2019

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CENTRAL VICTORIAN Greenhouse Alliance

Interim Report for Central Victorian Greenhouse Alliance

Charging the Regions: Local Government EV Charging Network Study

Component 1 & 2 preliminary findings

2019

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ELECTRIC VEHICLE COUNCIL

Charging the Regions: Local Government EV Charging Network Study

Contents

Version	Date	Author/Editor	Reviewed by	Description of Change
Draft vA.0	25.10.2019	Hannah Meade, Michaela Hermanova, Emily Kempson, Stephen Christos, Julianna Bedggood	Michaela Young	Component 1 & 2 Findings. Draft for CVGA & PCG review
Draft vA.1	22.11.2019	Hannah Meade, Michaela Hermanova, Emily Kempson, Stephen Christos, Julianna Bedggood	Michaela Young	Component 1 & 2 Findings. Incorporating feedback.

Glossary

Term, Acronym or Abbreviation	Definition
AC	Alternate Current. The electricity grid delivers AC, but EVs charge their batteries with DC. For AC charging infrastructure, an EV's battery needs to convert AC power to DC using its onboard charger, which slows down the charging process.
ARENA	Australian Renewable Energy Agency. ARENA was established by the Australian Government in 2012 to improve the competitiveness of renewable energy technologies and increase the supply of renewable energy in Australia. To date (November 2019) ARENA has invested $1.46B in 486 projects, with a $5.55B value.
BEV	Battery electric vehicle – a fully electric vehicle with rechargeable batteries and no internal combustion engine.
Bidirectional Charging	See V2G below
CCS	Combined Charging System, allows AC and DC charging on the same plug 
CHAdeMo	Abbreviation of "CHArge de MOve", for DC charging. 
Chargefox	Australia's largest public charging network
Chargenet	New Zealand's largest operator, providing EV charging hardware and software
DC	Direct Current. EV batteries are DC – DC charging infrastructure allows for a direct connection and communication between the car battery and chargers, enabling faster charging and "smart charging" where the EV can communicate to the charger how much is needed to charge its battery.
EV	Electric vehicle, refers to vehicles which are at least partially powered by electricity.
Fuel cell vehicles	A different kind of EV using a fuel cell instead of a battery, typically run using oxygen and compressed hydrogen. Generally better for heavier vehicles such as trucks where battery size and weight would significantly decrease "fuel" efficiency. A complementary technology to other EVs, with the first public hydrogen refuelling station to open in Australia in December 2019.
GPO	General Purpose Outlet – an abbreviation for the standard 3-prong power-point plugs found throughout Australia.
HEV	Hybrid Electric Vehicle, such as a Toyota Prius Hybrid – usually starts off by using an electric motor with petrol engine cutting in once load or speed rises. The battery in an HEV car is charged during the car's braking process (regenerative braking).
ICE	Internal combustion engine
kVA	Kilovolt-amps. Measure of Apparent Power provided by the electricity distributor to a circuit (of relevance to this report is that capacity provided to a site location will be provided in kVA).
kW	Kilo-watt. A unit of electric power - measure of Actual Power (apparent power x power factor) (of relevance to this report is that charging stations provide power rating in kW).

Term, Acronym or Abbreviation	Definition
kWh	"Kilowatt hour". Measure of Energy Consumption (i.e. the amount of electricity consumed in an hour) (of relevance to this report as electricity retailers are paid in $/kWh).
Load Management	Also referred to as "load balancing". A load management system that monitors power demand and adjusts the charging rate of each charging station dynamically.
Networked Charger	Networked chargers are connected through the internet of things, and can be activated through an app – users don't need an RFID card to activate a charging session.
OCPP	Open Charge Point Protocol – an initiative by the Open Charge Alliance to allow electric vehicle charging stations and software to communicate seamlessly with each other - can switch between providers without being "locked in". It has become the de facto standard in the EV charging industry, with updated versions released periodically.
PHEV	Plug-in hybrid electric vehicle. Usually has a small battery that can be charged either through regenerative braking or plugging into an external source of electrical power in addition to a combustion engine.
PlugShare	A worldwide crowd sourcing app allowing anyone to upload possible plug-in stations for EV owners (even GPOs – general purpose outlets). Able to distinguish between public/residential access points, allows users to leave feedback and comments.
Power Factor	Ranges from 0 to 1 and is the ration of actual power and apparent power.
Range	The distance an EV can travel before the battery requires a charging
Range Anxiety	Perceived anxiety that an EV will run out of battery while driving. Very common among non-EV drivers.
RFID Card	Type of card commonly required to access public charging stations, often used by older charge points and being replaced with app-based payments or credit card tap and go.
Single phase power	The single-phase power supply has one distinct wave cycle. A single wire is connected to the circuit. Voltage is 230V (the most common type of power in residential households).
Smart charging	An umbrella term for a series of functions that a data (usually Wifi) connected EVs and charging points can perform – monitoring, managing the use of devices to optimize energy consumption, as well as load balancing.
Tariff	An electricity pricing structure offered by energy retailers. Many people whose support.
Tesla Supercharger	A super-fast charging system that can provide up to 120kW directly into a car's battery – only available to Tesla vehicles.
Tethered/ Untethered	"Tethered" charging points have a permanently fixed charging cable/connecter, whereas untethered points require drivers to supply their own cables.
Three-Phase Power	Three phase has three distinct wave cycles and needs 3 wires connected to the circuit. Three phase voltage is 415V. (i.e. commercial supply) – most common in industrial areas but can also be found in some residential areas.
Top-up charging	The practice of plugging in an EV when out and about to "top up" existing charge on a battery.
Transformer	A transformer is a device which is used to either raise or lower voltages and currents in an electrical circuit. In modern electrical distribution systems, transformers are used to boost voltage levels to decrease line losses during transmission
Trickle charging	The slowest type of charging using a standard GPO, takes many hours and is best for overnight charging.

Term, Acronym or Abbreviation	Definition
Type 1	The first plug type to appear in Australia; these have been replaced by Type 2 by most manufacturers.
Type 2 (Mennekes)	The Australian standard plug type for level 1 and level 2 AC charging. Type 2 
V2G	"Vehicle to grid" or bidirectional charging – A system in which EVs plugged in can communicate with the power grid to transfer energy between the vehicle and the grid. Similar to smart charging, but goes one step further to allow communication between the EV to the grid.

Charging the Regions: Local Government EV Charging Network Study

1. Introduction

Ndevr Environmental was engaged by the Central Victorian Greenhouse Alliance (CVGA) to deliver the *Charging the Regions: Local Government Electric Vehicle Charging Network Study* (the project) on behalf of participating councils shown in Figure 1.

The project objective is to provide participating councils *with all the relevant information and tools to best facilitate a co-ordinated EV charging network across Victoria. The aim of the project is to both mitigate climate change, support economic growth in the regions and demonstrate leadership to the local communities.*

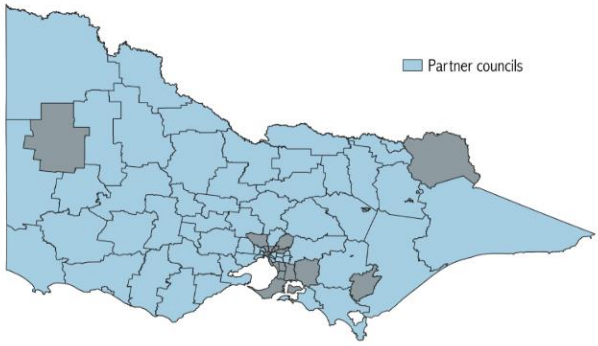


Figure 1: Participating Councils

The project, scheduled for completion in March 2020, is being delivered in five components:

- **Component 1** – EV Charging Maps and Decision Tree Model to facilitate optimal site location
- **Component 2** – Learnings from other Council's Charging Infrastructure Implementations
- **Component 3** – Investment and implementation options
- **Component 4** – Consultation and Communication materials
- **Component 5**- Outcomes Report

This Report provides an overview of the findings from Component 1 and 2 to update participating councils and allow them to start considering suitable locations within their municipalities. **It is not the final report.** Additional learnings and insights from stakeholder consultations still underway will be incorporated with the later components in the final outcomes report.

This report is structured as follows:

- Approach to Components. Section 2
- Findings from Stakeholder Consultation. Section 3.
- Maps. Section 4.
- Decision Tree. Section 5
- Next Steps. Section 6.
- Stakeholder Consultation List. Appendix A.
- Overview of Charging Stations. Appendix B
- Detailed Case Studies. Appendix C

Figure 2: Overview of project stages (star indicating current location)

2. Approach to Components 1 and 2

This section provides an overview of the approach taken to Component 1 and 2 to identify potential priority towns for council consideration.

The compilation of components 1 & 2 was an iterative process of obtaining information from key stakeholders to develop the maps and the decision tree framework.

2.1. Stakeholder Consultations

The project team sought to engage with a range of key stakeholders for learnings, insights, and valuable information to contribute to each of the project stages. Stakeholder consultation is ongoing and has been flexible to fit in with stakeholder availability.

Consultation has included a range of in person and telephone calls with end-users, installers, infrastructure providers, electricity distributors and key government entities. We have also utilised an online survey and contact via the CVGA with participating councils to collect information on the current barriers and key drivers for participation.

Figure 3: Range of Stakeholders Consulted

Learnings from stakeholders have been incorporated throughout these components; and learnings from end-users were used to build case studies on implementation roll outs.

A full list of stakeholders consulted is provided in Appendix A.

Charging the Regions Project - Victoria 2019

Welcome to Charging the Regions Project Survey

The objective of the Charging the Regions project is to provide Councils with the relevant information and tools to best facilitate a co-ordinated electric vehicle (EV) charging network across Victoria. To mitigate climate change, support economic growth in the regions and demonstrate leadership to the communities.

CVGA has engaged Ndevr Environmental to facilitate the delivery of this project on behalf of the participating councils.

Thank you for participating in our survey to better understand participating councils. Your feedback is important.

OK

Figure 4: Online Survey via Surveymonkey was distributed to maximise participating council engagement.

2.2. Maps

The maps have been constructed in QGIS, a free open source desktop geographic information system (GIS) used for analysing spatial data. Details of infrastructure locations have been developed using a combination of information available through open source plug share that was vetted for reliability, and information provided by participating councils, infrastructure suppliers, and the following sources:

- Chargefox App – Chargefox chargers
- Tesla Website – Tesla superchargers
- Chargepoint Website – Chargepoint chargers
- Plugshare website – Non-networked chargers, Tesla destination chargers

The objective of the maps is to identify gaps in charging infrastructure accessibility for EV tourism and regional accessibility, and economic opportunities. Therefore, chargers with a smaller capacity than 7kW and/ or chargers not available to the general public were excluded, with the basis for excluding the former being that less than 7kW chargers cannot charge vehicles at a level of desired speed and accessibility for those travelling.

Public charging stations are those intended for use by the public and intended for EV charging. They include infrastructure in public places or commercial facilities open to the public (e.g. service stations, tourist destinations), or open car parks or roadside stations. It excludes sockets that are not installed with the intention of being used for EVs (i.e. toilet blocks or caravan sites), and stations in restricted areas for private use (including hotels for guests only).

To investigate and prioritise the gaps, towns were considered against the following features:

- Traffic volumes and regional connectivity
- 50km or more from nearest charging station
- Key tourism destinations collated from council websites
- Population densities
- Access to amenities (i.e. Public toilets)
- Planning zones from local government planning schemes
- Socio-economic areas

2.3. Decision Tree Tool

To enable the participating councils to determine suitable locations within their municipality, the following tools have been developed and are provided in the accompanying excel document:

- A map of priority zones and flow-chart to shortlist potential sites, and
- Interactive questions to investigate potential sites and key considerations.

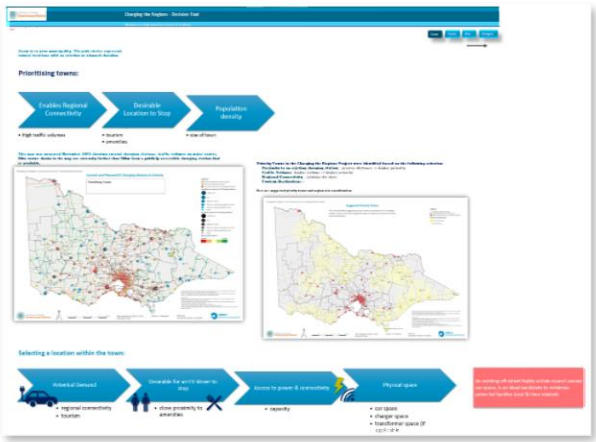


Figure 5: Excerpt from Tool

The tool has been drafted with the expectation that it will be updated as the project progresses to encapsulate the most up to date information.

3. Current and Planned Charging Infrastructure

This section provides maps of current and planned charging infrastructure across Victoria – with a focus on the regions – and investigates the current gaps in connectivity.

3.1. Maps

The following map illustrates charging stations above 7kW that are publicly accessible as well as those that are planned and in the process of being installed. Additional locations were indicated as possible future sites by stakeholders. However, given that no actual commitment had been made on these sites, they were not been included.

Figure 6 shows the current and planned stations and the kW rating,

Figure 7 shows the current and planned stations and the kW rating, not including stations installed for private customer use (i.e. motels) or limited to Tesla vehicles, Figure 8 zooming in on the Greater Melbourne region for clarity.

Figure 9 shows towns across Victoria indicating whether they are within a 50km drive from an existing station or not, and traffic volumes on major roads. This map shows the information that contributed to town and region selection.

Figure 11 shows the suggested priority towns and regions to facilitate regional connectivity.

Current and Planned EV Charging Stations in Victoria

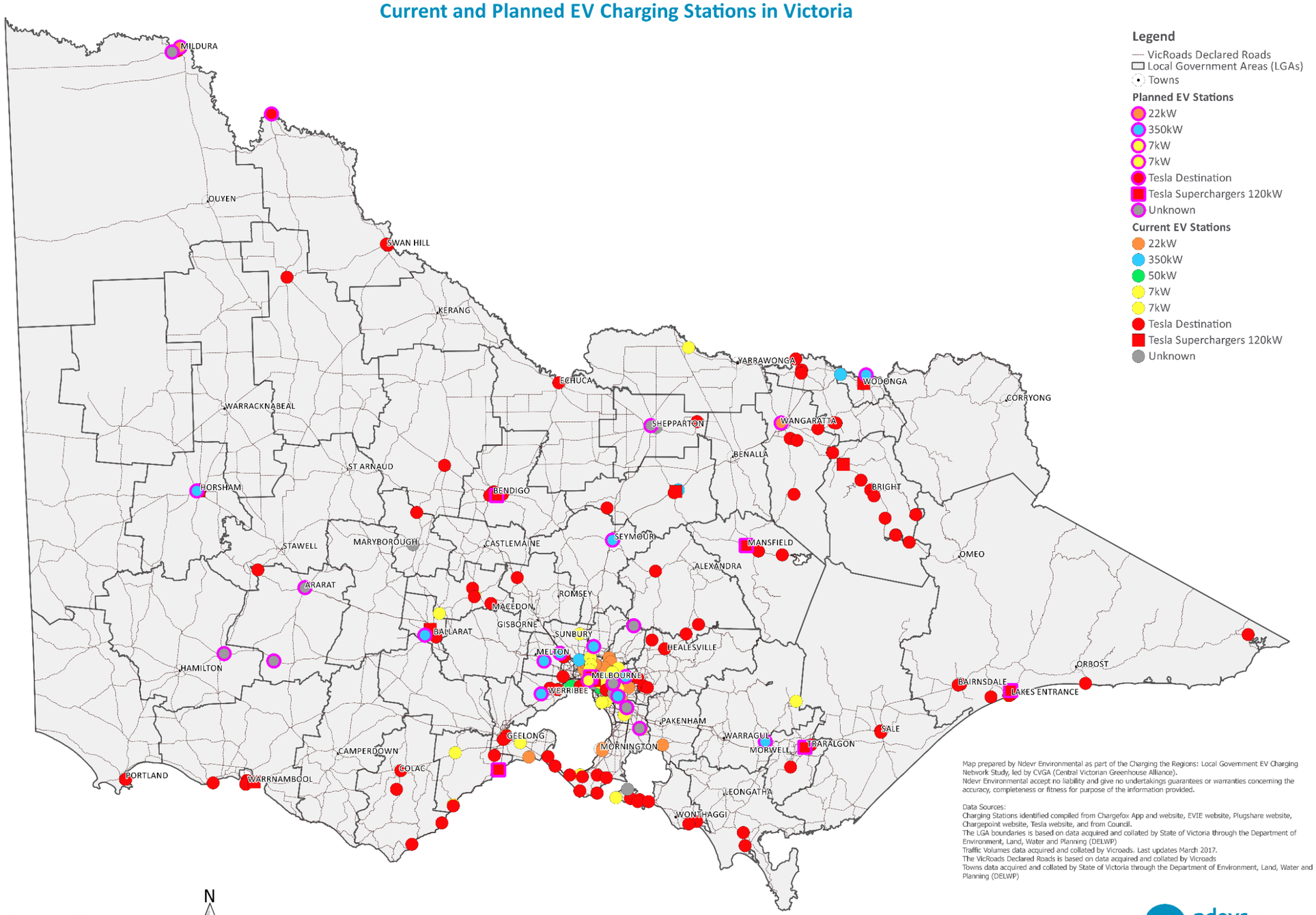


Figure 6: All Victorian Charging Infrastructure

Current and Planned EV Charging Stations in Victoria

This map does not show Tesla Destination chargers, and Tesla Superchargers, and EV charging stations not obvious for public use (i.e. wineries, hotels, and most private businesses).

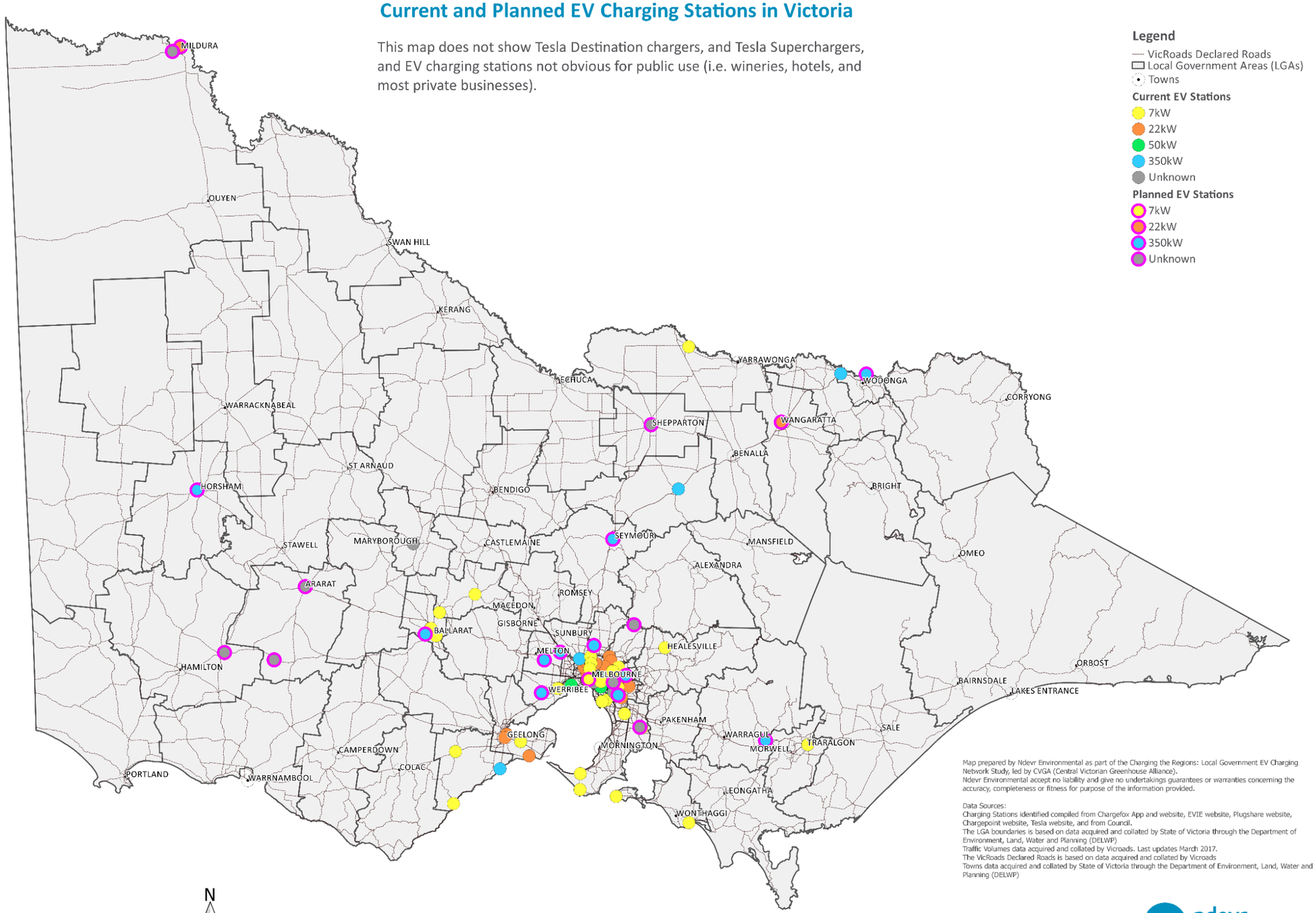
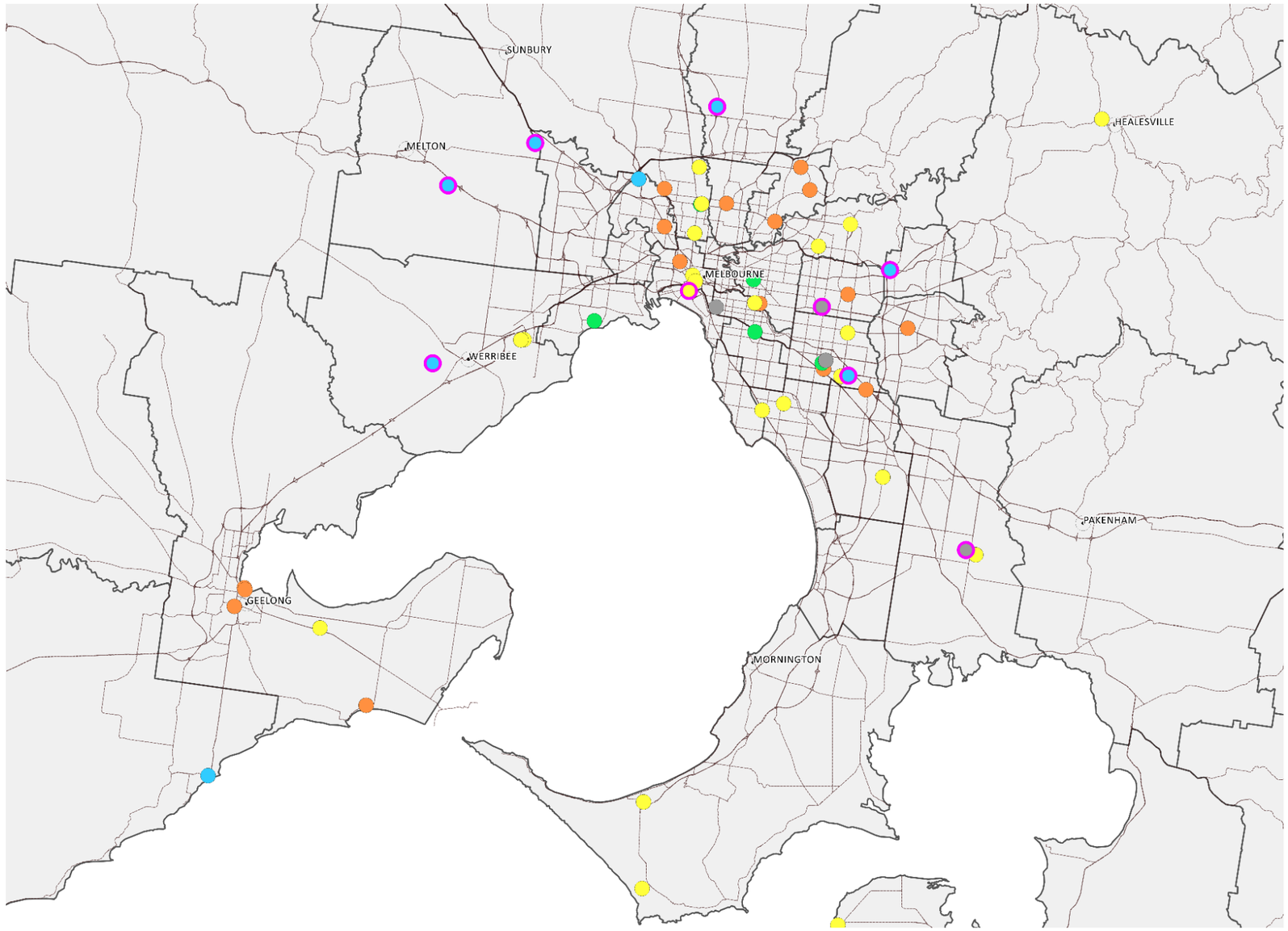


Figure 7: Victorian Publicly Available Charging Infrastructure (not including Tesla or private use stations)

Current and Planned EV Charging Stations in Victoria - Greater Melbourne

This map does not show Tesla Destination chargers, and Tesla Superchargers, and EV charging stations not obvious for public use (i.e. wineries, hotels, and most private businesses).



Legend

- VicRoads Declared Roads
- Local Government Areas (LGAs)
- Towns

Current EV Stations

- 7kW
- 22kW
- 50kW
- 350kW
- Unknown

Planned EV Stations

- 7kW
- 22kW
- 350kW
- Unknown

Map prepared by Ndevr Environmental as part of the Charging the Regions: Local Government EV Charging Network Study, led by CVGA (Central Victorian Greenhouse Alliance).
Ndevr Environmental accept no liability and give no undertakings guarantees or warranties concerning the accuracy, completeness or fitness for purpose of the information provided.

Data Sources:
Charging Stations identified compiled from Chargefox App and website, EVIE website, Plugshare website, Chargepoint website, Tesla website, and from Council.
The LGA boundaries is based on data acquired and collated by State of Victoria through the Department of Environment, Land, Water and Planning (DELWP)
Traffic Volumes data acquired and collated by Vicroads. Last updates March 2017.
The VicRoads Declared Roads is based on data acquired and collated by Vicroads
Towns data acquired and collated by State of Victoria through the Department of Environment, Land, Water and Planning (DELWP)

CENTRAL VICTORIAN Greenhouse Alliance

N

0 7 14 21 28 35 km

Map prepared in QGIS 2.18.24
November 2019

Author: E. Kempson

Scale: A1
Coordinate System: VicGrid94

ndevr environmental

Figure 8: Greater Melbourne Publicly Available Charging Infrastructure (not including Tesla or private use stations)

EV Public Charging Network by Locality

This map also shows traffic volume, tourism locations, and identifies localities that are within proximity to an EV charging station (approximately 40km), and those that are not serviced at all from an EV charging station.

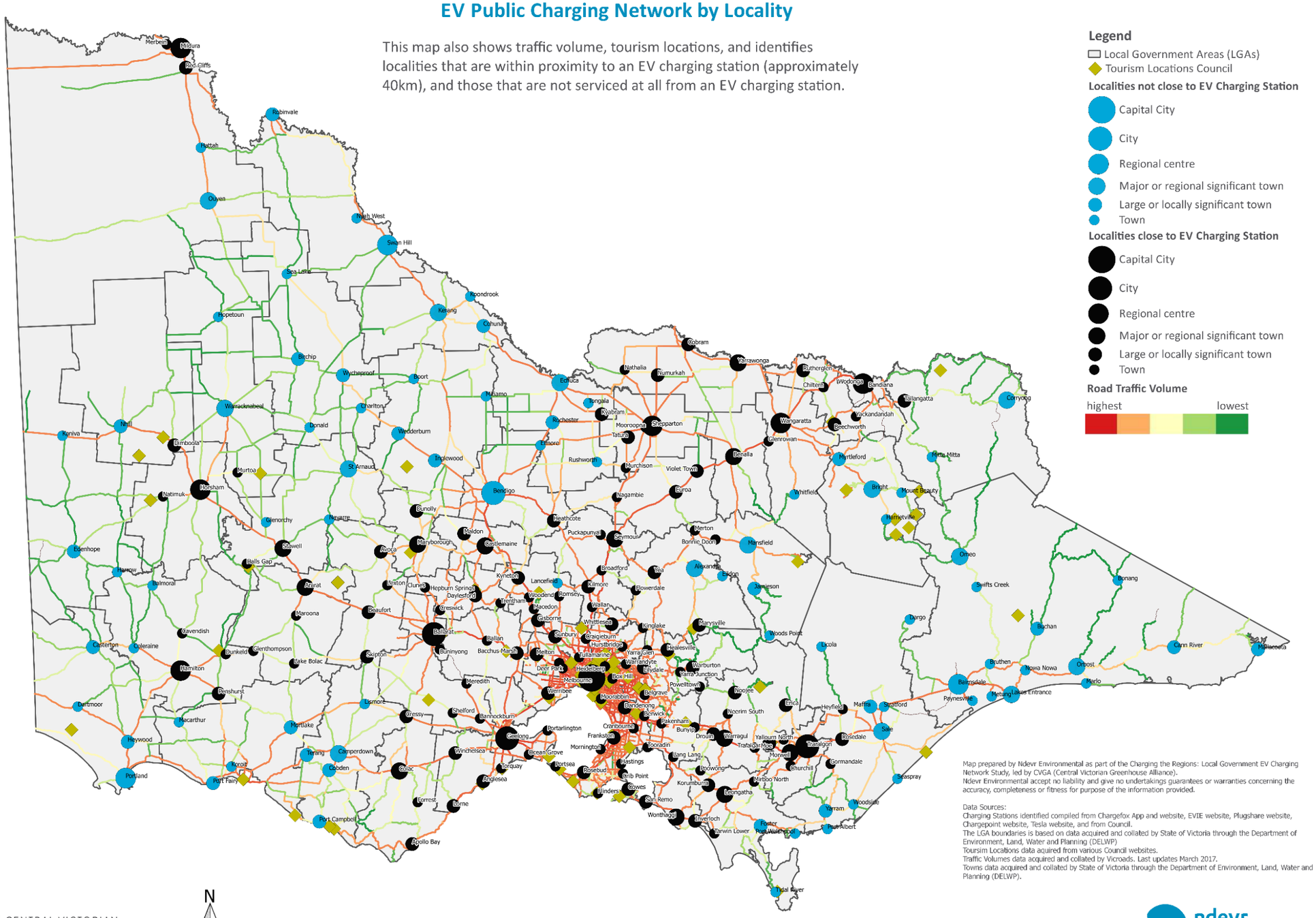


Figure 9: Indicative Coverage of Publicly Available Charging Infrastructure (not including Tesla) and Towns not connected

3.2. Additional Insight from Maps

Current zones of limited to no charging access align with lower socio-economic areas. Current EV ownership has predominantly been amongst high socio-economic groups and, therefore, likely higher current demand for stations. The absence of demand and, therefore, stations in the lower socio-economic areas will disconnect these areas from the potential EV tourism industry and further exacerbate the socio-economic divide.

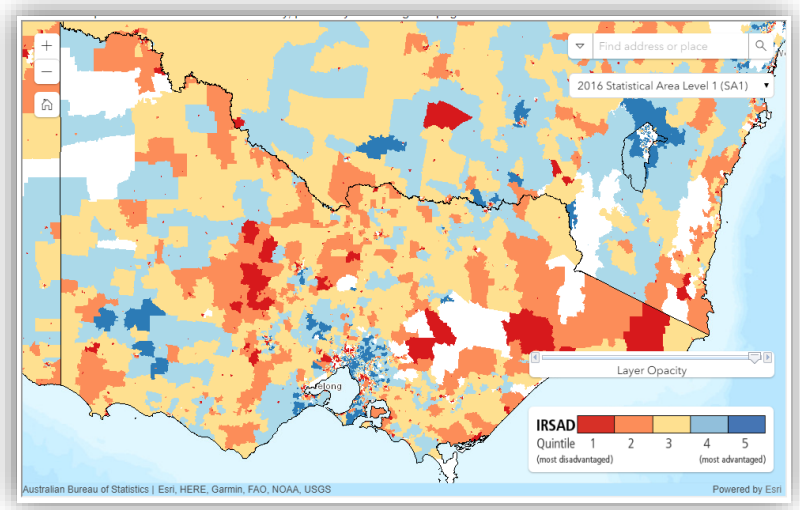


Figure 10: Socio economic level

3.3. Potential Towns

The following townships are suggested for consideration by the respective councils, and/or State Government based on the investigation approach detailed in Section 2.2 (i.e. regional connectivity, regional equity, distance to charging infrastructure). The role of council vs. state government and private investment will be considered in later components of the project.

- Alexandra
- Apollo Bay
- Bairnsdale
- Benalla
- Bendigo.
- Bright
- Buchan Caves
- Camperdown
- Castlemaine
- Colac
- Echuca
- Halls Gap
- Hamilton
- Harrietville (Alpine region)
- Kerang
- Lakes Entrance
- Leongatha
- Macedon
- Mallacoota
- Mansfield
- Omeo
- Orbost
- Ouyen
- Portland
- Sale
- St Arnaud
- Swan Hill
- Warrnambool
- Wilsons Promontory
- Wycheproof
- Yarrawonga.

This list is not considered exhaustive and all Councils should consider suitable towns within their municipalities.

Suggested Priority Towns

This map identifies suggested priority towns to consider for EV charging stations. Towns have been sugested based on regional connectivity and/or tourist destination. This map also displays towns that are in relitively close proximity, and those that are not in range to a public EV charging station.

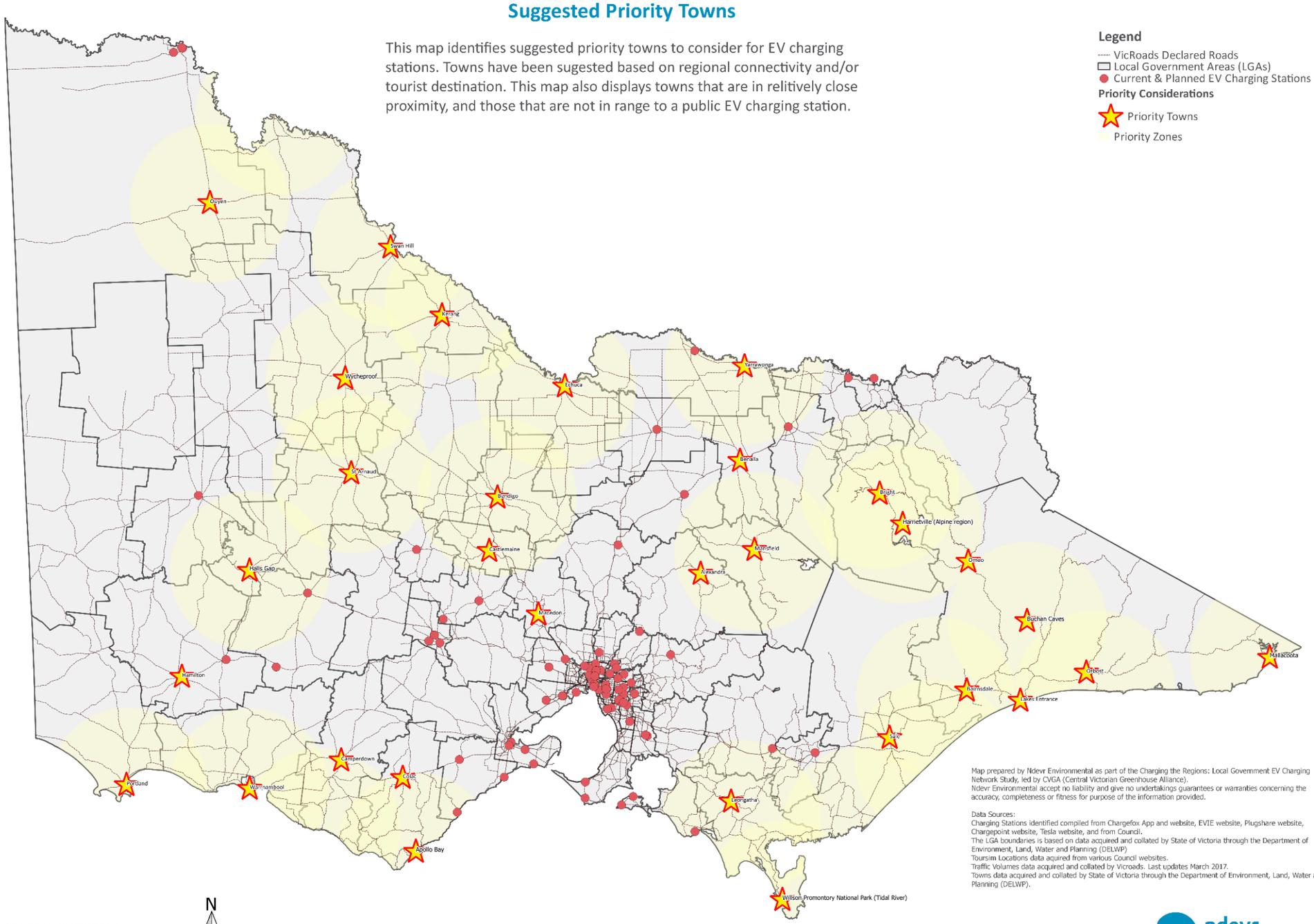


Figure 11: Suggested Priority Towns for Regional Connectivity

4. Learnings from Stakeholders

This section provides an overview of important learnings from key stakeholders and other EV charging station roll-outs.

4.1. Participating Councils – Survey Monkey Results

4.1.1. Response Rate

132 responses to the online survey from 57 different participating councils and from varying council positions (Figure 12) were received.

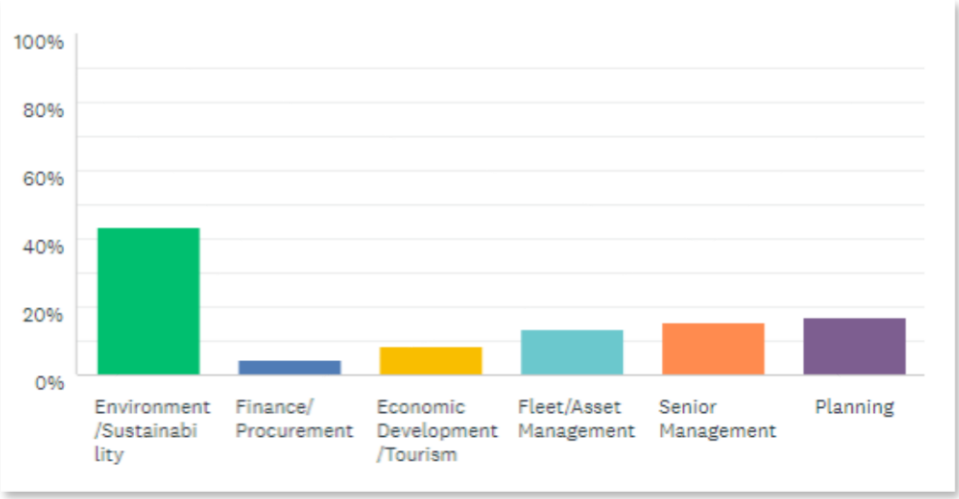


Figure 12: Role of Survey Respondent

4.1.2. Motivations for Participation

Survey responses indicated that the drivers for participation in the project included:

- **Leadership** to the local community and through strategic collaboration to ensure uniformity of approach.
- **Environmental benefit** of increased EV uptake by overcoming the range anxiety barrier and increasing awareness.
- **Supporting the Regions (access & equity)**: Ensuring no regional disadvantage from the current EV superhighways by facilitating EV tourism and economic development in towns off the highway to the benefit of the local communities.
- **Increase combined knowledge base**: Understanding options, being ready for/building for the future.

4.1.3. Current Barriers:

Survey responses indicated that the current barriers included:

- **Uncertainty of local governments role** with respect to charging stations was highlighted as the main barrier. Conflicting responses between supporting private investment, purchasing and maintaining public stations, or no role at all.
- **Access to funds** to purchase, install, manage and maintain the infrastructure.
- **Lack of demand** for stations due to low EV uptake numbers.

- **Uncertainty of best locations** and where stations were currently installed.
- **Network constraints** whether perceived or real.
- **Knowledge gap** of most appropriate infrastructure and requirements.

4.2. Insights from Key Stakeholders

4.2.1. Electricity Distributors

The project team was hoping that the Distributors would be able to provide a map that could be used in the mapping investigation, indicating network hot spots and the extent of three phase power coverage. However, those able to be consulted to date informed the team that while that is desirable, it does not yet exist, and each site will need to be assessed individually for connection.

"As a regulated network we are not in the business of deploying charging stations – our role is to help in the process of connecting" – Ausnet

They also provided the following pieces of information from their experience:

- Level 2 charging infrastructure installed behind the meter does not require approval from the distributor unless the electrician advises that upgrades are required (i.e. insufficient capacity, or inadequate switchboard). Level 3 charging will require a transformer, increasing costs.
- The distributor becomes involved when upgrades are required to the site - this can take several months. If a site requires a large supply the distributor recoups the costs through the tariff over the next 10-15 years.
- Council owned land often does not have a street address, which can make it complicated for identifying the location; and the network limitations are irrelevant if you cannot get planning approval.
- Solar powered charging stations involve two agreements. Load connection is one agreement -to get supply and then go through embedded generator connection to get solar to that site. It is not a limitation, but the cost may change.

4.2.2. Victorian Government

The Victorian Government (via DELWP) is co-funding this Charging the Regions project, in addition to having awarded funding for the Chargefox fast charger roll out. The desired objective of the Victorian government is a good, well-planned network that overcomes barriers such as *perceived* range anxiety. A network that provides convenience is connected and in operation. Public education is going to be a key enabler.

DELWP is also in the process of defining the Victorian Government's role with respect to EV uptake.

4.2.3. ARENA

The Australian Renewable Energy Agency (ARENA) was consulted as a future potential funding source for a charging infrastructure roll out.

ARENA has $250M of unallocated funding to be allocated within the next 12 months to projects that align with its new investment plan. However, while energy productivity/ transport was formerly a key priority stream, the recently released priority investment plan focuses more on distributed energy and battery demand response. ARENA will no longer be funding EV charging hardware.

Integration is the new focus for future ARENA funding opportunities. **Management** of the Charging the Regions network would be a potential candidate (not hardware installation)

With respect to EVs, while the previous plan included investing in breaking down barriers, this objective has been achieved from ARENA's perspective and the new focus is on Integration of renewables into the electricity system. This is Priority 1 from the Investment Plan (

Requirements to be eligible for ARENA funding include: progressing renewables in Australia along a technology readiness level and/or commercial readiness level; replicability across Australia; and matched funding. If it meets ARENA investment criteria, ARENA will fund the gap to get a financially unfeasible project across the line.

Knowledge sharing of project learnings is a key requirement of ARENA funding – as the objective for ARENA is that by funding demonstration projects it will move the technology along the commercial readiness scale and future projects will be financially viable without external funding (e.g. EV hardware roll outs).

ARENA indicated that if Councils were to purchase the hardware, ARENA would be interested in the network management (Ausnet also indicated they would be interested in partnering on this).

PRIORITY 1
INTEGRATING RENEWABLES INTO THE ELECTRICITY SYSTEM

By investing in innovative ways to use, store, manage and share renewable energy, ARENA can help provide affordable, secure and reliable electricity for Australians through the energy transition.

Australia's electricity system is undergoing a rapid transition. Wind and solar photovoltaics (PV) are increasingly competitive, ageing fossil fuel generation is becoming uneconomic and retiring and more Australians are choosing to install rooftop solar and other distributed energy technologies such as battery storage. Already, over two million Australian households have installed rooftop solar to help manage their electricity costs and lower emissions. Electric vehicles (EVs) are dropping in price and allow renewable energy to power transport.

Even as the problems of today are solved, new challenges and opportunities will arise in this transition. Innovation in enabling technologies and new ways of managing the electricity system will allow Australian families and businesses to confidently adopt increasing shares of renewable electricity.

Australia's world-leading solar PV research and development sector can continue its contribution to reducing the cost and improving the efficiency of solar, helping integrate solar electricity into more applications and allowing spare capacity for reliability.

WHAT WE WANT TO ACHIEVE

- demonstrate how integration costs can be reduced and where renewable energy can add value to the electricity system
- develop and commercialise new approaches and technology options to enable lower cost electricity with higher renewable energy shares
- increase confidence and capability in maintaining system security and reliability with higher shares of renewables.

WHAT WE ARE LOOKING FOR

- studies, tools and proof-of-concept projects to inform approaches for maintaining security and reliability as the share of variable renewable energy (VRE) grows
- feasibility studies for activities that target new opportunities for technologies or business models that unlock wider network, system, market, regulatory or commercial benefits
- demonstration and commercialisation of technologies that could balance the electricity system with higher shares of renewable energy, ensuring electricity is available where and when it is needed
- new ways to evolve electricity grids to solve the challenges associated with more distributed energy resources (DER), and to maximise the value DER can provide. DER includes solar PV, energy storage (including batteries and thermal energy storage), demand management and electric vehicles
- projects that inform the development of energy policy, markets, regulations and industry practices and procedures relevant to a high renewables electricity future.

Figure 13: ARENA Investment Plan Extraction (source: Page 8 https://arena.gov.au/assets/2019/08/2019-arena-investment-plan.pdf)

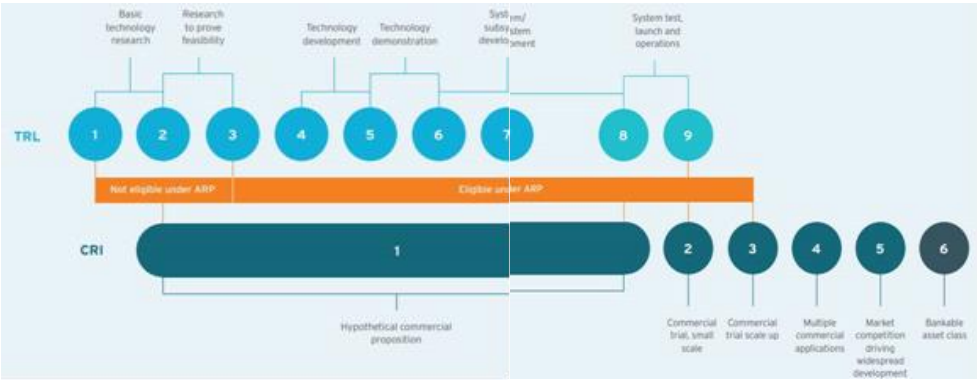


Figure 14: ARENA Technology Readiness Levels and Commercial Readiness Index Framework

4.2.4. Technology and Software Providers

There are various technology and software providers, and additional consultation with this sector will be undertaken in component 3. Consultation to date has provided the following insights into the market:

- **Private business is investing** in charging infrastructure, such as hotels/motels, which are putting in overnight chargers for guests, and Woolworths indicated that where feasible they will install charging infrastructure in new stores. Providers suggested that **most commercial sites will have capacity** to install charging infrastructure and this growing business case for **private investment is a potential opportunity** for council support in a later roll out.
- **Charging patterns of EV drivers are different** to internal combustion engine (ICE) vehicles. Charging Infrastructure software platform providers have rarely observed a driver charging from a near flat battery, while ICE vehicle drivers wait until near empty to visit a service station. **EV drivers will charge at any opportunity** and the average time charging is one hour in the middle of the day.
- While the majority are, **not all hardware providers are Open ChargePoint Protocol (OCPP) compatible**. OCPP compatibility allows the hardware to be managed by a third party and to ensure the buyer is not locked in to one specific software solution. This will be important when considering ownership and management models.
- **Software solutions bring a new range of considerations**, such as data security and ensuring that servers are compliant with Australian privacy and security legislation.
- Further, software platforms and Internet of Things (IoT) smarts can **enable demand management** functionality to be incorporated into the implementation. Load management devices can measure the building output and adjust charging rates as required to avoid exceeding the capacity of the site.
- **New ownership models** are emerging, including renting of infrastructure, that will be further explored with stakeholders in Component 3.
- **Tesla charging stations are designed for Tesla EV drivers**. However, Tesla Destination charging stations (AC) are not networked, so no data on their usage is collected or available, and theoretically any EV with an adaptor could use them.
- **Fast charging can reduce vehicle battery life expectancy**.
- The **switchboard circuit breaker** must correspond to the charging power of the station. (Note, that only a suitably licensed electrician can undertake works on a Victorian switchboard and they).
- It is recommended that the charging station be no more than **3m to the car connection point**. The longer the cable the heavier the cable and the more of a hazard they pose to pedestrians (tripping, prams, wheelchairs, etc).
- The use of **solar and batteries can reduce the potential need for network augmentation**. However, every case would need to be assessed by the distributor.

4.3. Insights from Case Studies

Case studies were prepared on the following EV charging infrastructure roll-outs and are attached in Appendix C with a summary overview provided in Table 1.

- Queensland Electric Super Highway and supplementary Northern Queensland EV tourist drive
- City of Adelaide
- New Zealand
- NRMA
- Eastern Suburbs Public EV Charging Station Network, NSW
- Moreland City Council
- Knox City Council

The WA RAC was contractually unable to provide information, so a short desktop case study was completed for WA below. In addition, a desktop case study of Norway, as an international leading country with respect to EVs, is provided below.

Additional Councils were consulted for insights into their experiences with EV charging stations that occurred within their municipalities as part of larger state/national roll-out. Notably, the councils advised that they did not feel included in these larger roll-outs as their input in implementation was minimal.

Councils reported greater positive value for their township and community from chargers located close to town centers, rather than from chargers placed further away from towns (i.e. in service stations). However, in one case, council saw the implementation of chargers on the outskirt of town as a way for external parties to provide utility and a landscaping service to an awkward piece of land that had no other apparent value.

Norway

Norway is currently the most advanced country in terms of EV uptake, with the largest per capita fleet, a 29% market share and an intention to prohibit non-EV sales from 2025. The latest figures show that almost 60% of new cars sold in Norway in March of 2019 were fully electric (Nikel, 2019).

In 2009-2010 the Norwegian Government provided financial support for the construction of public charging stations of appx. $11 million AUD (~50 million kroner) – up to $5,700 AUD per charging point (30,000 kroner) (Electric Vehicle Council, 2019). Enova, a public enterprise funded by the public Energy Fund and overseen by the Ministry of Petroleum and Energy supported fast charging infrastructure in 2013 with appx. $1.3 million AUD (~6 million kroner) and in 2015, to cover main roads with a fast charging station every 50 kilometres (Electric Vehicle Council, 2019).

Figure 15: Map of EV chargers in Norway - numbers indicate number of fast chargers in area, lighting bolt indicated there is only one. Slower chargers (2+ hours to charge) not pictured.

Western Australia

The RAC Electric Highway was Australia's first electric highway, with the first station built in June 2015. It includes 12 charging stations connecting Perth to Augusta in the South West of WA (Infinite Energy, 2016). A map of charging locations can be seen in Figure 16.

Figure 16: Map of RAC charging stations in WA

Figure 17: Image of RAC charging station in WA

Charging stations were funded by RAC but are owned and maintained by local governments. The chargers were supplied by E-Station, and ChargeStar manages the software. Users require a ChargeStar account and an RFID card to use the stations. Each of the 12 charging station locations has both a DC fast charger and an AC slow charger with CSS, CHAdeMO and a Type 2 cable connectors. Local governments implement charges for use (45 cents per kWh) and a $1 flat user fee.

Table 1: Case Study Features Overview

Feature	City of Adelaide	3-Council NSW	NRMA	Queensland Superhighway	New Zealand	City of Moreland
Motivation	Carbon Neutral City	To support a transition to zero emissions vehicle transport, making their suburbs EV-ready, and to bring benefit to local residents – revenue, fuel cost reduction, pollution and noise reduction.	Driver range certainty, economic benefits to regional areas, and to provide equitable playing field for EV owners.	Broader economic and social strategy to facilitate EV tourism.	Part of a major government roll out.	To support uptake of zero emissions vehicles and the promotion of zero emissions transportation.
Implementation included	2 x 50kW DC fast chargers, 38 x 22kW AC chargers, 2 x 15kW AC chargers	8 x Level 2 22kW AC chargers powered by renewable energy.	40 x Level 3 50kw chargers every 150km and not more than 10min from highway. 99% regionally focused (and ACT)	17 stations now, mix of 50kw DC and 22kw AC. Will add 50 more during Phase 2 - all chargers next to a tourism destination and are ideally 50km apart (max 200km).	230 x DC chargers and more AC chargers (expanding fourfold over next four years) and EV Roam platform.	10 x public charging stations, several with multiple parking bays – a combination of DC (50kW) and AC (25kW) charging Mix of Type 1 and Type 2 plugs, looking to phase out Type 1 plugs with Chargepoint departing Australia in 2021.
Financial Models Purchase	• 60% self-funded, 40% from grants from SA Government, Mitsubishi and co-funding from Tesla at one site. • Payment via Chargefox app or on-site via tap & pay function. • 22kW AC is free for the first hour, after first hour = 22c/kWh (6am-6pm Mon-Fri), 10c/kWh (outside of that). 50 kW DC is 30c/kWh; 15kW AC is always free.	• 100% self-funded. • Charging was provided free for 3months. Now, different rates for time of day apply: 25c/kwh in peak (2-8pm), 15c (7am-2pm 8pm-10pm) 10c off-peak (10pm-7am). • There was no contactless card payment method available suitable for their use at the time.	• 100% self-funded. • Charging is free, and will continue to be free to NRMA members. • Non-members to be charged following roll-out period (end date unknown).	• TMR and Energy QLD with hosting agreements with local councils. • Phase 2 just TMR. • All free for now. Plan to charge from October 2019, linger and spend model.	• NZ Transport Agency. $17M federal fund initially for roll out; and $3.4M National land and transport fund grant for EV Roam. • Now offer low Emission Vehicles fund ($7M) each year– to fund public and private chargers. • AC is provided free, and DC is 25c/minute + 25c/kWh. Advised to definitely require payment for use.	Free with free parking, with no plans to start charging DC fast chargers – 1 hour free parking AC charging – 3 hours free parking
Utilisation	Over two-thirds of all usage has been recorded at one site in front of central market (main tourist attraction).	Low usage – only for a few hours every 3 days across all stations.	Too soon to tell, however usage slightly higher near big cities.		Very high to the point of congestion.	Good – get asked to put in more often, especially more private chargers – Moreland has put in 11 private chargers in addition to their 10 publicly available ones. Looking to add 3 more public chargers this financial year.
Maintenance & Operations	Jetcharge operates and maintains stations (Jetcharge also provides tap and go payment technology for their hardware - at additional	Jetcharge & Chargefox Councils occasionally get a call and pass on to Jetcharge/ Chargefox.	NRMA responsible for own infrastructure maintenance and software since they have their own software platform. Additional maintenance provided by Tritium.	Chargefox from 1 July 2019 after transitioning to its platform and to maintain and operate all chargers.	Chargenet provided software and hardware. Other energy providers supplied the remainder of the hardware and are responsible for their maintenance.	

Feature	City of Adelaide	3-Council NSW	NRMA	Queensland Superhighway	New Zealand	City of Moreland
	cost); and Chargefox maintains the software system.					
Barriers to Uptake	Lack of knowledge on what to install, lack of knowledge in electrical community on network performance and impact, age of switchboards, and Australian Road Rules about parking in bays.	Internal stakeholder management, including getting agreement and approvals, managing and coordinating priorities and expectations. Complexity of site assessment for electricity capacity and impact on buildings – required a specialised electrician.	Education of councils of different types and roles of chargers, and understanding that change is coming. Barriers within energy space in relation to response time and uncertainty about possibility of connections. Uniformity of experience (too many different platforms).	The number of stakeholders at council caused delays. Expectation management – some councils wanted to be a part of it and were not able to. Some locations needed new car spots to be constructed and electrical upgrades (cost and delay). Telecommunications in remote areas.	Understanding the role of government and funding.	Internal stakeholder council management, and understanding- especially regarded contested parking Developing strategy
Communications & Marketing undertaken	Marketing was focused on increasing EV uptake and awareness. Roll out in near future of advertising on back of buses and social media, targeting people who have been in proximity of a car dealership.	Media release, radio station, photo montage, FAQ on website and partner announcement.				Got enough press and kudos for putting up chargers that they didn't feel the need to market or communicate the projects otherwise – just doing it was enough.
Signage used	Installed modular system in carparks – if close to capacity free up sites for normal parking (keeping minimum 2 EV ones at all times). Signage is more important to potential EV owners.	No signs on lead up to avoid visual clutter as they assume EV driver knows where to go – technology in EVS and smart phone. The only signage is at the location to identify the site and provide instructions.	No wayfinding signage, drivers feedback that reliance on technology is preferred and sufficient.	Standardised road signs in partnership with AustRoads. Have wayfinding signage to increase awareness – particularly in remote areas where reception is less reliable.	None as considered to be redundant because of the reliability and accessibility of technology.	
Sustainability		All stations powered by renewable energy.		Energy supplied has been renewable – bought through energy credits or offsets.	85% of New Zealand energy is renewable.	
Word of Advice:	The role of council is to support private investment and they are starting to provide rebates through *Sustainability Incentive Scheme.* Install more less powerful stations rather than fast chargers. Require payment for use of charging infrastructure.	One-stop-shop or single package works well for time and cost constraints of councils. (i.e. procuring one provider to lead and manage the project on behalf of Council).	Ensure buy-in from local councils and upskilling on charging infrastructure will be an enabler. Recommend talking to the energy sector early. The policy and legislation environment can also act as an enabler, by easing planning legislation.	Use pre-existing car parks. Ensure strategic alignment with policy objectives. Queensland was considering international tourism so partnered with regional airports to look at hire cars.	Plan for the future and be sure to maintain rights to the data. (Watch out for providers who are looking to monetise the data). Recommend use of signage in Australia as part of a communication and marketing strategy to spark uptake.	Believe it is council's role to provide charging infrastructure as a service to the council for free, would recommend doing that. Advise watching out for closed protocol services – Chargepoint is leaving Australia in 2021 and council will have to make a switch since their products are not compatible with others.

4.4. Key Takeaway Learnings

4.4.1. Selecting Coverage

The decision process for EV charging station coverage in the case studies was based on varying factors. Queensland placement is based on tourism destinations and the objective of ensuring charging infrastructure is available **every 50km with a max of 200km**. Local council examples were limited to available budget and funding for the extent of coverage within their municipalities.

Additionally, population density, EV ownership, and tourism routes are key considerations in determining the extent of coverage. Ideally, from a regional equity perspective, all regional town centres should have charging infrastructure to be future ready.

4.4.2. Selecting Sites

Engaging with local council stakeholders early to prevent delays was raised by the majority of stakeholders. While this project is being led by local councils there are still many internal stakeholders – planning, assets, traffic - that will need to be consulted for approvals.

Co-locating with an existing load rather than a new site will be much more affordable from a network connection perspective. Industrial loads will be the best place –unless they are already running at capacity. To determine current site capacity, information can be requested from the electricity retailer (in Victoria smart meters can indicate current peak demand).

Network Connections. Access to the network requires approvals from the electricity distributors. Distributors have indicated they will collaborate with councils in this project and require a street address to assess.

Proximity to Switchboard. Cables and trenching to connect a station to the switchboard incur the largest installation cost, often costing more than all other project components combined. Trenching costs may often trigger other additional costs – such as the need for traffic management for several days when trenching goes across the road. It is therefore advisable to install infrastructure in close proximity to switchboards, wherever possible, and that placement is carefully considered.

Off-street car spaces will generally have more space available for charging infrastructure than on street parking, and was generally recommended by stakeholders due to the hazards that face on street parking (tripping hazards, etc). Off street car spaces are also often easier to upgrade and modify for ease of use, lighting, safety (such as CCTV cameras, lighting, shelter, concreting if ground around charger is unstable, etc). Perpendicular spaces allow for ease of plugging in. The Road Rules prohibit reversing into angle parking, which precludes them as a suitable space as the cable will not reach. Construction of a new car space is in the order of $35-40,000. Availability and demand for existing car spaces can be a consideration.

Proximity to amenities. From the drivers' perspective, when stopping to charge, they will be seeking a location with access to public bathrooms and somewhere to purchase food. Additional amenities to consider are seating and shelter – the ability to sit outside while car is charging and have somewhere to rest on a longer journey. Ideally, supporting a local business in the process.

Renewable energy. A council driver for encouraging EV uptake is the environmental benefit and, therefore, ideally stations should be charged with renewable energy (either on site solar or a greenpower product). Batteries will be required to supplement solar PV for fast chargers.

4.4.3. Selecting Infrastructure

The more powerful the charging station, the more expensive and the more complex the installation. Network augmentation (i.e. increasing capacity to accommodate charger) can incur a range of costs depending on the additional capacity required (e.g. for the Queensland project, costs ranged from $4,000 to $100,000 per site).

Data ownership and advertising concerns. Multiple case studies raised concern with providers seeking to monetise the data collected from stations. Additionally, issues pertaining to advertising rights on the station were raised by several councils. Discounted or free infrastructure can incur hidden costs in the form of advertising or data contracts which may disadvantage councils in the long term and go against broader Council values (e.g. big advertisements for large national chain in front of local business). Driver and usage data and advertising space are very valuable.

Be future ready. A mix of charging stations will be required to provide a future ready network of charging for Victoria. Enough fast chargers on the major artilleries and a dense number of destination chargers in and around towns to cater for both passing through and visiting tourists will be required. The future is connected and a current limitation of the non-networked charging station is that the only way to be aware of a fault is to be on-site, whereas connected stations can send alerts instantaneously. New Zealand advised that Australia should also provide a similar government led/ managed online access to EV locations and status like its EV Roam platform in order to retain direct and full control over user charging data.

Collaborate to establish a networked model that will be accessible and visible to all EV users. A networked model that captures data and monitors demand will be required for potential ARENA funding.

Driver Amenity. Consider the end user - how much charge and how quickly it will be required.

DC charging stations require a transformer. This could already exist at the site, otherwise will need to be factored into costs.

OCPP compatible hardware to enable a software solution to manage multiple hardware types in one uniform data base. Councils could select a range of hardware and tender on the software platform.

4.4.4. Selecting Ownership & Payment Models

Ownership models will be explored in Component 3 of the project. Interim insights from stakeholders include:

Charge for usage. While many of the implementation case studies have provided free usage periods, many have advised not to provide anything for free to ensure appropriate usage (e.g. Driver disconnecting and reconnecting for a second 'free' hour). Further, people value something more when there is a fee albeit small attached – and the community tends to disapprove when something free is taken away.

Push for a universal model of charging that does not rely on multiple apps and allows for sharing of data.

5. Identifying Site Locations – Decision Tree Tool

This section synthesises the information obtained from the mapping component and the stakeholder consultation to identify the potential placement of charging infrastructure and the characteristics of the site.

Potential zones to select suitable sites were identified in Section Potential Towns 3.3 for consideration. However, given the objective of a dense regional network, ideally there would be an EV charging station in every regional town to supplement the super-highways.

The accompanying Decision Tree Tool provides guidance and a framework for identifying potential sites, comparing sites to determine the site which will provide best value for the investment required and highlight any show-stoppers.

Figure 20 overleaf shows the decision tree for identifying sites by running through key considerations and highlighting areas where external stakeholders will need to be involved.

Table 2 lists the ideal features that have been built into the accompanying Ideal Feature Scorecard to allow comparison between identified sites, and Table 3 highlights the key different considerations between selecting and AC or DC charging station.

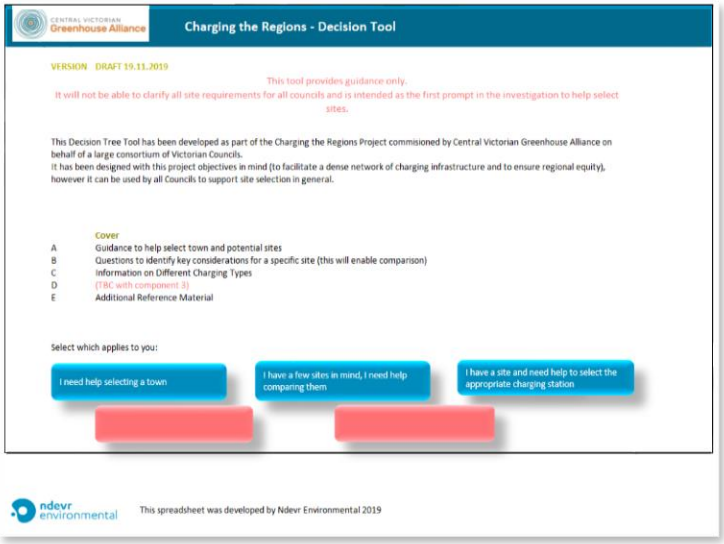


Figure 18: Excerpt from accompanying tool

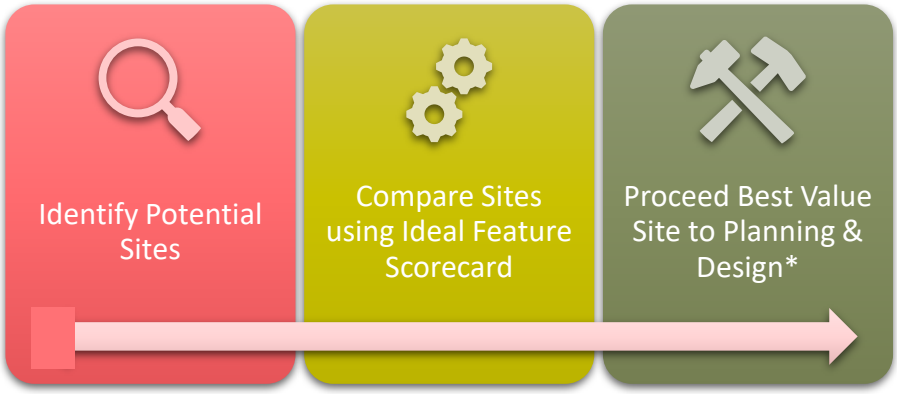


Figure 19: Overview of Decision Process

The ideal site is a highly visible off-street accessible car space near public amenities with access to a switchboard with spare capacity in a location desirable to drivers.

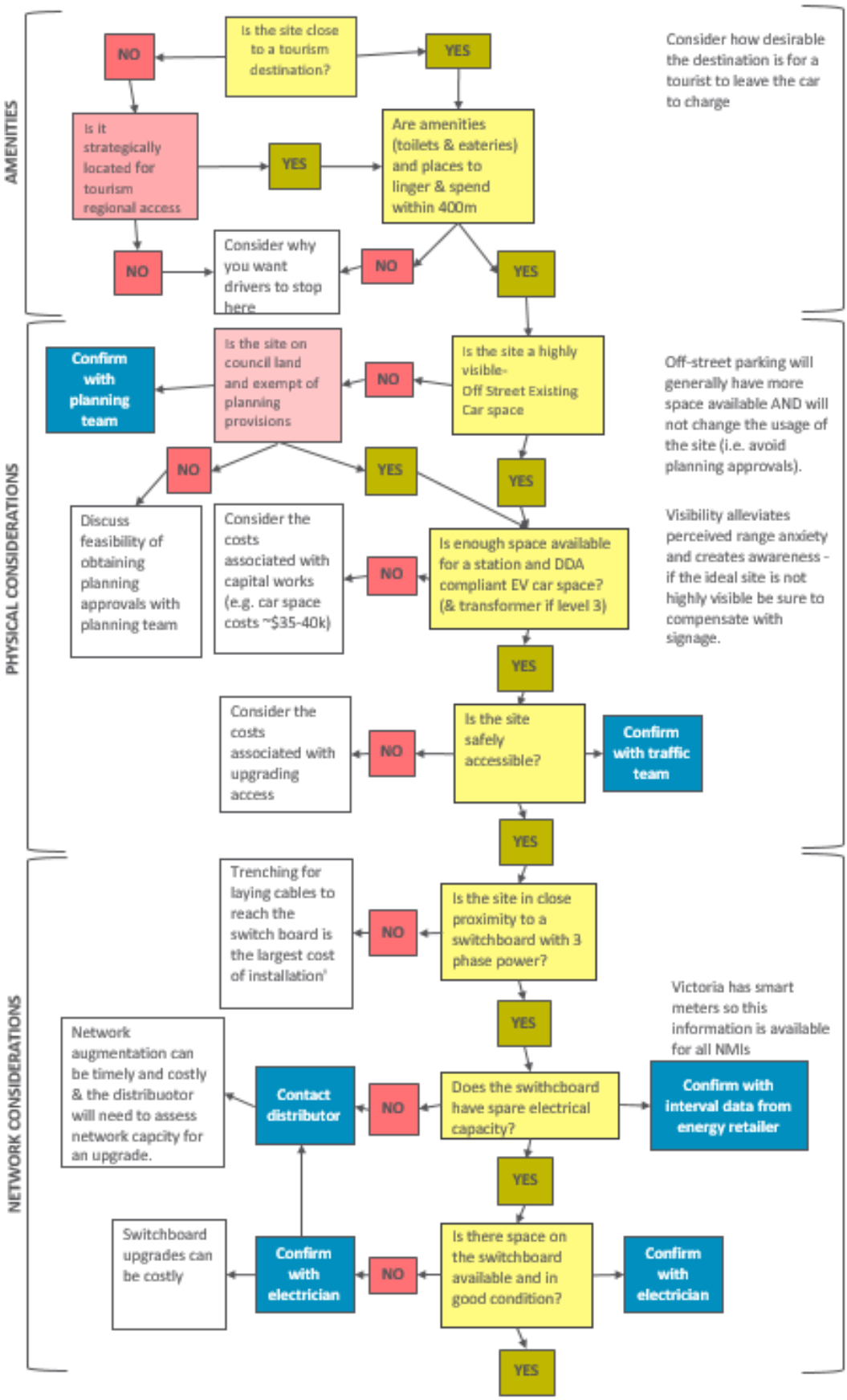


Figure 20: Specific Site Shortlisting

A list of key features is provided in Table 2, the attached spreadsheet incorporates the above flowchart and the below table to provide a score.

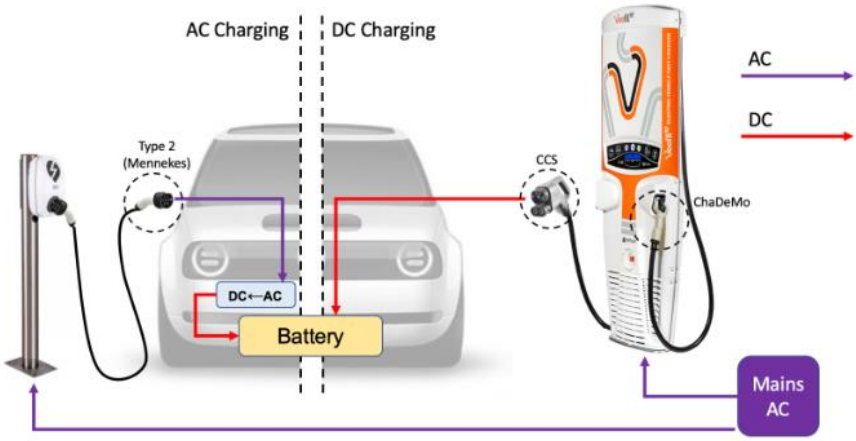
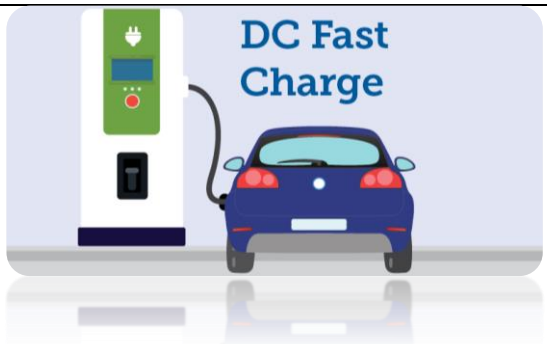
Table 2: Ideal Features of Charging Station Site

Features	Detail
Location	
Close proximity to Facilities	Destination charging needs to be close to driver amenities such as toilets and eateries for the driver; and located near recreation or tourism opportunities to linger and spend money to benefit the town.
High visibility	An objective of the Victorian Government network is to overcome perceived range anxiety. The presence and high visibility of charging station will assist in raising awareness and overcoming this barrier. Way finding signage and lighting can also be used to increase visibility and encourage uptake of EVs.
Existing car space	On-street or off-street locations that are ideally perpendicular (not angled). Off-street parking locations are likely to provide more layout options as more space is available. It is recommended that a wide zone is provided around the vehicle to enable the charging station to connect with multiple vehicle types and orientation requirements. Ideally with no more than 3m between the station and the car charge point to accommodate cabling.
Planning Scheme	Ideally located in a zone with no restrictive overlays to avoid the need for permits, and not on a space that crosses over title boundaries. Ideally council owned land and an existing car space.
Power & Connectivity	
Access to Power	An existing network connection with 3 phase power.
Proximity to Switchboard	Trenching to lay extended cabling can be the largest cost of installation. Decreasing the distance of cable from the charger to the switchboard will minimise costs.
Able to connect to an existing Load with spare capacity	Sites that are already connected to electricity will be much more cost effective than requiring a new network connection. (Network augmentation costs can range from $4k - $100k and in some instances there might not be any additional network capacity available). To identify spare capacity, electricity retailers can provide usage from the smart meter – and compare peak demand with capacity provided.
Network Capacity	This information is only able to be provided by the Electrical Distributor, however, is only required if wanting to upgrade the current connection for additional power.
Switchboard condition	To avoid upgrading the switchboard, one that is in good condition with an available circuit breaker with the required amperage for the charging level.
Internet Reception/Mobile Reception Signal	To enable the charging station to be monitored remotely and to accommodate different billing methods.
Physical - Traffic and Asset	

Features	Detail
Safe to access	New (and existing car parks) are to be constructed in accordance with Australian Standards – including that drivers can see oncoming traffic when exiting and are not required to reverse onto a main road.
Traffic Requirements	Sufficient space for traffic access and turning circles to access car space, assess impact on street from any change in traffic volumes.
Not on a flood plain	To reduce the risk of being inundated.
Space for a charger	Level 2 stations can be installed on a wall, Level 3 will require additional space.
DDA compliant	While this can be incorporated in at the installation the ideal site will have sufficient space to incorporate wheelchair and pram access into the design.
Drainage and gradient	In accordance with Australian Standards for carpark design, which will be incorporated already if an existing space.
Sustainability	
Renewable Power	For potential ARENA funding renewable energy will need to be incorporated into the design.
User Safety	
Clear of trip hazards	Once at design and construct phase ensure no cables will cause a trip hazard to pedestrians
Lighting	Does the site have adequate lighting levels for driver safety when charging at night or will this be required to be installed as an additional cost.
Hazardous materials	Safe proximity form hazardous fuels and materials.
Safe neighbourhood	The site needs to be desirable for a tourist to charge.

When considering Level 3 Fast Charge v Level 2 Destination Charging.

Table 3: Key Differences between AC Level 2 and DC Level 3 (image source: https://fleets.chargetogether.org/article/all-about-chargers/)

Level 2 (AC)	Level3 (DC)
	
$$$ Cheaper in design and cost Installation is of medium difficulty in a public environment as within the scope of a property owner to plan and deliver. The vehicle is connected directly to the electrical network via specific socket and plug and a dedicated circuit. Review of electrical infrastructure is still necessary and should be located next to main switchboard with a simple connection to host electricity. AC chargers often have longer cables which can reach to all sides of a parked car, in which case placement of the charger is less critical.	$$$$$ More complex in design and cost Installation more difficult and likely to require coordination with electricity networks and road transport planning agencies. Charger is part of station, not part of car Needs to be placed with high regard to capacity of surrounding electrical infrastructure - next to an existing high-power transformer with sufficient capacity. DC fast chargers carry high amounts of current and, therefore, the charging cables are thick and heavy, resulting in relatively short cable lengths.
Examples - Wall Charger in shopping centres, public car parks, on-street parking.	Examples - Fast charger in petrol stations and intercity travel locations
	

6. Next Steps

Components 1 and 2 have set the groundwork. The remaining components will provide the tools and information to facilitate the development of the EV charging network.

A webinar is scheduled for the 7 November to present the findings of Component 1 and 2 to participating councils and to demonstrate how to use the accompanying decision tree tool.

While the project team works on component 3 – investigating costs, considering ownership models and economic development - participating councils will be asked to start considering suitable sites within their municipalities.

Given the potential opportunity with ARENA is on the integration of the charging stations with the network, councils will need to consider covering the costs of the hardware. These considerations and more will be incorporated into the final outcomes report.

Appendix A: Stakeholder List

Stakeholder	Contact	Position	contacted
ABB	Steven Amor	National Managing Manager for EV Charging Infrastructure	pending
AEMO	Chris Mock	Principal – Emerging Markets and Services	consulted
Australian Renewable Energy Agency	Scott Beltram	Analyst, Business Development	consulted
AusNet Services	Chris Catanese Derek Javauriva Justin Harding	Relationship Manager Ausnet EV strategy work Ausnet EV strategy work	consulted
Chargefox	Martin Andrew Nick Franco	CEO Business Development Manager	consulted
City of Adelaide Council	Peter Nattrass	Sustainability - Technical Specialist	consulted
DELWP - Department of Environment Land Water and Planning	Steven A Johnstone	Manager - Sustainable Transport	consulted
Economic Development Queensland	Michael Kane	Director	consulted
Electric Vehicle Council of Australia	Alex Kelly	Policy and Communications Officer	consulted
Energy Networks Australia	Andrew Dillon	CEO	pending
EVERTY	Lance Douglass	Director, Strategy and Partnerships	consulted
EVIE Networks	Geoff Brady	Head of Sales & Marketing	consulted
EVolution	Russ Shepherd Emma Sutcliffe	Director Communications Manager	consulted
EVSE	Brendan Wheeler Sam Korkees	Managing Director Director	consulted
JETCharge	Tim Washington	Director	consulted
Knox City Council	Sam Sampanthar Justin Schreuder	Senior Program Lead, Sustainability	consulted
Middy's	Chris Day	Regional Manager	consulted
Moreland City Council	Stuart Nesbitt	Climate Change Officer	consulted
New Zealand Transport Agency	Greg Nelson	Principal Advisor – Vehicle Strategy	consulted
NHP	Ross De Rango	Product Development Manager	consulted
NRMA - National Roads and Motorist Association	Amelia Starr	Stakeholder and Community Engagement Specialist	consulted
NSW Tri-Council Charging Infrastructure Project	Anthony Weinberg	Regional Environment Program Coordinator	consulted
Powercor/Citi Power Australia	Praneel Pradhan	Project Manager Network Solutions	consulted
Queensland Department of Transport and Main Roads	Matthew Yong	Manager - Transport Policy Branch	consulted
RACV	Jesco d'Alquen	General Manager - Energy	consulted
Tritium	Howard Powell	Operations Manager - Sales	consulted

Appendix B: Overview of Charging Infrastructure

Category	Infrastructure provision	Capital & expected usage cost	Installation difficulty	Operation and management	Example of infrastructure	Typical locations
Occasional Charging (Level 1 / Mode 2) See page 6	Standard power outlet (GPO), and user supplied specific EV charging cable	$	Straight forward, assuming a standard GPO is within reach of car parking space	Self managed.		Not a recommended solution for existing or new developments as this method is designed only for occasional EV charging.
Basic AC Charging (Level 2 / Mode 3) See page 7	Dedicated AC circuit (15-32A single phase) with hard-wired EVSE (EV supply equipment) AC charger	$$	Straight forward installation by a licenced electrician	Can be self-operated or managed by a third party where costs could be recovered		Long dwell time destinations such as homes, apartments, accommodations, and workplaces.
Destination AC Charging (Level 2 / Mode 3) See page 9	Dedicated AC circuit (single phase or three phase, up to 32A) with hard-wired EVSE charger	$$$	Medium difficulty in a public environment - within the scope of property owner to plan and deliver.	Likely to be operated by third party where costs could be recovered		Shorter dwell time destinations such as shopping centres, tourist attractions and public parking areas.
Fast DC Charging (Level 3 / Mode 4) See page 11	Dedicated DC charger for high traffic public areas	$$$$$	Difficult, likely to require coordination with electricity networks or masterplan developer, and possibly local government and road transport planning agency.	Likely to be operated by third party where costs are recovered		Inter-regional travel on major transport routes or areas with high demand for fast charging
Ultra-fast DC Charging (Level 3 / Mode 4) See page 14	Dedicated ultra-fast DC charger for strategic public areas	$$$$$$	Difficult, highly likely to require coordination with electricity networks, local government and road transport planning agency	Likely to be operated by third party where costs are recovered		Strategically placed service centre on national highway routes

Figure 21: Excerpt from Queensland EV Practice Note

Appendix C: Case Studies

CENTRAL VICTORIAN Greenhouse Alliance

ndevr environmental

Charging the Regions Case Study
City of Adelaide

CITY OF ADELAIDE

The City of Adelaide is striving towards carbon neutrality and aims to reduce carbon emissions and improve air quality. The charging infrastructure project forms part of City of Adelaide vision and goals. Further driving the project is City of Adelaide's desire to position itself as an EV hub for tourists and residents, to harness positive economic and environmental outcomes for residents.

Charger Types:

The project involved the installation of 42 EV charging stations in on-street and off-street public car parks. This included a combination of chargers:

- 2 x 50kW DC fast chargers
- 38 x 22kW 3-phase AC chargers
- 2 x 15kW single-phase AC chargers

The City has found that that 15kW or even 7.5kW chargers would suffice, and that 22kW chargers were too powerful given the battery capacities of currently available EV models.

Maintenance & Operations:

City of Adelaide owns the charging stations; Chargefox maintains and operates the software for the charging network and payment system.

Financial Models:
The following three models were used:

- Self-funded - City of Adelaide covered approximately 60% of the costs of the project
- Grants – received grants from the South Australian Government and Mitsubishi
- Co-investment – Tesla co-paid on one site for the remainder of the costs.

Payment:

Payment is possible through the Chargefox app, with contactless payment available. Payment structure is:

- 50kW DC – 30c/kWh all times
- 22kW AC – free for first hour, then 20c/kWh 6am-6pm Mon-Fri, then 10c/kWh all other times (min. $1 fee)
- 15kW AC – free all times

Utilisation:

Over two-thirds of all usage has been recorded at one site, the Franklin Hub. This site has 4 chargers and is in in front of the Central Market, a key tourist attraction. The car spaces offer 2 hours of free parking and 1 hour of free charging on the AC 22kW charger.

Insights for this case study were provided from discussions with the City of Adelaide.

CENTRAL VICTORIAN
Greenhouse Alliance

ndevr environmental

Barriers to Uptake:

City of Adelaide identified several barriers to the implementation and operation of EV charging stations:

- Council lack of knowledge and expertise in electricity network and technology of chargers, old switchboards and electrical systems
- Phase charging differences between EV models
- Australian Road Rules (e.g. EVs cannot reverse into non-90° bay to charge)
- Partnership contracts with hidden agendas (e.g. predatory advertising involving long-term lock in contracts with hardware that may be obstructive of footpath or local business; user and charging data monopolisation and monetisation)

Be wary of hidden agendas in partnership offers

Key enablers:

City of Adelaide recommends early engagement with electricity distributors to understand network constraints and how much capacity is available at certain sites.

Contactless payment is important from a bigger picture perspective, allowing a seamless and user-friendly experience across different models.

The City implemented a modular system for multi-level car parks to match EV demand to car park capacity. This involves a shift to limit the number of EV parking bays available as car park occupancy increases to over 60%. At 95% capacity, only 2 of 10 EV bays will be strictly available for EVs.

Contactless payment is important for universality of charger

Communications and Marketing:

To date the campaign has involved education on the existence of EVs and EV charging. Roll out in near future of advertising on back of buses and social media, targeting up to 100,000 people who have been in proximity of a car dealership within the last 2 months.

Signage Used:

Educational/restrictive signage was used to identify a parking bay as an EV charging bay with operation instructions.

Multi-level car parks included a parking agility system with lights indicating:

- Red – occupied bays
- Green – vacant bays
- Orange – EV bays

City of Adelaide identified that visibility of signage is key primarily for non-EV users to raise awareness and ease perceptions of range-anxiety, and encouraging uptake.

Future Plans:

Move from council-ownership model towards an incentive-based model through City of Adelaide's *Sustainability Incentive Scheme*. A $10,000 rebate is being offered to City of Adelaide property owner and tenant on a 22kW charger and a $5,000 rebate on a 50kW charger.

Incentives for businesses with existing car parks and a destination purpose to implement EV charging. For example, Woolworths, Coles and shopping centres.

A better business case for local council is an incentive-based model

Insights for this case study were provided from discussions with the City of Adelaide.

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Charging the Regions Case Study
NSW Tri-Council Project

Randwick City Council a sense of community

Woollahra Municipal Council

Waverley Council

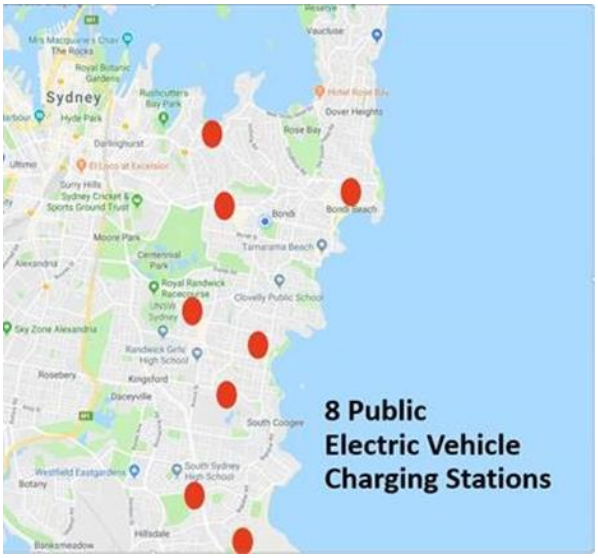
Three councils in Sydney's eastern suburbs – Waverley, Woollahra and Randwick - became the first councils in NSW to provide public on-street EV charging stations. The installation was completed in June 2019. Stations are currently installed at Bondi Beach, Double Bay, Coogee Beach and Randwick, Bondi Junction and Maroubra.

The charging station network forms a key part of the tri-council's plan to reduce emissions across the region, committing to make their suburbs 'EV-ready' and to support the transition to zero emissions vehicle transport. Other drivers for the project include providing revenue to local areas, fuel cost reduction to residents, pollution and noise reduction, as well as overcoming range anxiety.

Charger Types:

8 x Level 2 22kWh AC charging stations.

All stations are powered with 100% renewable energy.



Maintenance & Operations:

Hardware installed and managed by JET Charge, software (network and payment) managed by Chargefox.

Council in charge of the maintenance of other aspects around the charging station (civil works e.g. pavement/bollards).

Financial Models:

Self-funded – three councils funded the project entirely.

Payment:

Initially free for a three-month roll-out period.

Now, different payment rates have been implemented for charging depending on the time of day:

- 25c/kWh in peak (2pm-8pm)
- 15c/kWh in shoulder (7am-2pm, 8pm-10pm)
- 10c/kWh in off-peak (10pm-7am)

Council was interested in tap & go payment but could not find anything that was robust enough for outdoor use.

Strongly advise against free roll-out

Insights for this case study were provided from discussions with the Tri-Council Project Manager.

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Barriers to Uptake:

Some of the biggest barriers to the project have been within councils and the energy space. A major barrier was internal stakeholder management (within council). This included getting agreement and approvals, managing and coordinating priorities and expectations.

Additionally, there was substantial uncertainty surrounding the suitability of sites - both electrically and in terms of finding a parking spot that can be reserved for EV charging in a high demand area. A specialised electrician was required to conduct an electrical suitability assessment to scope out sites, which meant additional costs and time.

Internal (within council) stakeholder management a big barrier

Key enablers:

Not many existing enablers – a lot of hoops to jump through and moving parts to the project. Future key enablers would include:

- EV charging providers covering everything necessary (hardware/software/installation/management etc.) in one package
- Setting standards for uniformity to make it easy for councils to know what to do and expect

Providers can be best enablers

Signage Used:

No wayfinding signage - council was worried about too much visual clutter on streetscape and adding to it, citing that technology in cars and smartphones are adequate to cover wayfinding.

Signage on site is educational and restrictive, with additional instructional stickers on charger infrastructure.

Communications and Marketing:

Project was communicated through variety of media channels (TV on 6pm news, radio, print, online), launch event and partner announcement.

Utilisation:

Few charging sessions per week have been recorded.

Expected to rise during summer and with release of new EV models.

Insights for this case study were provided from discussions with the Tri-Council Project Manager.

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Charging the Regions Case Study
NRMA

The National Roads and Motorist's Association (NRMA) invested $10 million in 40 fast chargers across NSW and the ACT in target corridors along major highways. The goal of the NRMA network is to cover 95% of road trips - charging stations have been installed along major highways and placed no more than 150km apart, focusing on regional coverage as opposed to demand.

The main drivers behind the project are to increase range certainty for drivers, bring economic benefits from EV motorists to regional areas, and to equalise the playing field for EVs given existing disincentives in the market (e.g. model availability and price points).

Charger Types:

40 x Level 3 50kW DC fast chargers

Chargers use a combination of Type 2 CCS and CHAdeMO style plugs.

Site selection criteria included:

- Uncontested, existing council parking spots
- Distance from major highways (no further than a 10-minute detour)
- Amenity requirements (i.e. safety, security, proximity to shopping centers or eateries)

Maintenance & Operations:

NRMA created its own software platform and is responsible for its maintenance and operations. NRMA has control over usage data. NRMA partnered with local councils.

NRMA is also responsible for customer service and the maintenance of relevant infrastructure (e.g. lighting, signage, markings, parking bay and future works).

In addition to NRMA maintenance, Tritium (which installed the hardware) has a maintenance schedule to periodically service hardware.

Single ownership model is an attractive, one-package for council

Utilisation:

Some chargers are still in construction, and it is too soon to tell. Currently, usage is greatest in proximity to cities.

Fair usage principles apply, meaning that chargers are not available for vehicles used for any commercial use (e.g. taxi, Uber) or for government purposes.

Insights for this case study were provided from discussions with NRMA.

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Barriers to Uptake:

Some of the biggest barriers lie with councils and in the energy space –

- Response time from energy and utility providers
- Uncertainty about whether a connection will be possible

And within councils –

- struggle to understand the different types of chargers and roles of different charging infrastructure (e.g. why trickle charger is insufficient, or why there is a need for a charger in the first place)
- Understanding that change is coming

Another barrier has been the lack of uniformity of experience for users – there are too many payment platforms, apps, and subscription models.

Council education key

Key enablers:

Buy in from councils can act as a big enabler. Hence, the importance of education – from understanding the global market and uptake of EVs and why it is important for Australia to follow the global trend to understanding where to put what kinds of chargers.

Talking to the energy sector early is also recommended.

The policy and legislative environment can also act as an enabler, by easing planning legislation, for example – however, this is often state-specific.

Signage Used:

Signage within the network is limited to restrictive/instructional signage, with no wayfinding signage on the main road network. This is from feedback from drivers, who rely on technology either within the vehicle or on a smartphone to locate chargers. In addition to signage, adequate lighting is provided, for signage in addition to security and safety.

Financial Models:

NRMA is the owner of the project, financing the project in full.

Payment:

Charging is free and will continue to be free to NRMA members - charging costs are covered by membership fees. Non-members will be required to pay in future - after the initial free roll-out period (length currently unknown).

Membership payment model

Insights for this case study were provided from discussions with NRMA.

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Charging the Regions Case Study
Queensland Electric Super Highway

Queensland Government
Department of Transport and Main Roads

The Queensland Electric Super Highway is the world's longest single-state electric superhighway, spanning 1,800 kilometres along the coast of Queensland. It was started in 2017 and connects Cairns in North Queensland to Coolangatta in South Queensland, and inland to connect Toowomba to Brisbane.

The highway is part of a bigger state tourism strategy. The 2017 Queensland Electric Vehicle Strategy estimated that EV- based domestic tourism in Queensland could be worth up to $234 million within the next decade (not including international visitors), and that an inherent risk was presented if Queensland did not support the roll out of charging infrastructure for EV owners not taking driving holidays into regional Queensland.

Charger Types:

There are currently 18 charging stations, each with both a 50kW DC and a 22kW AC charger (with the exception of one location, which has 2x50kW DC chargers). They are placed no more than 200km apart, with 50 more chargers planned in Stage 2 of the project to fill in the gaps and create a denser network, with chargers around 100km apart. Chargers have been supplied with renewable energy bought through credits.

Maintenance & Operations:

Queensland TMR engaged Chargefox on 1 July 2019 to provide a "driver care management" package. This includes:

- Portal for customer access and eventual payment
- Customer service support
- Complete maintenance of site

Additionally, TMR and Energy Queensland have hosting agreements with councils.

Financial Models:

The project is owned and operated by Yurika, and the first phase was co-funded by TMR and Energy Queensland. The second phase will be funded by TMR.

Payment:

To support the roll- out and implementation of the Super Highway, the stations have been free of charge, which is set to change in October 2019. The plan is to encourage a linger-and-spend model (where tourists linger and spend in local shops while waiting for the charge to complete).

Insights for this case study were provided from discussions with the Department of Transport, Yurika and Main Roads and Economic Development Queensland.

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Barriers to Uptake:

- Electrical upgrading of several locations and high civil/electrical conduit costs from dispersed car parking (e.g. longer trenching, conduits, etc).
- High cost of upgrading car parks – paving, fencing (etc).
- Many moving parts and stakeholders, often waiting a long time for an answer.
- Council fragmentation (internal stakeholder management) causing delays in acceptance of land use for EV charging and hosting agreements
- Expectation management – some councils wanted to be a part of the Super Highway but TMR had to focus on key sites on the highway to prioritise funding, and could not include all.

Avoid electrical and location upgrades to decrease costs

Key enablers:

- Engaging whole of council.
- Message about not doing this to make money but to make change and getting EVs into regional areas, selling it as an economic opportunity story.
- Introduced as part of broader economic and social government strategy – developing an EV tourism product.
- All land was provided to the project for free.
- Partnerships with airports to encourage EVs for rental cars and capture international tourism.

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Utilisation:

Have seen 100% growth when comparing August 2018 (appx. 238 charges) to August 2019 (appx. 450 charges). Expecting grater uptake.

Signage Used:

There is consistent wayfinding signage along the highway – this is especially important in remote areas, where reception is less reliable. However, users mostly use technology - the Chargefox app, a smartphone, or built in EV software and GPS to find charging stations. Location specific signage consists of parking information (e.g. “EV Only” signs and “1-hour parking” limits), and instructional signage on how to operate chargers.

Tropical North Queensland EV Drive:

This separate pilot project complementing the Queensland Electric Superhighway has implemented a set of six 7kW chargers. These chargers are free, based on a ‘linger and spend’ model at tourism locations. These chargers will be non-networked due to the network challenges in these areas and the types of chargers.

Linger and spend model

Insights for this case study were provided from discussions with the Department of Transport, Yurika and Main Roads and Economic Development Queensland.

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Charging the Regions Case Study
New Zealand

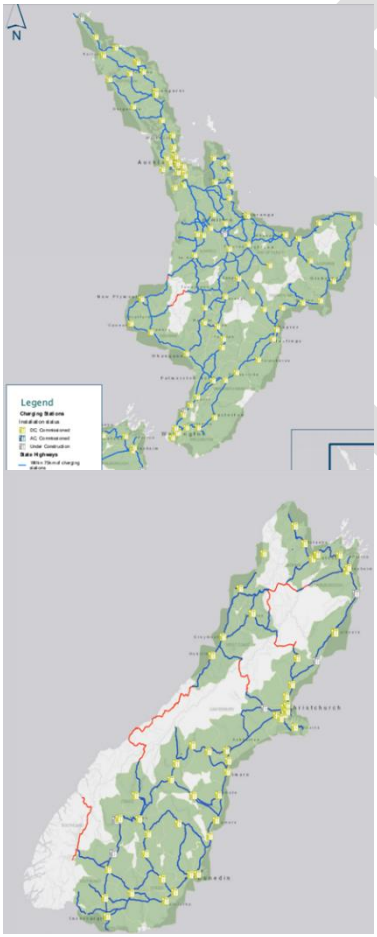
NZ TRANSPORT AGENCY WAKA KOTAHI

The Ministry of Transport announced an EV programme in 2016. The programme entailed the development of public charging infrastructure along with other incentives for EV uptake such as rebates and the creation of guidelines to make installation easier and uniform. The aim was to install one DC charger for every 35 EVs in urban areas and every 75km on all major roads. Uptake has been so high that those numbers are now being revisited.

Charger Types:

230 x DC chargers (indicated in yellow on map)
Many more AC chargers (not indicated on map)

Roads coloured red indicate there is more than 75km between DC chargers.



Maintenance & Operations:

Chargenet is the largest operator and is leading the market. Chargenet installed 150 of the 230 DC chargers and is in charge of the operation and maintenance of its hardware. A handful of energy providers supplied the remainder of the hardware and those providers are responsible for maintenance. 95% of all chargers use Chargenet software.

In addition to Chargenet software, the New Zealand Transport Agency developed its own software tool, EV Roam, which allows users to locate chargers and see whether or not they are in use.

Advise having own software overlayed on provider software. Data is valuable

Financial Models:

The New Zealand Transport Agency is the owner of the project, receiving an initial $17 million in funding from the government. Funding also comes from the NZ Low Emission Vehicle fund, which offers up to $7 million a year to fund public charging infrastructure, along with electric buses and car sharing programs, among other projects, and is currently in its seventh year of operation. Furthermore, EV Roam was developed using a $3.4 million fund from the National Land and Transport Fund.

Payment:

Free AC charging

Usual DC charging rate: 25c/minute + 25c/kWh

Some variance in DC charging if not operated by Chargenet

Insights for this case study were provided from discussions NZ Transport Agency.

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Barriers to Uptake:

Trying to figure out where EVs fit in terms of Government and funding – New Zealand does not subsidise fuel, and thus there was no existing framework to subsidise EV charging.

Unlike some of the Australian case studies, New Zealand faces the opposite problem with uptake being so high that congestion has become an issue, leading to a need for more funding for more chargers and upgrading sites.

Key enablers:

- Early start – formed clear guidelines around EV charging that was able to be applied across whole of New Zealand
- Uniformity of experience across country
- Small size of country, relatively easy to connect and easier to combat range anxiety
- Early engagement with electricity industry
- Paired with government incentives on purchase of EVs – part of bigger strategy
- 85% of all energy in NZ renewable seen as an enabling factor to positive perception surrounding EVs

Consistent guidelines key

Utilisation:

Uptake has been significant, and New Zealand has experienced significant congestion at chargers, leading to plan to expand charging infrastructure four-fold over the next four years.

Encourage multiple chargers at one site to build for future and avoid congestion

Signage:

Considered old school in NZ at this point, redundant because of so much technology surrounding EVs.

However, would be valuable in Australia because of low uptake – signage would help place EVs on radar and inform of all possible charging stations, easing range anxiety of potential EV owners, as well as prompting general public to wonder about EVs.

Signage key for EV awareness and important in Australian context

Insights for this case study were provided from discussions NZ Transport Agency.

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Charging the Regions Case Study
Moreland City Council

Moreland City Council

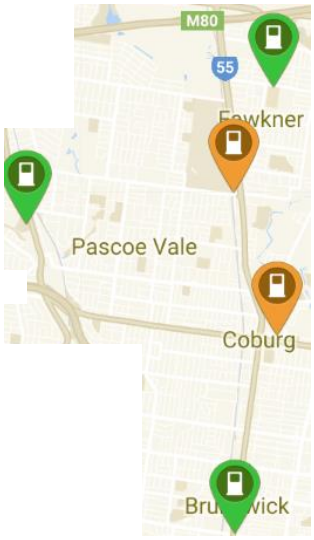
In April 2007, Moreland City Council endorsed a Climate Action Plan, which includes a commitment to the goal of zero net emissions for Council's corporate emissions by 2020, and the goal of zero net emissions for the Moreland community by 2030. Moreland City Council has been certified carbon neutral since 2012. As part of its strategy, the Council supports uptake of zero emissions vehicles and the promotion of zero emissions transportation.

Moreland City Council has been an EV pioneer since joining the Victorian Government's EV trial program in 2012. The Council installed the first DC fast charging station in Victoria (the second DC charger in Australia!) at Council offices in 2013.

Charger Types:

10 x public charging stations, several with multiple parking bays – a combination of DC (50kW) and AC (22kW and 7kW) charging.

Mix of Type 1 and Type 2 plugs, looking to phase out Type 1 plugs.



Maintenance & Operations:

Hardware and Software is provided by a combination of Chargepoint and Tritium, and more recently Chargefox and JET Charge. Maintenance and operations are provided accordingly.

Council will need to make a change once Chargepoint departs Australia (2023). This is complicated by the fact that Chargepoint products are closed protocol and because the Plug 1 types will need to be retrofitted.

Look out for closed protocol products

Financial Model:

Council received $50,000 from joining the Victorian Government's EV trial program in 2012; otherwise local Council funded.

Council has also bought 14 EVs for its fleet and is looking to add 6 more this financial year.

Payment:

Has been free with free parking, with no plans to start charging.

DC fast chargers – 1 hour free parking

AC charging – 3 hours free parking

Strongly advise free charging – believe it is role of Council to provide this service

Insights for this case study were provided from discussions with Moreland City Council.

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Barriers to Uptake:

Moreland City Council identified the following factors as barriers to uptake:

- Internal stakeholders (Council management), understanding, especially regarding contested parking
- Complexity in development of Council EV strategy

Key Enablers:

The City of Moreland identified Council support from the Executive level as a key success factor.

The City's smart approach to implementation, based on a feasibility study for one location, which was then replicated and reused for other sites, rather than conducting a full study for each site as a critical enabler.

In addition to funding, potential enablers for councils could also be through EV requirements for new buildings/precincts or existing council infrastructure.

Replication and reuse of feasibility study a big timesaver

Utilisation:

Overall, very positive and Council regularly receives requests for further chargers to be installed– Moreland has installed 11 private chargers (for Council owned vehicles) in addition to the 10 publicly available ones.

Council endeavours to add 3 more public chargers this financial year.

Signage Used:

Council has installed both restrictive and instructive signage.

Communications and Marketing:

Purchased EVs for use in Council fleet. Council EVs are clearly marked by a prominent sticker on the side of the vehicle. The sticker displays the carbon neutral logo and Council name.

Since Moreland Council was an early adopter, media interest and in the project was high and as such Council did not feel the need to market or communicate the project through a focused campaign. Having the first fast charger in Victoria (and the second in Australia) certainly helped!

Being an early mover holds marketing benefits

Insights for this case study were provided from discussions with Moreland City Council.

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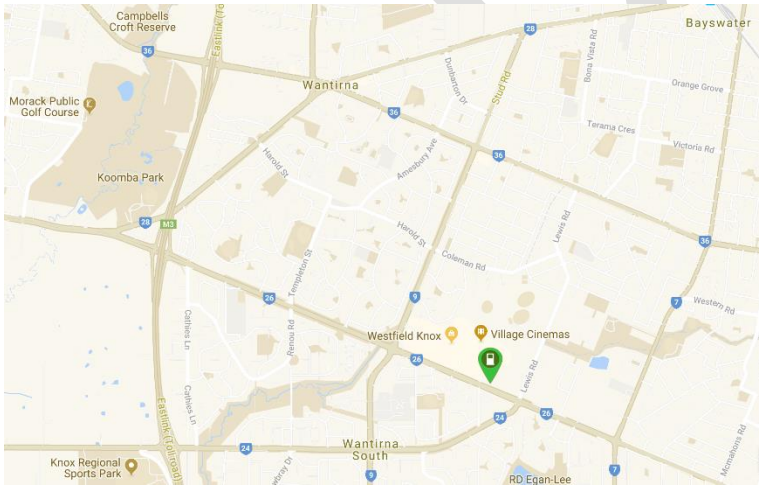
Charging the Regions Case Study
Knox City Council

Knox City Council

Knox City Council installed two twin charging points (two stations, with four charging points in total) in April 2019. One of these stations is available for public charging and the other is for use by Council to charge its new EV fleet. Public chargers are located at the front of council building next to the entrance for high visibility, and council's private chargers are located behind council buildings for added security and to accommodate the needs of the EV fleet.

Knox City Council had noticed a gap in publicly available charging infrastructure in its precinct. There were several privately-owned chargers, but council wanted to ensure publicly accessible chargers are available to support EV uptake, and wanted to show leadership in the community within the EV space. Council acquired several EVs for its fleet, which influenced the direction of the project by adding private charging for Council use.



Charger Types:

Each station is 22kW with 2xMennekes sockets (users have to bring their own cables to connect).

Jet Charge supplied and installed Schneider hardware with Chargefox providing software.

Prioritise visibility for public charging to encourage uptake and utilisation

Location:

Visibility of the public charging station was prioritised during the location decision-making. The draw-back of this prioritisation is that trenching costs for the public chargers exceeded the cost of the chargers themselves. Trenching costs were also influenced by the fact that the works triggered the need for traffic management, as the works extended across the road. Other considerations for council was CCTV availability and proximity to amenities and entertainment.

With the driver in mind, council is interested in upgrading lights around the chargers and sheltering chargers from rain and leaves, plant material and bird droppings from the trees directly above the chargers. Council is also interested in providing a place for drivers to sit (such as a picnic table) to maximise user-friendliness.

Keeping driver in mind – providing seating and proximity to amenities

Insights for this case study were provided from discussions with Knox City Council.

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Financial Models:
The project is owned and was financed in full by Knox City Council.

Payment:

To date, charging has been provided for free by Council. If Council installs more chargers in the future, this may eventually change.

Barriers to Uptake:

Many unknowns, for example:

- Knowledge around charging/EVs within council
- Lack of standards and blueprint for council around EV implementation (e.g. where to place charger)
- Community perceptions
- Future uptake

Lack of standards and blueprint for councils a barrier

Key enablers:

- Very strong support from Council CEO
- Consulting with other Councils who had done similar projects
- Seeing the value for money regarding EVs and EV charging – biggest cost to project was trenching

Council and CEO support is key enabler

Signage Used:

Signage used includes standard parking signs and green markings on pavement indicating EV use. As of now, signage denotes parking is for EVs that are plugged in and charging, and council may time-restrict parking in the future – depending on uptake and whether behavioural or congestion issues arise.

Communications and Marketing:

Chargers were communicated through a mostly digital media release and presence, as well as through a local paper. Council EV fleet is kitted with sleek stickers on the sides promoting both EV fleet and chargers, reading "Knox going electric".

Utilisation:

Council has noticed increased use on weekends and after hours – which has prompted Council interest in upgrading lights around charger.

Insights for this case study were provided from discussions with Knox City Council.