (in km/h)[52]	80-100	km/h

Parameters and their sources to process route energy profiles		
Type	Source	Collection Method
Registered Vehicles	Australian Bureau of Statistics	CSV files
Central NSW Visitor Profile	Destination NSW	PDF file
Traffic Volume	Traffic Volume Viewer - Transport for NSW	CSV files
Number of visitors	• Tourism Research Australia • Weddin Shire Local Strategic Planning Statement 2020-2040 • Lachlan Shire Council - Destination Management Plan 2019-2022 • LGA Profile (Blayney) • Oberon Council Tourism Strategy - 2016 • Cabonne Tourism Plan 2013-2022	PDF files
Tourism (guest nights occupied)	Australian Bureau of Statistics	CSV files
Network capacity	AREMI	Manual entry

[52] Google Maps route average speed used per route

Schedule 3 - Electric Vehicle Charging Infrastructure

Schedule 3 provides an overview of charging infrastructure concepts that may be required by readers who seek a more detailed understanding.

Charger design

Charging Hardware

Electric Vehicle Supply Equipment (EVSE)

The core of every charging station is the Electric Vehicle Supply Equipment (EVSE), considered to be the external charger and associated accessories. Most EVSE connect to the 400/230V Alternating Current (AC) mains power, but may differ in the way that they deliver power to the vehicle. Generally, the higher the charging rate required from the EVSE, the more complex and heavy-duty the equipment.

There is a fundamental difference between AC and DC chargers that enables DC chargers to deliver higher power and thus shorter charge times. Ultimately, the battery of an electric vehicle must be charged with a Direct Current (DC) power source. This is shown by the red arrows in the diagram below.

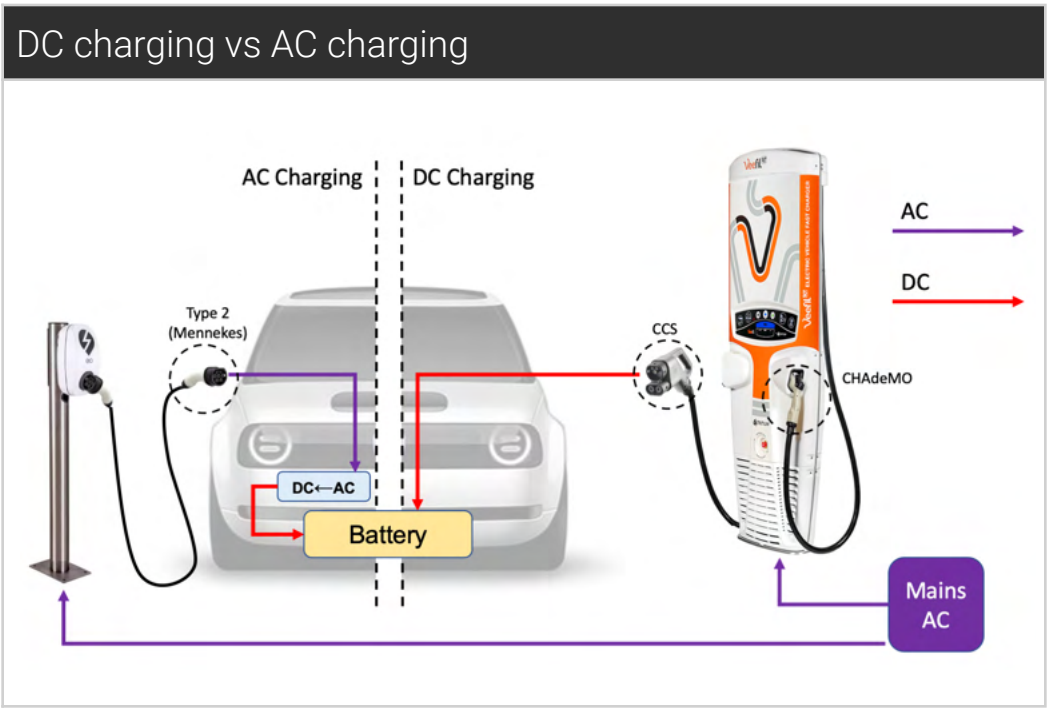


Image: AC charging scheme (left) is compared with DC charging scheme (right). The onboard charger (rectifier) is in blue, the AC circuit is purple and the DC circuit is red.

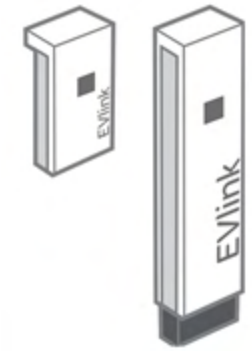
To get DC power to the battery, it is most common for the conversion from mains power AC to occur inside the vehicle. In this case an external AC charger plugs into the car, sending power to an onboard rectifier (simply referred to as an 'onboard charger'), which converts AC to DC and feeds this to the battery. Alternatively, the power source can go through an external rectifier to be converted to DC (a DC charger) which plugs directly through to the battery.

All EVs incorporate an onboard charger (rectifier), which converts AC to DC for both charging and regenerative braking. Due to the size, weight and cost of high power 'onboard chargers', manufacturers tend to limit the maximum input power to around 7 - 22 kW.

High powered DC chargers that deliver DC power directly to the battery are capable of delivering upward of 50 kW. While next generation DC chargers can deliver over 350 kW, most cars will have a limit to the power that they accept.

Wall vs Pedestal Mounting

Many Level 2 EVSE can be mounted on a wall or be integrated into a pedestal installed on the ground. Functionally, there is little difference between the two, however pedestal mounted EVSE can be around 25% more expensive to install than wall mounted EVSE. This is because pedestal mounted EVSE usually requires trenching to run the conduit between the EVSE and distribution board, with cost increasing with distance.



Example: The Schneider EVlink comes in both wall (left) and pedestal (right) forms.

Connector Types

AC and DC charging require different connectors, and within each of these categories there are alternative connector types. While there is currently no Australian Standard for plug types, the peak industry body for automotive, the Federal Chamber of Automotive Industries, has released a Technical Statement committing to a limited scope of plugs coming into Australia. This settles the de facto standard for AC charging as the Type 2 (Mennekes) plug and defines both the Charge-de-Move (CHAdeMO) and Combined Charging System (CCS) as DC standards for plugs. In reality, the industry is moving away from CHAdeMO as a solution and in the future the type of plug will become less effective as a public charging solution.

FCAI Technical Statement on EV Charging Standards for Public Recharging Infrastructure

General IEC 61851-1	Electric Vehicle Conductive Charging System, General Requirements
AC Charging AS IEC 62196-2	Plugs, socket-outlets, vehicle connectors and vehicle inlets Configuration Type 2
DC Charging IEC 62196-3	Configuration AA CHAdeMO or Configuration FF CCS Type 2

Level 1 chargers

10A domestic wall sockets for domestic use

The slowest and least expensive option is a common 10A wall socket. Electric vehicles can accept power from a typical wall socket and can be generally fully charged overnight, adding around 23 kWh over 10 hours.

10A domestic wall sockets for public use

Domestic sockets are not designed for regular plugging and unplugging, nor extended use at maximum rating. Domestic sockets are known to deteriorate and fail after 1-2 years of regular use in this way. Domestic sockets are not considered a reliable means to offer regular charging services to the public and are not recommended for this use-case.

3.6 kW slow chargers

Ideally suited to home charging where regular overnight charging is expected, and public charging can be leveraged for when faster battery top-up is needed. As a public charging solution, 3.6kW slow chargers can only be seen as an overnight destination solution or emergency opportunity charging location for those unable to access a suitable charger. Slow chargers without billing technology or other value-adds can now only be found for under $1,000, with installation costing from a few hundred to over one thousand dollars.

Level 2 chargers

7.2 - 16 kW AC fast chargers

Ideally suited to public destination charging such as at cafes, tourist hot-spots, shopping centres or overnight locations such as hotels and motels. Scheduled duration charging such as where a vehicle can be expected to regularly be available for charging over, for example, a lunch break period is also well suited to chargers of this speed. All-in costs as low as $2,000 per charge point are available on some low-specification chargers, with up to $10,000 per charging point required to access the higher specification connected, monitored, and billing-enabled options.

22 kW AC fast chargers

Ideally suited to public destination charging in the same way as the lower power AC fast chargers described above, the 22kW AC fast chargers are also sufficiently fast to be considered as an effective opportunity charging enabler. This means this charger speed is suitable for locations where an EV driver might stop specifically to charge, taking advantage of nearby amenities. This type of charger may be considered in order to attract EV drivers to stop for short periods of time and spend money in the local economy as they receive a boost to their driving range.

Level 3 chargers

25 kW DC fast chargers

Ideally suited to public destination charging and opportunity charging in the same way as the 22kW AC fast chargers described above. DC charging stations are currently more expensive than AC charging stations, but provide a more effective charging experience with higher average speeds. These lower powered DC rapid charging stations are uncommon currently, and are likely to be sought-after by EV drivers as they become more common. Since many EVs have a 7 kW limit for AC charging, 25 kW DC is widely appealing.

50 kW DC fast chargers

These charging stations are ideal for short-dwell applications where a full 20-80% charge can occur while the driver uses local amenities.

100 - 150 kW DC ultra fast chargers

These charging stations are suitable for journey enablement applications where drivers place high value on minimising their dwell time, such as highway service centres. This represents the current state of the art fast charging.

175 - 350+ kW DC ultra fast chargers

Ideally suited to journey enablement, DC rapid chargers can be significantly more expensive than AC fast chargers. These chargers include the well-known Tesla 'Superchargers' brand/model of charger and are necessary to enable travel through and within the region in support of growing tourism spend.

DC rapid chargers are known to attract EV owners to a region, with Bathurst Regional Council's findings from a survey of users of the NRMA and Tesla DC rapid chargers in Bathurst supporting this view. The findings from that survey indicate that many EV owners came to Bathurst and spent time in the city primarily because of the ability to access DC rapid chargers.

Connector types and their features		
Plug	Power Delivery and Features	Appearance
Type 2 (Mennekes)	Level 1 and Level 2 AC • Vehicle-charger communications • Single-phase charging up to 14.5 kW • Three-phase charging up to 43.5 kW • Compatible with CCS vehicle socket • Theft-proof locking pin	
Combined Charging System (CCS)	Level 3 DC • Deliver high power, over 50 kW • Uses Power Line Communication (PLC) – the standard grid communication system	
"Charge de Move" (CHAdeMO)	Level 3 DC • Deliver high power, over 50 kW • Uses CAN (Controller Area Network) – the 'standard' in-vehicle communication protocol	

Tethered or Untethered Chargers

A tethered charger is one where the charging cable is permanently connected to the EVSE. Untethered chargers feature a socket and require drivers to supply their own cable. The Type 2 mennekes plug/socket system features a locking mechanism that can be configured for semi-permanent attachment to the charger.

The clear benefit of untethered is that it is theoretically future proof, as an adaptor cable can be used in many instances if the socket type is not supported. However, a tethered unit is sometimes thought of as more convenient due to the fact there is no chance of loss or theft of the cable, and lifting the cable in and out of the car can become onerous.

DC fast chargers require specialised heavy duty cables, capable of transmitting high currents. Some even incorporate cooling systems into the design of the cable. For these reasons, DC chargers are always tethered with many EVSE featuring both CHAdeMO and CCS connectors.

> **Recommendation:**
> We expect that nearly all EV drivers will carry an AC charging cable with them, meaning untethered chargers are suitable for public charging points. However, anecdotal evidence suggests that regular users prefer the convenience of tethered chargers.

Modes

Charging infrastructure can also be categorized by "mode," which specifies the type of power delivery, safety and communications connection between the vehicle and the charging infrastructure.

- Mode 1 consists of 230 V charging up to 16 amperes (A) on a shared circuit without safety protocols.
- Mode 2 consists of 230 V charging up to 32 A from a standard outlet, on a shared or dedicated circuit, with safety protocols including grounding detection, overcurrent protection, temperature limits, and a pilot data line.
- Mode 3 allows 230 V charging at any amperage on a wired-in charging station on a dedicated circuit, with the same safety protocols as Mode 2 and an active communication line with the vehicle. This enables smart charging—the coordination of charging according to utility needs, fleet schedules, or renewable energy availability.
- Mode 4 is defined as DC fast charging on a 400 V, wired-in connection, and requires more advanced safety and communications protocols.

The public charging infrastructure outlined in this report are categorised as Mode 3 and Mode 4.

Hardware available in Australia

There is a diverse range of EVSE on the market, with many features aimed at satisfying different market segments. We have narrowed the field and present here a range of suitable EVSE for public use. Each is robust for outdoor applications and features connectivity that complies with the Open Charge Point Protocol (OCPP), allowing monitoring and billing services. Each of these EVSE are available from a major distributor.

EVSE is available in a number of different designs that package features tailored to the application. The table below highlights some of the available models of charger available on the Australian market and their key design features and functionality. Further examples are provided in Schedule 3.

Examples of chargers available in Australia, with key design features and functionality				
Type	AC Chargers		DC Chargers	
Design				
Common Names	AC Fast Charger AC Mounted Charger AC Wallbox Charger	AC Fast Charger, AC Pedestal	DC Wallbox DC Fast	DC Pedestal Supercharger DC Ultra-Fast
Application	Dedicated or Scheduled	Multi-purpose charging (Networked)	Opportunity Charging	Heavy duty opportunity charging or public fast charging
Power	3.5 to 22 kW	7.2 to 22 kW	7 kW - 25 kW	50+ kW
Plug	Type 2		CCS or CHAdeMO	
Available Models	All come in both: < 22 kW 3-phase < 7.4 kW 1-phase		7 - 11 kW **Rectifier Technologies** Highbury (AUS) **Rectifier Technologies**	

	EVolution Auriga (AUS) **Schneider** EVlink (FRA) **eo** Genius (UK) **ABB** Terra AC (CHE) **Keba** X-Series (AUT) **Circontrol** eVolve (ESP) **Delta** AC Max (TWN) **ChargeAmps** Aura (SWE) **Garo** Wallbox (SWE) **Tesla** Wall Connector (USA)	Highbury Bi-directional (AUS) 24 kW **ABB** DC Wallbox (CHE) **Schneider** EVlink DC (FRA) **Delta** DC Wallbox (TWN) 50+ kW **Tritium** Veefil (AUS) **ABB** Terra DC (CHE) **Tesla** Supercharger (USA) **Circontrol** Raption (ESP)

An interesting alternative to the above approach is the approach taken by SEA Electric, manufacturers of heavy electric vehicles in Australia. This involves installation of an AC charger in the vehicle, with the connection to the vehicle to enable a charger then coming from a commonplace 5-pin 3 phase charge point. This approach enables regular brief charging at any commercial site the vehicle visits and spends time at.

Details of level 2 chargers						
Manufacturer	EO	Keba	Rolec	Schneider	Circontrol	ABB
Model	Genius	X-Series Fast EV	Autocharge: EV Superfast	EVlink Parking	eVolve Smart T	Terra AC
						
Distributors	EVSE Australia	EVSE Australia	JetCharge	JetCharge, Chargers Direct	E-Station	Everty

Mount	Wall	Wall	Pedestal	Wall/ Pedestal	Wall/ Pedestal	Wall/ Pedestal
Power (kW)	22	22	22	22	22	22
Port(s)	1	1	2	2	2	1
Unit Price*	$1,500	$3,500	$2,500	$9,800	$5,000	
Pedestal	$770	$1,012	$0	$400		
Control Unit**	$800					
Power Supply	400 VAC, 3ø	400 VAC, 3ø	400 VAC, 3ø	400 VAC, 3ø	400 VAC, 3ø	400 VAC, 3ø
Plug Type	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2
Range per hour***	125 km	125 km	125 km	125 km	125 km	125 km
Connectivity	EO Pay (OCPP with eoHUB)	Chargefox	Chargefox (OCPP with EV Charge. Online)	Chargefox	Charge Star, Next Charge	Everty
*Some prices are from overseas vendors and are converted from foreign currencies and are correct as of April 2019. **One control unit is required locally for each installation, ***Rate of charge varies between vehicle						

Tesla Destination Chargers

Tesla destination chargers are Level 2 AC chargers that can deliver up to 22 kW of power depending on the configuration. They have become popular among tourism operators and can be found across Central NSW. The underlying reason why they are so popular is that operators receive up to two chargers from Tesla at no cost. The upfront cost of installation and the electricity supply are the only costs borne by the operator, and Tesla promotes the use of the charger to Tesla owners through its online map and in-car navigation system. While it might be a good deal for operators and Tesla owners, we hesitate to recommend the installation of Tesla Destination Chargers as a publicly accessible charging solution due to the occasional 'Tesla-exclusive' setting these chargers can exhibit.

Example of Tesla Destination Charger installation


DC Level 3 Chargers

Details of level 3 chargers						
Manufacturer	ABB	Delta	Delta	Circontrol	Tritium	Efacec
Model	50 kW DC Fast Charger	DC Quick Charger	DC Wallbox	Raption 22	VEEFIL-RT 50kW Fast	HV160 / HV175
						
Distributors	JetCharge	JetCharge	NHP	E-Station	JetCharge	N/A
Mount	Floor-standing	Floor-standing	Wall	Floor-standing	Floor-standing	Floor-standing
Power (kW)	50	50	25	22	50	161
Port(s)	2	1	2	2	2	1
Unit*	$35,000		$20,000	$25,000	$35,000	N/A
Plug Type	CHAdeMO and CCS	CHadeMO	CHAdeMO and CCS	CHAdeMO and CCS	CHAdeMO and CCS	CHAdeMO and CCS
Range (km) per hour**	280	280	140	125	280	800

Connectivity	Chargefox	Chargefox	Chargefox,	Nextcharge	Chargefox	OCPP
*Unit prices are only indicative, **Rate of charge varies between vehicle						

Upfront cost of infrastructure

This section will outline how each component of the charging station contributes to the overall cost of a charging station installation. The following are the key cost components related to installation of charging infrastructure.

Key cost components of installing charging infrastructure	
Item	Component
EVSE	• The charger unit, connectors, pole mount
Electrical	• Cable, conduits, distribution board • Transformer* • Labour
Network*	• Site inspection • Connection fee • Cost of network upgrade
Civil	• Trenching, tunnelling, boring • Repairing • Labour
Site works	• Signs, bollards • Road markings • Landscaping • Labour
Connectivity	• Software installation
*For new grid connections and high power installations such as DC fast chargers or multiple Level 2 AC chargers that require	

It is important to note that these cost estimates are indicative only and current only at the date of publication of this report. Each location will require a site inspection for an accurate installation cost estimate. Some equipment costs are converted from foreign currencies. Civil and electrical costs are derived from case studies and industry analysis.

Electricity network connection fees can vary by an order of magnitude if network augmentation or upgrade is required.

Cost of electric vehicle supply equipment

The EVSE considered in this paper is a shortlist of models suitable for public charging applications. They are robust, weatherproof designs with billing and monitoring features. As such they are more expensive than typical home or work chargers. The costs given here have been based on discussions with installers and are indicative only, and may vary considerably with the typology of the charging station site.

Cost for components of electric vehicle supply equipment		
Component	Description	Cost
Type: AC or DC	DC chargers are inherently more expensive than AC chargers due to the additional hardware, called a *rectifier,* required to convert the current from AC to DC. Additionally, the purpose of this design is to deliver a higher power to the vehicle, and so DC chargers are heavier duty, with thicker, heavier and stiffer connectors which all add to the cost.	AC cost range: $1,500 to $10,900 DC cost range: $20,000 to $35,000+
Power Output	EVSE with higher power delivery does so by utilising a higher amperage current. Most AC EVSE delivers power at either 16 A or 32 A, with a 3-phase supply facilitating higher power at the same amperage. Commercial grade chargers are equipped for both 16 A and 32 A.	3-phase power delivery incurs a 5% increase in charger unit cost
Number of ports	Some EVSE are available in single and double port versions. While the double port version is more expensive, on a per-port basis, it is much cheaper than installing two single-port versions.	Double port versions can cost 17% more than single port versions. However, on a per-port basis, a double port version costs 42% less than a single port version.

Mount type: Wall or Pedestal	Pedestal mounted EVSE is generally more expensive than wall mounted EVSE for a number of reasons: ● The pedestal mount itself has a material cost ● For pedestal mounted EVSE, the electrical circuit must pass underground. The civil work involves trenching/tunnelling and repairing	Overall costs for pedestal designs are between 20% and 30% more expensive.

Cost of charging station electrical system

The electrical design work, installation and connection to the electricity network must be done by a Level 2 Accredited Service Provider (ASP), with associated civil works best done by a local contractor. These costs will depend greatly on the site. A site inspection must be carried out in order to get an accurate cost estimate.

Charging station electrical system costs		
Component	Description	Cost
Design and labour	The design of the charging system by an electrician.	AC: $1,000 DC: $10,000
Switchboard	The majority of Level 2 charge installations require an upgrade to the switchboard. 72% of installations require new/upgraded switchboards[53]	Up to $6,000
Meter	A National Meter Identifier (NMI) meter is required so that the energy retailer can measure the energy consumption of the site. Only required if the charging station is the only network connection on site.	$1,500
Distance to switchboard	The cost of installing the electrical circuit increases with the distance between the EVSE and switchboard. For pedestal mounted EVSE, this means higher trenching costs.	Trenching, laying conduit, repairing: $360 per metre [54]

[53] EPRI
[54] US Department of Energy

Transformers	Charging stations with multiple Level 3 DC fast chargers will require an on-site transformer to step down the mains supply voltage to the correct voltage for the chargers.	Equipment cost: $50,000+

Cost of network connection

Connecting the EV charging station to the electricity network involves working with the local utility. In central NSW, this is Essential Energy or Endeavour Energy.

Cost of connecting EVSE to the network		
Component	Description	Cost
Site inspection	For Level 3 chargers, a site inspection by a network technician is necessary.	$500
Connection fee	"Pole to pit" connection to local distribution network (Essential Energy cost calculator)	From $2,500
Cost of network upgrade	The additional load from a level 3 charger may trigger an upgrade to the local distribution network.	Cost provided on application to the network

Cost of civil works

Civil works are a major cost of outdoor charging stations. The cost can be minimised if the work can be done by the council. The costs given here have been based on discussions with installers and are indicative only. Each site may vary depending on whether the charging system is retrofitted or part of a new development, indoors or outdoors, rocky or soil ground and any other combination of circumstances.

Cost components of civil works		
Component	Description	Cost
Trenching and coring	The electrical cable must pass underground to supply a pedestal mounted EVSE.	Trenching and electrical circuitry costs $250 to $500 per meter (depending on ground type)
Concrete	The foundation of the EVSE pedestal, footpaths and gutters.	$1,200 per EVSE
Install	The installation of the pedestal, bollards	$1000 per EVSE
Total cost	For pedestal mounted Level 2 EVSE	$1,500 to $4,000 per EVSE
Total cost	For pedestal mounted Level 3 EVSE	Up to $40,000 for new project

Cost of site equipment installation

Site equipment installation is similar for most site layouts, both indoor and outdoor. Costs here have been derived from supplier quotes.

Cost for site equipment installation		
Component	Description	Cost
Road markings	Line and road stencil painting	$700 per car space
Vehicle Safety	Tyre stops	$400 each
Wayfinding	Signs	$200+ each
Landscaping	Low maintenance garden bed	Varies

Cost of connectivity

EVSE that have built-in connectivity are often referred to as smart chargers. All of the chargers referenced in this report are Open Charge Point Protocol (OCPP) compliant, which means they are equipped with hardware and software that allows them to connect to cloud based charging networks. Unit costs can be reduced by packaging a modem and router into a control module that

is separate to the EVSE, with each EVSE connected to the Local Area Network (LAN) via Wi-Fi. Sometimes these control modules are incorporated into a *master* EVSE that controls a number of *slave* EVSE.

Cost of adding EVSE connectivity options		
Component	Description	Cost
Hardware[1]	Control module for site	$400 to $800 per site
Connection	Management software subscription (annual)	$120 to $380 per EVSE

Cost minimisation strategies

The up-front components of cost for installing and commissioning a charging system are outlined in the table below. Each of these costs can be minimised through careful planning and design, as highlighted below.

Up-front components of cost and cost minimisation strategies for charging system installation		
Component	Item	Cost minimisation strategy
Site Charging Layout	• Location of chargers relative to each other and vehicle storage	• Plan ahead to ensure suitable charger location over the forward planning period • Plan to cluster chargers and invest in enabling infrastructure upfront so work doesn't need to be repeated
EVSE	• The charger unit, connectors, mounting	• Use EVSE with dual connectors • Mount to existing infrastructure • Plan charger specification carefully
Electrical	• Cable, conduits, distribution board	• Minimise distance between EVSE and switchboard • Minimise trenching under roads/paths
	• Transformer*	Technical Note: • Only one supplier (Tyree) is available through Essential Energy. Essential Energy only places an order once the design has been approved • 6 months lead time on top of the design approval process (2-6 weeks).

Network*	• Site inspection • Connection fee • Cost of network upgrade	• Install chargers at sites with existing high-power grid connection • Engage energy distribution network operators (Essential Energy) early in the planning process
Civil	• Trenching, tunnelling, boring • Repairing	• Install multiple chargers on one site to improve economy of scale
Site works	• Signs, bollards • Road markings • Landscaping	• Plan for fluid vehicle movement around EVSE, including line markings and physical EVSE protection
Connectivity	• Software installation, commissioning	• Plan for future use-cases, understanding whether lower cost 'dumb' chargers can be upgraded to 'smart' chargers if the future demands it • Ensure training and supporting documentation is clear and made available widely
*For new grid connections and high-power installations such as DC fast chargers or multiple Level 2 AC chargers.		

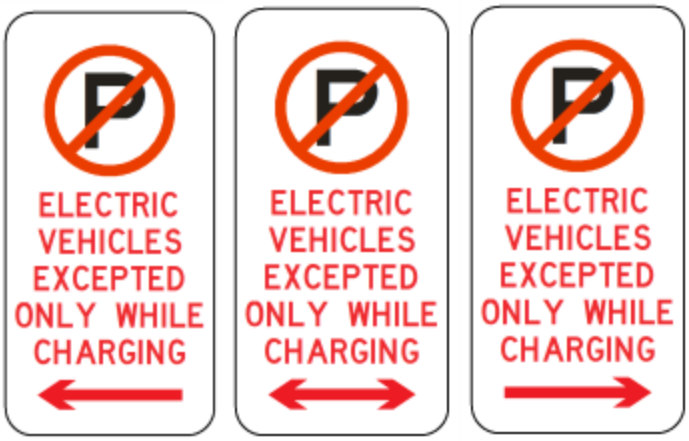
Costs vary significantly depending on site-specific considerations. It is recommended that project planners obtain multiple quotes for these works in order to obtain the most cost effective implementation.

Implementation considerations

Signage

There are currently few Australian regulations specific to EV charging stations, and so we will present some examples of current practice. Signage can be grouped into wayfinding signage and station signage.

Types of signage, their functions and examples		
Type	Function	Examples
Wayfinding Signage	Help EV drivers navigate to and identify charging stations Facilitate deployment of	 (1a)  (1b) (1a and 1b) Main Roads Western Australia

	plug-in vehicles by providing visibility for charging infrastructure to prospective PEV drivers. An important reference document is AS 1742.15:2019[55].	
Station Signage	Optimize use of EVSE by helping all drivers understand that parking spaces at charging stations are for PEVs only. Refer AS 1742.2, 1742.11, AS 2890.1 and RMS supplements[56]. These are the only enforceable signs that can be installed.	 RMS r5-41-5: Panel sizes and arrangements to be in accordance with AS1742.11 and AS1743
	Provide instructions for the use of EVSE	
		(1) Example from USA with billing instruction

[55] https://infostore.saiglobal.com/en-au/standards/as-1742-15-2019-126128_saig_as_as_2772335/
[56] https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guidelines/as1742-p1-p15.pdf

	Provide information about regulations - such as access, time limits, and hours of use - and facilitate enforcement	 (1)  (2)  (3)  (4) (1) Reserved parking sign by EVSE Australia (2) Street sign (USA) (3) Tow warning sign (USA) (4) Tesla parking rule sign
	Hazard identification and safety	 (1)  (2) (1) Hazard warning for power supply (2) Hazard warning for EVSE

Public Safety

The following measures can be undertaken to minimise the risk of serious injury to members of the public, both operators and bystanders.

Measures to minimise the risk or serious injury to members of the public		
Hazard	Risk	Strategy
EVSE Connector	Trip	The charge station should be designed to minimise the risk of tripping by: • implementing car stoppers, bollards and elevated connectors • Situating charger away from pedestrian traffic • Signage to alert pedestrians • Providing convenient and safe stowage of cables
Water	Electric shock, damage to electrical equipment	The charge station and associated infrastructure should: • not be placed in an area of flood risk and standing water • be weather resistant to at least IP54 and be operable in usual prevailing weather conditions
Moving vehicles	Collision damage	The charging station bay and layout should ensure: • physical protection and enclosures for electrical and electronic equipment • provide anti-collision infrastructure such as tire stops and bollards
Equipment failure	Electric shock	The charging equipment should be periodically assessed for safety at a period not exceeding 12 months.
Bushfires	Fire damage	Reduce risk of damage from bushfire by implementing a Building Protection Zone around the asset. Different building rules may apply if asset is located in a designated bushfire prone area

Electricity costs overview - Business customer in Essential Energy network consuming greater than 160MWh per year		
Charge	Typical cost	Description
Energy commodity charges		
Peak (kWh)	8-13c/kWh	For energy consumed between 17:00-20:00 on weekdays.
Shoulder (kWh)	8-13c/kWh	For energy consumed between 7:00-17:00 and 20:00-22:00 on weekdays.

Off peak (kWh)	6-8.5c/kWh	For energy consumed 22:00-7:00 on weekdays and all weekends/public holidays.
Network charges		
Peak (kWh)	4.2784c/kWh	Cost to deliver energy to the site by Essential Energy, the peak period is from 17:00-20:00 on weekdays.
Shoulder (kWh)	3.7133c/kWh	Cost to deliver energy to the site by Essential Energy, the shoulder period is from 7:00-17:00 and 20:00–22:00 on weekdays.
Off peak (kWh)	2.4364c/kWh	Cost to deliver energy to the site by Essential Energy at all other times.
Demand peak (kW[57])	$9.9526/kW/month	The calendar monthly demand measured by the meter for the peak, shoulder and off-peak periods. The monthly demand is the maximum half hour demand for the month occurring within the peak, shoulder and off-peak periods
Demand shoulder (kW)	$9.0047/kW/month	
Demand off peak (kW)	$2.1848/kW/month	
Fixed charges		
Daily supply and metering charges	$25/day	These are to cover fixed costs in delivering energy to the site and are not affected by how energy is consumed.
Environmental charges		
Environmental charges (kWh)	1.5-2.5c/kWh	Environmental charges are passed on by energy retailers to cover the costs incurred to meet their obligations under the Renewable Energy Target.

[57] Measured as kVA by Essential Energy

Electricity costs overview - Business customer in Essential Energy network consuming less than 160MWh per year		
Charge	Typical cost	Description
Energy commodity charges		
Peak (kWh)	26-35c/kWh	For energy consumed between and 17:00-20:00 on weekdays.
Shoulder (kWh)	24-32c/kWh	For energy consumed between 7:00-17:00 and 20:00-22:00 on weekdays.
Off peak (kWh)	16.5-20c/kWh	For energy consumed 22:00-7:00 on weekdays and all weekends/public holidays.
Fixed charges		
Daily supply and metering charges	$1.35-$2.15/day	These are to cover fixed costs in delivering energy to the site and are not affected by how energy is consumed.

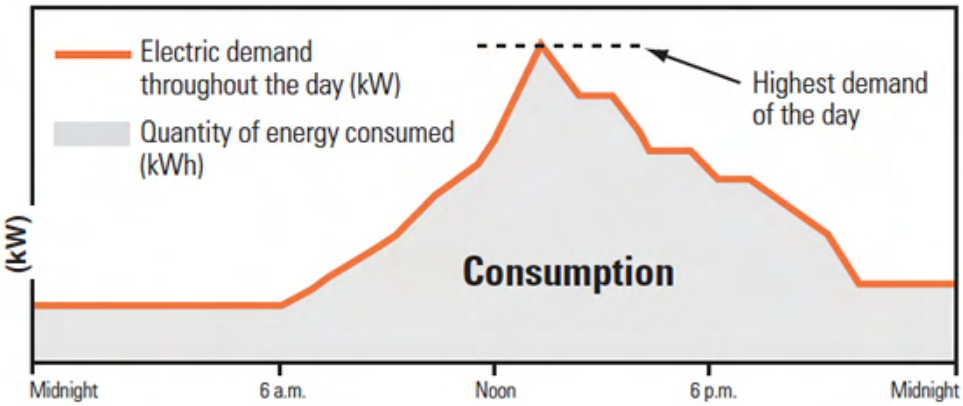
Alternatively, an operator may explore a Power Purchase Agreement (PPA) either by contracting directly with a renewable energy source such as a wind or solar farm or from a renewable energy retailer (e.g. Flow Power), whereby a long term renewable energy supply contract can be negotiated, hedged against the wholesale electricity price. These are becoming increasingly popular ways of sourcing low emission energy at low prices.

In some markets, Distribution Network Service Providers (DNSPs) are entering the EV charging space as they have a vested interest in the cost and reliability of the grid. Partnerships with DSOs (such as Essential Energy) may present an opportunity to participate in smart grid projects that reduce the network costs for charge station operators.

Dynamic Load Management systems

The energy delivery of electric vehicle (EV) charging consists of two components:

1. The rate at which charging happens, or charge level. Measured in kilowatts (kW)
2. The amount of energy required to charge the battery. Measured in kilowatt-hours (kWh).

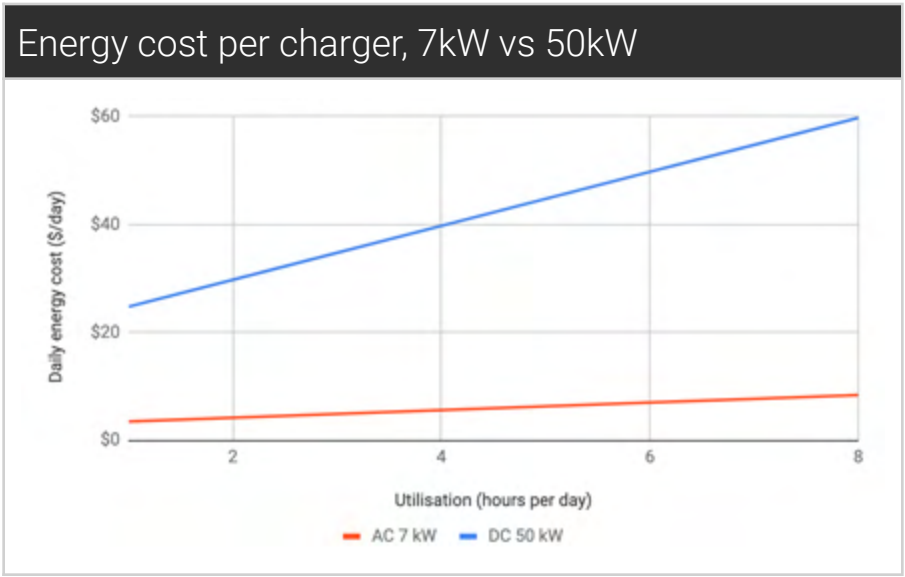


Demand[58] vs consumption

As the level of charging (kW) is increased, it will drive the requirement for electrical infrastructure upgrades both on the site and upstream of it. However, reducing the level of charging may mean that a vehicle's energy needs are not met within the available time to charge them. This trade-off must be carefully balanced through modelling and analysis.

In addition to the costs associated with infrastructure upgrades, there are ongoing costs for the energy required by the vehicles. Energy costs need to be viewed both from total energy requirements and charging strategy. These costs will vary based on the time of day, amount of total energy a site consumes and season.

High powered chargers incur higher demand/capacity ($/kVA/pa) and energy ($/kWh) costs. If we compare a 7 kW AC charger to a 50 kW DC charger, we can see that the charger costs increase proportionally with utilisation.



[58] Demand is also represented as kilovolt-amps (kVA) which is correlated to kilowatts using a term called power factor, but for the purposes of this document, kW will be used as they are closely related.

The number of chargers multiplies the relationship described above. However, with multiple chargers comes flexibility. A demand management system can cap the total power draw for the site, resulting in lower demand and capacity costs. Load management systems are designed to keep the power draw of a group of EV chargers within the limit of the overall site power capacity. Dynamic systems can respond to other loads, reducing charging rate in response.

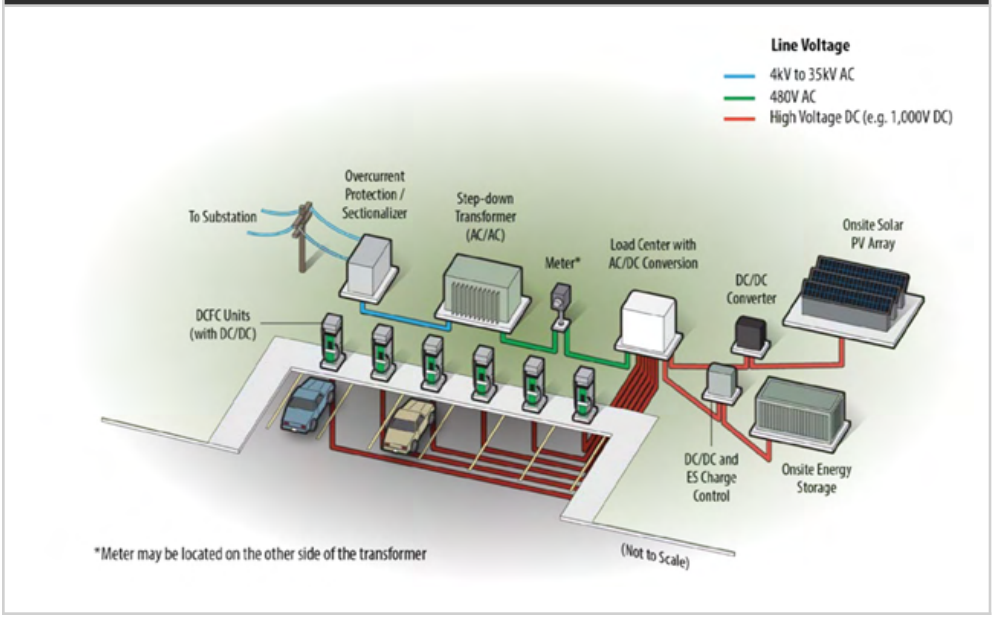
Since load management systems may slow the rate of individual chargers, they are more suitable for destination (or work) charging systems. To ensure a fair distribution of power, systems can be set up to prioritise EVs with a lower battery state, or charge a premium for priority charging.

Solar-battery-charger

A feature of grid constrained sites is the potential expense of grid connections and the risk of loss of connection. Storage can dramatically reduce the demand and capacity cost of energy while also having the potential to provide grid services. On-site solar can reduce fixed and variable costs while also generating revenue by exporting surplus power to the grid.

The addition of battery storage decouples the power delivery to the vehicles from the power drawn from the grid. By charging at lower power and discharging at higher power to the EV, the power draw of the site is flattened, reducing demand peaks that incur high network costs (highlighted yellow in table). This can be useful for both lowering costs and enabling connections in areas with constrained supply. Integrating on-site generation in the form of solar is another way of reducing fixed costs, while also generating revenue when the system is not in use. Of course, the battery can be an expensive addition to the installation at about $1000/kWh .

Battery integrated DC fast charger



Credit: Idaho National Lab

Examples of battery integrated DC Fast Charging (DCFC)

An example of a battery integrated DCFC is Chargefox DCFC Euroa :

- 2x 350 kW ABB DC Chargers
- 150 kW Solar
- 273kW/410kWh battery.

Chargefox Euroa (source: ABB)

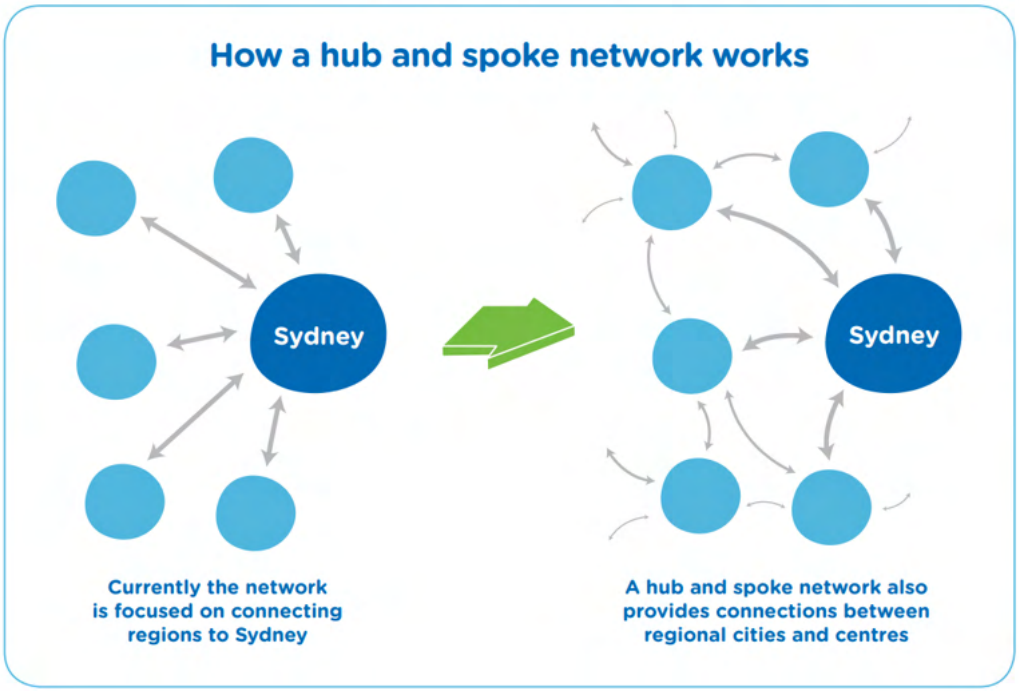
Schedule 4 - Linkages with Transport for NSW plans

In 2018 Evenergi participated in the development of the NSW Government's Future Transport 2056 Strategy. To a large degree, NSW has focused on investments in roads. The Future Transport document investigated and made recommendations around the emergence of autonomous vehicles and the impact on the road strategy, assisted mobility devices, autonomous aerial mobility and electric vehicles.

Detailed plans were developed around electric vehicles with significant funding allocated for electric bus trials, infrastructure investment and consumer awareness (which Evenergi is now delivering). Future travel in regional NSW is covered in the Future Transport 2056 Strategy, with a particular focus on connections through a 'hub and spoke' network model radiating out from regional cities, rather than a network focused on Sydney.

The hub and spoke model, as outlined below, is designed to capitalise on the role that regional cities and centres play as hubs for employment and services such as retail, health, education and cultural activities. Opportunities to leverage and align with the Future Transport 2056 Strategy will be reviewed and proposed as part of the Plan.

Hub and spoke model graphic



Source: NSW Future Transport 2056 Strategy

DPIE has been working on a number of initiatives, including mapping potential charging infrastructure. In March 2020, Matt Kean MP, announced the first stage of the Net Zero Plan

focused on the period 2020 - 2030. In this plan there were some exciting breakthrough announcements for the fleet electric vehicle market in Australia. An excerpt from the plan:

> *"Electric vehicles present a significant opportunity for motorists to reduce their yearly car operating costs…. (however) there are two primary barriers to widespread electric vehicle adoption in New South Wales: the lack of convenient, fast-charging infrastructure and the limited range of affordable electric vehicle models in the market.*
>
> *In January 2019, the NSW Government released its Electric and Hybrid Vehicle Plan to help overcome these barriers in New South Wales. The NSW Government will expand that Plan by developing an Electric Vehicle Infrastructure and Model Availability Program to fast-track the growth of the electric vehicle market in New South Wales. The program is identified as a priority program for Bilateral funding."*

There are a number of pathways of influence related to Transport for NSW (TfNSW) and broader NSW Government plans and these are outlined in the following sections. The effectiveness of each pathway as a means to influence the direction and timing of state budgets is difficult to qualify and will to a large extent depend on the established understanding and relationships of the CNSWJO, member councils and specific senior management.

The Future Transport 2056 Strategy

The below table presents the key takeaways from Transport for NSW Future Transport 2056 Strategy, and the potential for leverage into support for the region:

Strategic relevance of takeaways from the Future Transport 2056 Strategy	
Takeaways from the Future Transport 2056 Strategy	Strategic relevance
What change is Future Transport responding to? • In regional NSW, new technologies could transform transport services, with data-driven models matching demand with a range of service and vehicle types. • Create intelligent transport networks, managed with data: installing technologies and building networks that actively gather data.	A connected and strategic regional plan for charging would meet this description. Putting the concept on the agenda and keeping it there will be important to ensure it is a consideration within relevant budget planning cycles
A Strong Economy • Regional cities and centres will be connected to outlying towns and centres by a 'hub and spoke' network. They will be centres for health, education,	The lower cost per km and net lower cost (potential) of electric mobility should be equitably available and fully functional for those that commit to it. It is

and justice services as well as providing access to employment opportunities and air transport connections ● Towns and villages will offer employment and housing and will continue to be important in attracting domestic and international visitors, bringing job opportunities and economic benefits to rural communities.	inequitable for employment opportunities to only exist for those with combustion engine vehicles and a robust regional charging infrastructure will not only connect key regional centres, but open employment and tourism access to EV drivers.
Sustainability NSW will need to consider a range of approaches to secure revenue sources and deliver continued efficiencies through improved operations and maintenance, innovation and a commercial focus on asset management.	Attracting tourists through infrastructure supporting eco-tourism and bespoke EV-centric regional travel experiences is a key avenue for securing new revenue sources.
Regional NSW Customer Outcomes Regional NSW transport customer outcomes include: ● Economic development is enabled by regional transport services and infrastructure ● A transport system that is resilient to significant weather events including floods, fog and bush fires ● Accessibility to employment and services such as health, education, retail and cultural activities within Regional Cities and Centres ● Customers enjoy improved connectivity, integrated services and better use of capacity	The highlighted regional NSW customer outcomes align strongly with the outcomes of investing in robust regional charging infrastructure. This alignment provides the foundation for funding through the various avenues of the Future Transport 2056 strategy. 75-80% savings per km are available through electrification of regional transport services. Lower regional transport costs lower barriers to accessing national and international markets.
Our road customers Future directions to investigate ● Provide better road connections between key centres, particularly in regional NSW ● Prioritise efficient vehicles, taking into account the type of corridor, customer mix and the importance of local spaces ● Deliver 'smart' motorways and work with industry and innovators on new technologies that can improve the road user experience ● Enable new and upgraded physical and digital assets to support new technologies and adapt to future developments	The Future Transport 2056 Strategy includes areas for future investigation over the 10 years from publishing. The commitment to these areas and their alignment to regional charging infrastructure implies that approaches for funding will be well received if based on robust analysis.

The Central West and Orana Regional Plan 2036

The Central West and Orana Regional Plan 2036 is a 20-year blueprint for the future of the Central West and Orana region, and is a related plan to the Future Transport 2056 Strategy. The top 3 economic opportunities per LGA are presented in the Central West and Orana Regional Plan 2036, and these are presented below:

Top 3 economic opportunities per Local Government Area

CENTRAL WEST	Agribusiness	Transport and logistics	Tourism	Manufacturing	Mining	Aged care	Health	Aviation	Technology and education
Bathurst Regional			✓	✓					✓
Blayney	✓	✓			✓				
Cabonne	✓		✓		✓				
Cowra	✓			✓				✓	
Forbes	✓		✓			✓			
Lachlan	✓	✓	✓						
Lithgow		✓	✓		✓				
Oberon		✓	✓	✓					
Orange		✓	✓				✓		
Parkes	✓	✓			✓				
Weddin	✓		✓				✓		

Source: Central West and Orana Regional Plan 2036

This table helps to visualise the importance of tourism, which is relatively consistent amongst the top three economic opportunities for councils of CNSWJO. Another clear takeaway is the importance of agriculture, transport and logistics, manufacturing and mining. These economic verticals can be well served through transport electrification, with a competitive advantage to be enjoyed by regions that can optimise the electrification timeframe.

The below table presents the key takeaways from the Central West and Orana Regional Plan 2036, and the potential for leverage into support for the region:

Strategic relevance of takeaways from the Central West and Orana Regional Plan 2036	
Takeaways from the Central West and Orana Regional Plan 2036	Strategic relevance
Direction 4: Promote and diversify regional tourism markets	The 8 identified directions and two actions from the Central West and Orange Regional Plan 2036 are consistent with the outcomes of investing in optimised charging infrastructure for the Central NSW region. The Central West and Orana Delivery, Coordination and Monitoring Committee should be receptive to the arguments put forward for funding assistance by the CNSWJO and member councils. While there may not be existing budget in the regional plan to support new activities
Direction 13: Protect and manage environmental assets	
Direction 15: Increase resilience to natural hazards and climate change	
Direction 18: Improve freight connections to markets and global gateways	
Direction 21: Coordinate utility infrastructure investment	
Direction 22: Manage growth and change in regional cities and strategic and local centres	
Direction 23: Build the resilience of towns and villages	
Direction 29: Deliver healthy built environments and better urban design	
Action 4.1 Align land use and tourism strategies with a Destination Management Plan for the Country and Outback NSW Destination Network.	
Action 4.3 Develop the region's capacity to grow food and wine tourism	

The NSW Government has established the Central West and Orana Delivery, Coordination and Monitoring Committee to deliver, coordinate and be accountable for achieving the vision and goals of this Plan. In the short term, its focus includes planning for growth and change in the region's centres, which strongly aligns with the endeavours of the CNSWJO.

The Central West and Orana Delivery, Coordination and Monitoring Committee should be receptive to the arguments put forward for funding assistance by the CNSWJO and member councils.

TfNSW Freight and Ports Plan 2018-2023

TfNSW Freight and Ports Plan 2018-2023 sees electrification as a focus for 'sustainability', and not health, nor economic benefit. This is a missed opportunity as there are significant economic

opportunities attached to the successful electrification of freight through the region, with typical costs per kilometre travelled being 75-80% lower than for existing diesel-powered freight.

Progress in this area has the opportunity to take further advantage of TfNSW investment in connecting the region to key 'Global Gateway Cities', lowering the barriers to global competitiveness for local export such as agricultural produce.

Infrastructure to support freight electrification such as Hydrogen refuelling and ultra-fast charging can come with high up-front costs. As such, the issue of freight electrification becomes a strategic discussion, and it is recommended that CNSWJO seeks to raise and sustain this topic through all relevant pathways of influence, including through the TfNSW Section responsible for the Freight and Ports Plan 2018-2023.

Transport and Tourism Plan and Visitor Economy Industry Action Plan 2030

Transport has the potential to support and enhance existing tourism as well as create new economic development opportunities. In recognition of the critical interconnect between transport and tourism in regional NSW, a supporting Tourism and Transport Plan was developed as part of Future Transport 2056.

The Tourism and Transport Plan focuses on what the Transport cluster of agencies can do to deliver on the NSW Government's state-wide targets for the visitor economy set in the Visitor Economy Industry Action Plan 2030. It was developed in collaboration with the tourism sector and will inform the state-wide Tourism Infrastructure Strategy.

This plan provides a framework of customer outcomes for visitors to the region and initiatives to guide the work of the NSW Transport cluster[59] over the next 10 years. The Transport and Tourism Plan provides a number of key insights into how CNSWJO and member councils can benefit from broader strategic investment across NSW.

This Visitor Economy Industry Action Plan 2030 (VEIAP 2030) responds to the independent Visitor Economy Taskforce's review of the NSW Visitor Economy Industry Action Plan and provides a reinvigorated direction for the NSW visitor economy to the next decade. VEIAP 2030 supports the Commonwealth Government's ambition to develop Australia's visitor economy industry to a top tier sector, with the Tourism 2030 Strategy due for launch later this year.

The below table presents the key takeaways from the Transport and Tourism Plan and Visitor Economy Industry Action Plan 2030, and the potential for leverage into support for the region:

[59] https://www.transport.nsw.gov.au/system/files/media/documents/2020/transport-cluster-chart-july-2020.pdf

Strategic relevance of takeaways from the Transport and Tourism Plan and Visitor Economy Industry Action Plan 2030	
Takeaways from the Transport and Tourism Plan and Visitor Economy Industry Action Plan 2030	Strategic relevance
Customer Outcome 2. Greater access to more of NSW Transport is essential in connecting visitors to our cities and regions. By improving existing connections and expanding connections to new destinations, transport can create new visitor experiences across the state and support new industries and employment in regional communities.	As transport electrification gains deeper penetration of the total vehicle pool, and of the cohort that may travel to the region, the performance and transparency of the regional charging infrastructure will play an increasingly pivotal role. More than a potential barrier, experience in Bathurst demonstrates that effective charging infrastructure networks attract a new type of experience-based tourist to the region.
Customer Outcome 3. Making transport the attraction Transport not only gets visitors to destinations, but can also be an attraction in itself. Heritage tours, walking and cycling trails, and iconic journeys by road, rail and sea all contribute to attracting visitors to NSW.	
Stage of journey - "arrive" - Experiencing The Destination Ease of getting around and to sites and attractions The destination experience is often shaped by the ease of getting to and around the sites and attractions including for people with disabilities. Creating attractive and vibrant places that are well connected to the transport network will also help boost tourism.	
Creating places initiative "Ensure the design and function of transport investments improve places"	This initiative is committed over the 10 years from publishing of the Plan and provides an insight into an approach that may receive funding support. A strategic overlay identifying the scope of investment and how charging infrastructure supports creating spaces may provide a persuasive argument.
Electric vehicles are coming fast: A range of studies show that electric vehicle ownership rates are starting to increase significantly, due to cost	This section of the Transport and Tourism Plan provides the clearest messaging about the alignment of TfNSW plans and

reductions and advances in battery technology. Public charging points are critical for electric vehicle owners and hirers to be able to access all parts of the state and be confident in the regional touring market. In order to support the growing number of visitors driving electric vehicles, *regions and tourist operators will need to plan for the provision of charging stations, particularly along major tourist routes.* In NSW, the importance of giving regions access to the growing market of visitors driving electric vehicles cannot be overstated. This will require planning and possible industry-government co-investment to establish charging infrastructure. In particular, fast public charging infrastructure is principally required to facilitate inter-city travel for trips greater than 150-250 km.	those being investigated by CNSWJO and member councils.
Focus 02. Support regional decisions. Back regional NSW. How are we going to better support the Destination Networks and increase local decision making? ● Introduce annual funding agreements between each Destination Network and the Chair of Destination NSW[60] Board on behalf of the NSW Government. ● Redesign Destination NSW grant processes to increase Destination Network participation in grant design, assessment and funding allocations. ● Require the Destination Networks to actively engage with local councils. ● Increase short term funding to each Destination Network to reflect resources required to develop and implement destination management plans. ● Ensure each Destination Network has access to Destination NSW regional staff with the necessary skills and expertise to deliver on destination management plans.	Funding streams are established through the Destination Network mechanism coordinated by the NSW Government. The Country and Outback NSW Destination Network offers a potential pathway to progress requests for funding. Direct unsolicited approaches to Destination NSW, TfNSW or other areas of the NSW Government or elected leaders may also present valid and effective funding pathways.
Focus 05. Invest in infrastructure. Investing in critical infrastructure, future planning and better ways to do business will ensure the continued growth and future prosperity of the NSW visitor economy.	The Visitor Economy Industry Action Plan 2030 considers investing in infrastructure to be a core focus of the plan.

[60] https://www.destinationnsw.com.au/contact-us/key-contacts#executive

Regional NSW Services and Infrastructure Plan

The Regional NSW Services and Infrastructure Plan is the NSW Government's blueprint for transport in regional NSW out to 2056. It sets out the Government's thinking on the big trends, issues, services and infrastructure needs which are now, or will soon shape transport in regional NSW.

The Regional NSW Services and Infrastructure Plan outlines the vision and customer outcomes that the government will use to go about its detailed transport planning in each region and also support its future decision making.

The transport plan for regional NSW is underpinned by the outcomes customers can expect. The below table presents the key takeaways from the Regional NSW Services and Infrastructure Plan, and the potential for leverage into support for the region:

Strategic relevance of takeaways from the Regional NSW Services and Infrastructure Plan	
Takeaways from the Regional NSW Services and Infrastructure Plan	Strategic relevance
Customer Outcome 2: Embracing new technology Customer needs are met by a transport system that is continuously adapting to and embracing new technology The NSW Government is committed to adopting and applying new technology to transport needs in regional NSW. Technology will continue to challenge and disrupt current thinking and innovation will be critical as we seek ways of doing things differently	The 5 customer outcomes identified in the Regional NSW Services and Infrastructure Plan are consistent with the outcomes of investing in optimised charging infrastructure for the Central NSW region.
Customer Outcome 3: Movement and place framework Implementing the movement and place framework: By engaging across government with those bodies responsible for transport, land use and roads in NSW, Street Environments will be agreed and become a common platform for road planning, based on an integrated view of: • the strategic significance of roads and streets in their role to move people and goods	

● the strategic significance of the land use adjacent to roads and streets Through this more collaborative and integrated approach, the Movement and Place Framework will enable greater transparency, collaboration and a tool to provide better clarity to communities and the public, how the NSW Government plans, designs and operates the road network.	
Customer Outcome 4: Supporting centres with appropriate transport services and infrastructure Importance of connections to closest regional city A change in approach to providing transport in regional NSW will be a shift away from a network focussed on servicing trips to Sydney to providing more services and facilities in regional cities and leveraging changes in technology to reduce the need to travel long distances	
Customer Outcome 6: Economic development is enabled by regional transport services and infrastructure Transport plays a major role in bringing this vision to life through three underlying programs of investments which are best described as: 1. Providing quality transport services and infrastructure in regional NSW – ensuring a baseline set of transport services across regional NSW 2. Aligning effort to support growing regional centres, acknowledging the needs of areas with strong growth in population, jobs or both 3. Identifying and activating economic potential through new transport services and infrastructure The visitor economy The visitor economy is one of the key drivers of regional economies. Service and infrastructure initiatives identified in this plan are targeted at supporting the attraction of people to regional NSW and also an uplift in the tourist experience through improved transport infrastructure and end-to-end customer journey offerings	
Customer Outcome 9: Accessibility to employment	

and services
 	
Greater coverage:
 	
● An equitable transport system that provides connections to all settlements.
● A transport network that enables seamless and affordable inter-regional and cross-border travel
  ○ Transport services improve opportunities for people and industry to travel easily and affordably interstate
  ○ Travel to your nearest centre or city without penalty
  ○ We will work collaboratively with other State governments to remove barriers and improve connectivity for communities and industries of NSW
● Provide for trips within centres, between centres and between regions	

A flexible, agile investment approach Our investment approach is designed to be flexible, responding to change and uncertainty.	The Plan proposes to take a flexible, agile investment approach. This is consistent with a receptiveness to unsolicited requests for funding where the requests align with the overall customer outcomes captured in the Plan.
Central West and Orana Hub & spoke A key to the future success of the Central West and Orana region is supporting efficient transport connections to, from and within the region. Working with the Department of Planning and Environment, we have identified key hubs to support travel in the Central West and Orana region. These include: Bathurst, Dubbo, Forbes, Lithgow, Mudgee, Orange and Parkes	Designated key hubs including Bathurst, Forbes, Orange and Parkes receive place-based plans and may have an advantage in accessing funding owing to their designation.
Future transport planning A region specific supporting transport plan and vision will be prepared for the Central West and Orana region.	The Regional NSW Services and Infrastructure Plan specifically calls out that a plan and vision will be prepared for the Central West and Orana region by TfNSW in conjunction with key stakeholders

Place-based plans, plans considering the implementation of the movement and place framework will be developed for prioritised key hubs across the Central West and Orana region. These will be developed in conjunction with key stakeholders such as the local government and Department of Planning and Environment.	such as the local government and Department of Planning and Environment. This mechanism may be a key pathway for influence

Schedule 5 - Linkages with regional travel and tourism

The Central NSW region is a popular destination for domestic and international travellers, with 6.4 million domestic and international tourists per year and growing. These visitors also stay in the region and spend locally, with over 7.4 million nights stayed and $1.9 billion spent in the region every year.

The tourism industry in Central NSW is a critical part of the local economy, and barriers to getting to the region present a significant risk as vehicle technology changes and electric vehicles become the preferred mode of transport. The region's daytrip visitors travel to the region by private car 97% of the time, and the vast majority of overnight visitors also reach the region by private car.

Key tourism data for Regional NSW

Domestic overnight travel

Visitors: 2.6m (-8.5% YoY)
Nights: 6.8m (-11.0% YoY)
Expenditure: $1.2bn (-1.7% YoY)

Average spend
$177 per night
$459 per visitor

Average length of stay:
2.6 nights

#4 for visitors
#4 for nights
#4 for expenditure
In Regional NSW

Domestic daytrip travel

Visitors: 3.7m (+13.7% YoY)
Expenditure: $615.6m (+24.6% YoY)

Average spend
$165 per visitor

#5 for visitors
#4 for expenditure
In Regional NSW

International travel

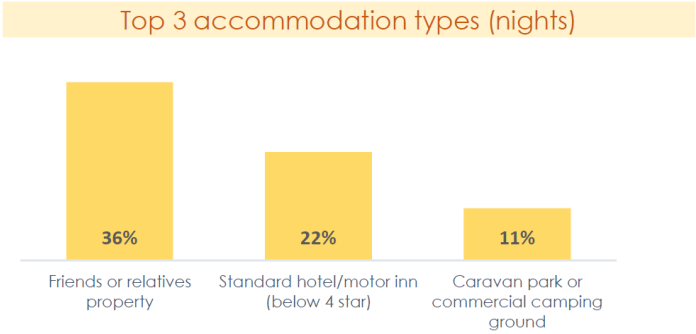
Visitors: 41,700 (+12.4% YoY)
Nights: 585,400 (-37.0% YoY)
Expenditure: $29.5m (-23.3% YoY)

Average spend
$50 per night
$706 per visitor

Average length of stay:
14.0 nights

#6 for visitors
#7 for nights
#7 for expenditure
In Regional NSW

Source: Central NSW Visitor Profile: Year ending March 2020 - Destination NSW



Each domestic overnight visitor to the region spends on average over $450 during their stay[61], and growing barriers to their ability to travel to the region stemming from the transition to electric vehicles can quickly have a very large impact.

Over three quarters of domestic overnight visitors travel from within NSW, with 30% of the total travelling from Sydney. This means travel into Central NSW is made up of short trips of less than 50km from surrounding regions, through to stayover or destination travel from other states that may include travel of more than 500km. These varied travel types will demand different charging services, ranging from rapid top-up through to overnight charging at hotels, motor inns, caravan parks or at friends and relatives properties.

The data presented in this document pertains to year-end March 2020 tourism data for the region. While not fully reflective of the impact of cultural and regulatory changes brought about through fear of the SARS-CoV-2 coronavirus and related disease COVID-19, the data does show a drop relative to previous time-series.

The Cowra Guardian notes that "In the past decade, the number of visitors from China to Australia has increased fourfold from 355,000 in 2009 to 1.43 million in the period between July 2018 and June 2019."[62] The Port Stephens Examiner adds "Tourism Australia data suggests $45.2 billion dollars is contributed to the national tourism economy from the China market which inevitably filters through to our regional destinations. Events such as the coronavirus and the bushfires will undoubtedly have an effect.[63]"

With the recent summer of bushfires, cracks growing in the China-Australia relationship and the impact of coronavirus related restrictions and fear-based cultural shift, it is more important than ever to ring out the message that Central NSW is open for business.

The NSW Government has committed through the Visitor Economy Industry Action Plan 2030 (VEIAP 2030) to a goal of more than tripling 2009 overnight visitor expenditure by 2030, aiming to achieve $45 billion by 2025 and $55 billion by 2030.

[61] https://www.destinationnsw.com.au/wp-content/uploads/2020/08/central-nsw-fact-sheet-ye-mar-20.pdf
[62] https://www.cowraguardian.com.au/story/6639511/coronavirus-impact-hits-regional-tourism/
[63] https://www.portstephensexaminer.com.au/story/6613654/coronavirus-bushfires-impact-on-port-tourism/

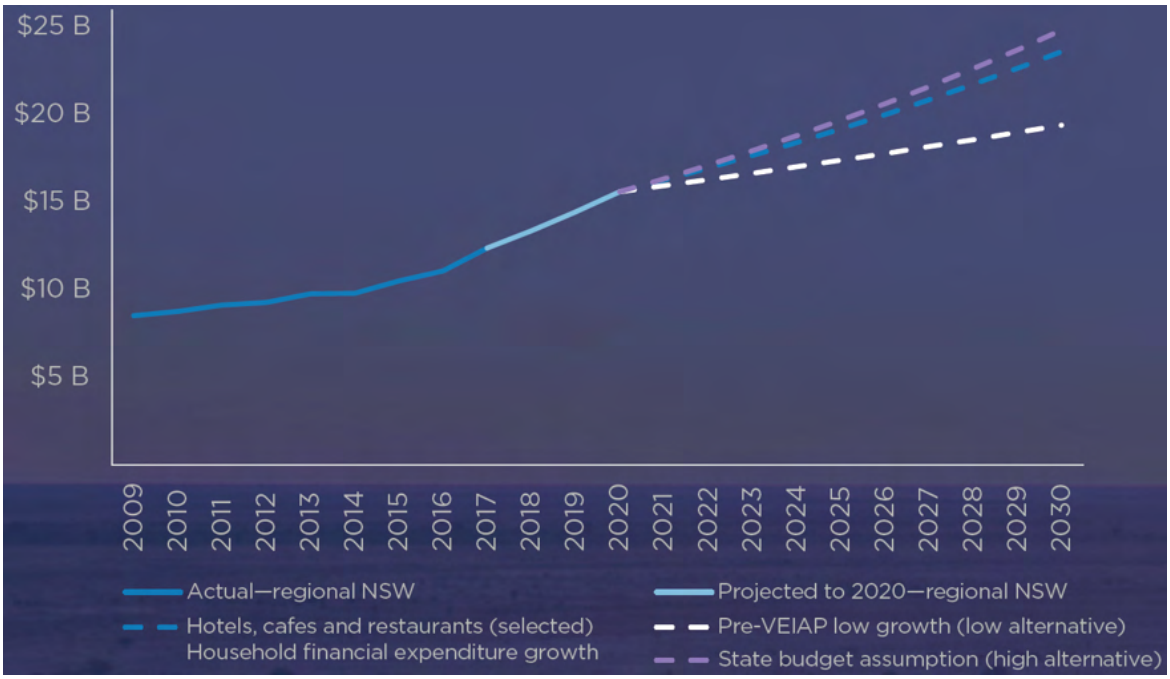
The Tourism and Transport Plan considers the customer outcome "greater access to more of NSW" to include a commitment to "investigate economic opportunities of electric vehicles at tourism destinations and for the regional touring economy." While it may not yet be clear due to low levels of penetration in the national vehicle fleet, electric vehicles will make or break the committed visitor expenditure goals out to 2023.

Electric vehicle charging infrastructure is expected to act as an attractant to early electric vehicle adopters, and early-majority adopters out to 2025. Regions and cities with highly visible and functionally suitable charging will be more likely to attract electric vehicle owners, with those visitors in many cases previously not considering the region for their travel.

Electric vehicle manufacturing costs are predicted to become lower than those for combustion engine vehicles from the middle of the decade. It is likely there will be a significant shift in the products offered in Australia at this time, such that the balance and competitiveness of offerings tends towards electric and away from combustion.

As electric vehicle adoption rapidly accelerates and the electric proportion of the total vehicle fleet grows, a lack of functionally suitable and highly visible charging infrastructure would become highly detrimental to the ability of the region to grow tourism key performance indicators above the low alternative projection presented in the VEIAP 2030 (see below).

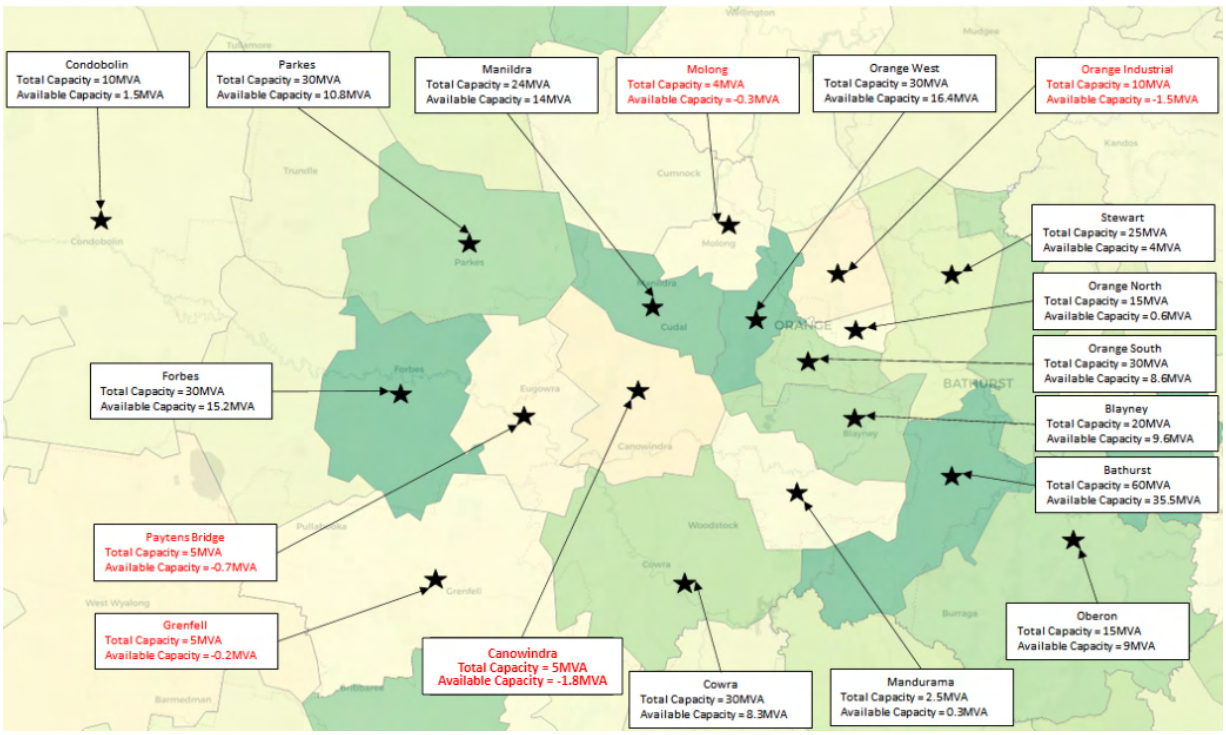
Alternative growth paths for NSW regional overnight visitor expenditure to 2030[64]



[64] Source: VEIAP 2030

Schedule 6 - Zone Substation capacity details

AREMI-sourced map and details of Zone Substations in Central NSW



Note: 2020 Zone Substation capacity projections by regional DNSP (via AREMI map)