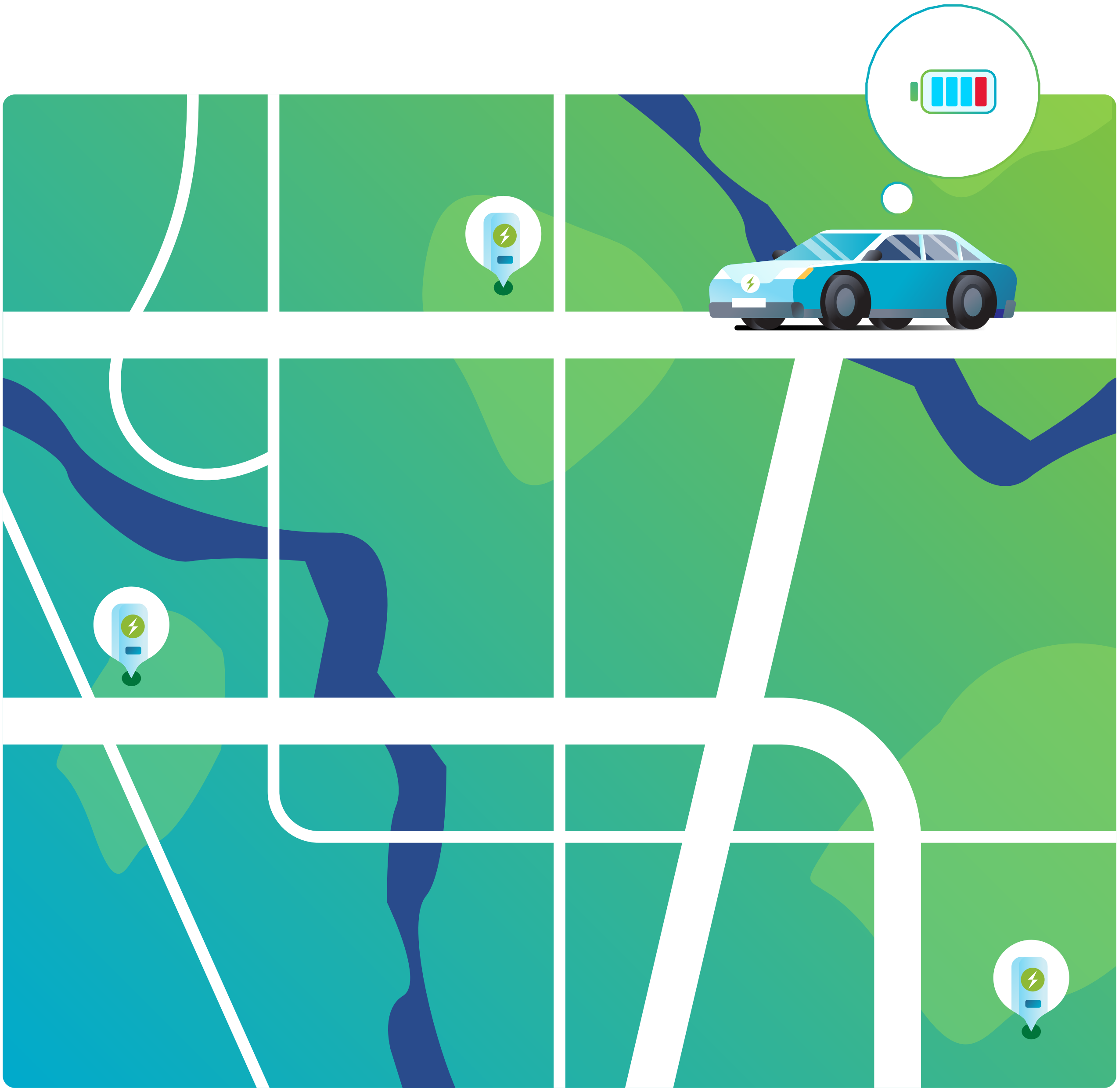
Public high power EV charging availability

Prepared by
Ross De Rango

May 2023



ELECTRIC
VEHICLE
COUNCIL

Executive summary

The transition of our road transport sector from vehicles reliant on foreign oil, to vehicles running on electricity, requires the construction and operation of significant amounts of electrical infrastructure, spanning generation, transmission, distribution, all the way down to the public EV charging equipment consumers will use every day.

Transitions of this scale take time to execute. It took decades from the introduction of petrol cars for petrol to be readily and reliably available in regional Australia. It also took decades from the introduction of electricity in the major cities before many rural properties were connected. Along the way, challenges around reliability and performance were experienced, and overcome. Supply of petrol for our cars and electricity for our homes will never be 100% flawless, but it's very good by global standards, having had a hundred years to evolve.

Public high power EV charging is at an early stage today in Australia, and it's not quite at the level of reliability that it needs to be. The high level goal should be that a driver rolling up to a public high power charging location experiences similar availability to a driver rolling up to a petrol station today. It's OK for an individual pump to be out of action, and it's OK for there to be short queues at particularly busy times, but absent issues like flood or electricity network outage, the service should be available.

This whitepaper lays out some considerations for public EV charging point operators (known as CPOs), and for the parties providing funding to them, in the Australian context. These considerations have been developed by an Electric Vehicle Council working group, comprised of many stakeholders. It's not intended as a definitive list, and there's certainly more work to do - but it's our hope that it's a useful starting point, to take us in a direction of public facing infrastructure meeting public expectations.

The EVC encourages robust discussion around this matter and looks forward to continued engagement with many stakeholders in the space.

Introduction

Problem statement:

1

The consumer arrives at public high power EV charging location and cannot charge their car.

Causes considered within scope for this whitepaper:

a. EV charger offline due to equipment fault

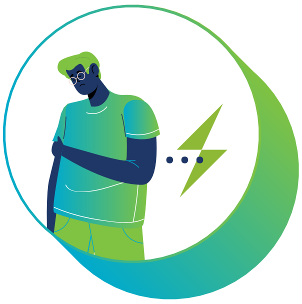
b. EV charger operational, but driver unable to authenticate to CPO

c. EV charger physically inaccessible due to parking infringement

d. Site is without power

2

Consumer cannot identify a nearby, working and available high power EV charger.



3

General public perception of lack of reliability in the public high power EV charging network

Work in other jurisdictions:

The UK government ran a consultation on this issue recently:

https://www.gov.uk/government/consultations/the-consumer-experience-at-public-electric-vehicle-chargepoints/the-consumer-experience-at-public-chargepoints

Their consultation arrived at a target of 'mandated 99% uptime' but did not define a mechanism to achieve it. At time of writing, this is still work in progress. This consultation does demonstrate very clearly that other jurisdictions which are further along the EV transition journey than Australia, are experiencing very similar challenges, and grappling with solutions.

The EVC would observe that 99% uptime implies that 4 days per year is an acceptable outage rate. We're of the view that this might serve as an interim goal, but that ultimately consumers will expect better than this, in terms of availability of the service of vehicle charging at a high power EV charging location, especially if it's a regional location with no nearby alternatives.

Work in adjacent sectors in Australia:

Energy networks have had well defined reliability metrics and requirements for a very long time, and financial measures applied to things like time taken to re-connect customers after outages. Excluding natural disasters, downtime is typically measured in minutes or hours per year, not days.

In cases where some hours per year of downtime is not acceptable (for example hospitals, data centres, some industrial processes), a wide range of solutions have existed for a long time. Multiple supplies to site, UPS systems, backup generation assets, and so forth are commonplace in many applications that are considered 'mission critical' by the organisations operating them.

Where availability matters, the first engineering answer is redundancy. Supermarket checkouts and petrol stations are an obvious parallel example here. One checkout, or one pump, out of action doesn't matter if there are multiple units at the same location available. To the extent that there is a single point of failure, the whole site can fail to be available, but the transformer and main switchboard are far less likely to fail than a single high power EV charger at a high power EV charging location.

Preventing the problem:

Reducing the degree to which a high power EV charging location is unable to provide high power EV charging to a consumer

Redundancy

At site level, if there are multiple EV chargers, and one charging asset out of multiple co-located EV chargers is offline, it is far less likely to negatively impact the driver than a site with a single EV charging asset. Multiple EV chargers at a location, each with 95% uptime, will almost certainly deliver better consumer outcomes in terms of availability than a single EV charger with 99% uptime. The provision of multiple chargers at a location also dramatically reduces the likelihood of queuing at the location.

Individual physical constraints at the location will limit the degree to which multiple EV chargers can be physically deployed at a particular site, and there will be an upper limit as to the number of chargers that it is reasonable to deploy, based on projected utilisation, budget, and location-specific electrical constraints. We do not state a particular number of chargers that is optimal for all locations, simply that consideration should be given to there being more than one where physical space and budget allows.

Consideration should also be given to redundancy in communication pathways. This may take the form of a backup modem, or a single modem with dual sim cards and fail-over technology, for example. The intent here is not to present a prescriptive solution, but rather to highlight the benefit of avoiding a single point of failure. See also: provision of Wi-Fi at the location, under authentication.

Consideration would not generally extend to site back-up power in the event of network outage. Network outages will typically be relatively infrequent, so should not impact acceptable service levels. In rural locations where network interruption is more likely, and the nearest alternative high power charging location is likely to be further away, consideration should be given to on-site backup power.

At charging network level, the goal should be to ensure multibay DC charging locations at maximum spacing of 70km on highways/freeways, and at maximum 5km spacing in metropolitan areas. If one site is unexpectedly offline, this will create a reasonable chance for the driver to get to the next one.

Maintenance

It should be assumed that public facing high power EV charging equipment will degrade over time and need repair. A plan covering who is responsible for managing the execution of maintenance work, who will actually execute the work, and a budget to carry the work out should be part of any deployment of public facing fast charging equipment.

It would be reasonable to expect that this maintenance plan would be negotiated between site hosts, equipment owners, equipment manufacturers and CPOs.

Vandalism can be expected to be an issue over time, particularly at unattended sites. This should be considered in site selection, site design, and maintenance budgeting.

Site design should incorporate planning for maintenance. For example, it should be possible to electrically isolate the EV charging elements of a site, without electrically isolating any other elements of the site, so that maintenance on EV charging equipment does not impact other site operations.

Sufficient spare parts to enable prompt repair should be available in-country. Responsibility for this might sit with the charging equipment manufacturers, importers or the charging station operators. This is likely to be difficult to directly enforce. In the general electrical equipment industry, it's left to the free market.
An SLA-type approach negotiated between the parties at time of equipment purchasing (common in the IT industry) could work, subject to appropriate contractual arrangements between interested parties.

Visibility principally relates to enabling the driver to avoid offline EV chargers, but it plays a part in maintenance as well. If the charging asset is not connected to a monitored backend system, the first awareness of a problem is likely to be a consumer arriving and being unable to charge. Therefore, all high power public facing fast charging equipment should be connected to a backend system monitoring performance. See also the visibility section below.

Authentication and payment

Overseas and local experience has been that the use of RFID fobs, which are physically supplied by charging station operators to drivers via a registration process, leads to poor consumer outcomes. It is recommended that this approach not be used as the sole authentication and payment approach for future deployments in Australia.

Apps which can be downloaded on demand to Android and iOS devices are much better, but not perfect. It's possible for a driver to have issues with the app, and experience difficulty with charging. It's also possible for cellular phone service to be out in a location, which can compromise the authentication process. Consideration should be given to the provision of wifi at the location to mitigate this risk.

Consideration should be given to universal payment methods at high power EV charging locations. This could include physical credit card reading devices at sites where this is appropriate, but could also be enabled through methods like over-the-phone payments, QR code scanning to connect to app-based payments, text messaging to payment providers, or phone calls to call centres.

It is expected that the plug & charge elements of ISO15118 may provide a more seamless experience for drivers in future, but this is a relatively nascent approach at this stage.

Accountability

Linked to requirements for a maintenance plan is a requirement for clear accountability as to which parties are responsible for which aspects of the ongoing operation and availability of the charging location. In some instances this may be the charging station operator, but in others it may be local government or some other party.

This can incorporate matters of electrical maintenance (both scheduled and reactive), but also extends to considerations such as:

- Vegetation management at site
- Cleaning to the extent required. For example in the event of graffiti that is unsightly, but doesn't compromise function, or removal of rubbish dumped at the site that may interfere with access or create a health and safety issue.
- Issuance of parking infringement notices and removal of illegally parked vehicles, where applicable, to ensure that the site is physically accessible to EVs.

Accountability should include target metrics around percentage uptime of each individual EV charger at the location, and where multiple EV chargers are at a location, percentage uptime of 50% or more of the EV chargers at the location. For example:

- The target percentage uptime figure for an individual charging asset might be 98%, meaning each charger at a location may be offline up to 7 days per year

- The target percentage uptime figure of a site with two or more chargers might be 99.8%, meaning there should be less than 17 hours per year during which more than 50% of the chargers at the location are offline.

We would suggest reporting uptime figures inclusive and exclusive of times when the electricity distribution network is unavailable from the uptime calculation. So, for example, if the network is out for 36 hours during the year in a particular location, and the charger is out of action for 48 hours including the time that the network is out of action, then the uptime calculations would be:

- Excluding upstream network outages: ((365*24) – 48) / ((365*24) – 36) * 100 = 99.86%.

- Including upstream network outages: ((365*24) – 48) / (365*24) * 100 = 99.45%.

The intent here is to assign accountability appropriately, and clearly.

This concept could be further extended to include outages due to loss of cellular coverage for regional locations. If the energy network is functional, but cellular communications are down in the region, and the charger therefore cannot communicate with the CPO platform in order to authenticate the driver, charging may not be available. This is important to report on but should be distinguishable from the charger not operating because of a fault at site.

As with the correct number of chargers for a location, we do not state a specific uptime percentage that should be applied across all chargers or all locations, simply that we should have a model for reporting on this which is consistent across industry.

In setting the percentage uptime targets they key balance to be struck is between cost and availability. Getting from 99.8% excluding upstream network outages at a site level, to 99.99% (<1 hour outage per year) when including upstream network outages, is possible but very expensive, and probably not worth the cost.

Addressing the problem when it happens anyway:

Despite the measures above, drivers will sometimes arrive at offline sites, or have difficulty with authentication and payment that impacts their ability to use the charging asset.

Customer assistance

Given that issues around authentication can be expected to impact consumer experience, consideration should be given by CPOs to providing a 24 hour point of contact for drivers experiencing difficulty with using the charging station.

Visibility

For public facing high power charging in particular, the charging equipment should be online, so that the consumer can at minimum see real-time status via an app or website. This will reduce the degree to which consumers will roll up to an offline charging asset and experience inconvenience.

There's an education piece here for consumers as well: if the driver is relying solely on Plugshare, they will periodically arrive at offline chargers, because Plugshare does not provide real-time status information.

Aggregation of real time charger status data into a common platform might help consumers rapidly identify alternatives to sites that are out of action. The back end of a platform aggregating real time availability could also be used to independently report performance in terms of uptime, mean time to repair, and so on.

The EVC could play a role in the creation and operation of such a platform, on behalf of industry.

Disaster recovery

The future will include flooding, bushfires and other extreme weather events that wipe out charging locations along with upstream energy network assets, meaning restoration to original state might take weeks.

Ready-to-deploy temporary stations at ~100kW size (comprising DC charger and CO_2 neutral biofuel generator, for example) would be worth consideration for funding as the network of high power public charging equipment scales.

Conclusion:

The EVC encourages robust discussion around this matter and looks forward to continued engagement with many stakeholders in the space.

ELECTRIC VEHICLE COUNCIL

Public high power EV charging availability

Prepared by Ross De Rango

May 2023

Please get in touch if you'd like to work with us in this space: office@evc.org.au