EVC Submission to

AEMO 2022 Integrated System Plan

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Introduction

The Australian Energy Market Operator (AEMO) started producing Integrated System Plans (ISPs) on a two-yearly basis in 2018. The ISP is a 'whole of system plan' that offers a roadmap for development in eastern Australia's electricity system. The draft ISP for 2022 is currently open for consultation, and AEMO has sought input from the Electric Vehicle Council (EVC).

https://aemo.com.au/consultations/current-and-closed-consultations/2022-draft-isp-consultation

https://aemo.com.au/-/media/files/major-publications/isp/2022/draft-2022-integrated-system-plan.pdf

The EVC is the peak body in Australia representing the interests of manufacturers and suppliers of Electric Vehicles (EVs), EV charging equipment (EVSE), public EV charging network and software service providers in the field of EV charging orchestration. We also have strong membership amongst energy market participants, including retailers, DNSP, TNSP, and generators. The EVC has a very strong interest in ensuring that uptake of electric vehicles in Australia is beneficial to the overall energy system.

The draft ISP makes a point in several places that applies to many of the topics we raise below:

"Full DER integration requires a step change in engagement across the industry to ensure all consumers, retailers, networks and other market participants orchestrate these resources to optimise net benefits and maintain security and reliability"

EV uptake

The draft ISP lays out a range of scenarios, leading to a range of possible futures. The spread of possibilities with respect to EV uptake ranges from 36% of the fleet being EV, to 99% of the fleet being EV, by 2050[1].

The EVC would suggest that the outcome will be much closer to 99% over 28 years than 36% but acknowledges that given how dependent the outcome is on government policy, and how volatile policy has been in this space, it is difficult to plan with certainty.

Prudence dictates planning for a range of outcomes in this respect. Based on the commitments of many global car makers to shift to EV only production well before 2050, and the net zero commitments of Australian state and federal governments, 80%-99% fleet transition is likely the right range to be planning for.

[1] Figure 7, page 28 of draft 2022 ISP

EV convenience charging

Similarly to EV uptake, the draft ISP posits a range of possibilities with respect to EV drivers 'convenience charging' in a residential context. In this document, convenience charging essentially means 'charging at home immediately on arrival home from work, during peak time'.

According to the draft ISP, rates of consumers relying on 'convenience charging' in 2050 range from 22% to 58%[2]. This question is crucial, because it is a direct input into network peak demand, which is a key driver of DNSP and TNSP network augmentation costs, and hence consumer energy costs.

The EVC would suggest that under the more likely scenarios (progressive change and step change), convenience charging is likely to be much lower than the 31%-44% stated. This is because the financial benefit to the consumer of shifting their EV charging away from peak times is already strong (on the order of $700-$800 per annum per car for an average driver) and can be achieved without any significant loss of amenity to the consumer.

There is published research available that indicates that greater than 80% of consumers would be willing to shift their EV charging behaviour away from peak times in exchange for a 50% discount on energy cost[3]. The EVC notes that there are already retail tariffs available that offer higher discounts than this for off-peak energy overnight, designed specifically to target EV drivers, and that solar feed-in tariffs already represent a greater than 50% discount over typical retail supply from the grid[4]

In addition to this, state and federal jurisdictions have announced funded plans to support and incentivise orchestration of EV charging. The technology stack to achieve this outcome has already been proven through various ARENA trials; state and federal support will see these approaches scale beyond trial level.

The EVC highly recommends analysis of smart meter data of consumers adopting EVs today, to identify the aggregate change in peak demand, and hence the proportion of consumers relying on convenience charging today. Relying on data from older studies is not likely to be reflective of mainstream consumer behaviour in the future, because older studies either rely on early adopters in the Australian context, or on user behaviour in other jurisdictions operating under different market conditions. This analysis should be ongoing, to inform future projections as increasingly mainstream consumers adopt EVs.

Cybersecurity

The report picks up on a range of risks, but not cybersecurity. If we are relying on large scale orchestration of EV charging to limit peak demand and/or provide dispatchable support to the grid in the form of vehicle to grid (V2G), and this orchestration is achieved via the internet, there are non-trivial risks associated with malicious action.

For the avoidance of doubt, the view of the EVC is that orchestration of EV charging and V2G are part of the solution, and that the cybersecurity risks require management. The challenge in the transformation is that historically the threat surface where the electricity grid meets the internet has been much smaller than it will be in future, and within the control of market participants. This merits close attention, given that in future the threat surface will be distributed across millions of homes, and partially under the control of consumers.

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[2] Figure 7, page 28 of draft 2022 ISP

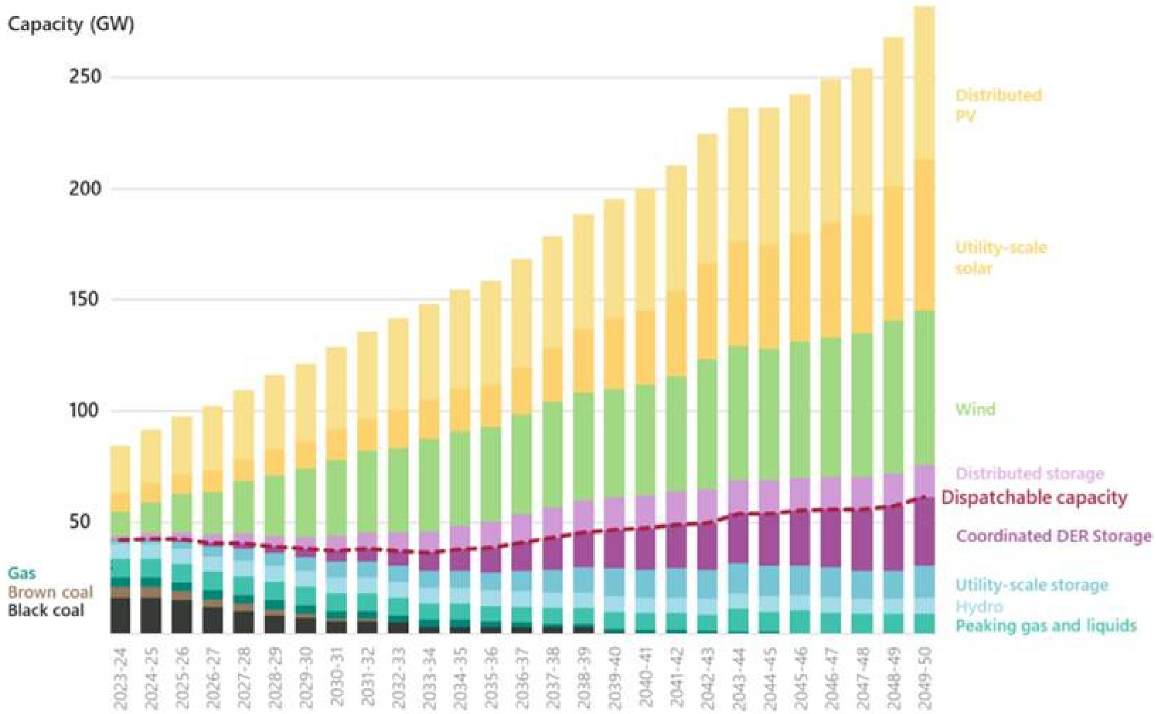
[3] https://www.researchgate.net/publication/355444278_Electric_Vehicle_Charging_Consumer_Survey_Insights_Report

[4] https://www.powershop.com.au/electric-vehicle-tariff/electric-vehicle-tariffs-by-state/

Vehicle to grid

The step change scenario in the draft ISP indicates closure by 2050 of all coal fired assets, with dispatchable capacity made up of peaking gas and liquid plants, hydro, utility scale storage, and co-ordinated DER storage.

Figure 1 Forecast NEM capacity to 2050, *Step Change* scenario, with transmission



AEMO have indicated to the EVC that the 'co-ordinated DER storage' element at 2050 amounts to 30.6GW, of which 7.2GW is provided by vehicle to grid (V2G), and 23.4GW is provided by behind the meter batteries in virtual power plants (VPPs).

The technical underpinning of the V2G element of this forecast at a household level can certainly be made possible, and likely commercially viable, within 30 years. At the household level, V2G might be achieved by:

- Having a dedicated V2G inverter on the wall draw DC from the vehicle and present AC to the grid. This is the most common approach in the global market at the present moment. It is relatively expensive, but technically proven for vehicles with Chademo DC connection (Mitsubishi, Nissan), and coming soon for vehicles with CCS2 DC connection.
- Incorporating the DC to AC conversion function associated with V2G in a solar inverter that also handles the DC to AC conversion of the roof-top solar panels. This approach has the potential to increase the asset utilisation of the power electronics associated with roof-top solar installations, thereby saving hardware cost.
- The EV exporting grid-synchronised AC directly, using the power electronics in the vehicle to perform the conversion. Once again, there's a hardware cost saving associated with improved asset utilisation.

All of these approaches have a range of technical standards, commercial, and consumer experience considerations associated with them, but there is nothing fundamental that would stop them.

The key challenge the EVC sees is not at the household technical level, it is at the consumer engagement level. The EVC is of the view that vehicle to grid services will evolve to become an important part of the market but would urge close consideration of the conditions necessary for V2G to reach 7.2GW of dispatchable capacity.

In the context of V2G, 7.2GW of dispatchable capacity means one million vehicles available to export on demand at 32A single phase from the home.

Peak export requirement from the vehicle fleet is likely to be when solar generation drops off and air-conditioning load ramps up, nominally 3pm-8pm. The history of Peaksmart events in Queensland provides a useful indication of this.

From ~3pm to ~7pm, many vehicles will be either at work or in transit, so there is effectively a high-level capacity factor consideration. It might require 2-3 (or more) homes set up and participating with V2G infrastructure in order to be reasonably sure of one vehicle being plugged in and available at any time during the afternoon peak.

If the home has two EVs, hardware constraints (for example point of connection to the property or inverter size on the wall) might mean that only one EV can export at a time. Similarly, if the home has both a stationary battery participating in a VPP and one or more EVs, it might only be able to export from one asset at a time.

Assuming 15 million EVs (all V2G capable) across 8 million dwellings by 2050, without considering the impact of stationary batteries in VPPs this might imply 25-40% of households actively participating in V2G in order to create a reliable 7.2GW of distributed dispatchable capacity when it's needed. If we also account for the degree to which participating in V2G might impact a particular home's ability to simultaneously participate in VPP, the participation rate for V2G would potentially need to be much higher than this.

Further to this, not all homes are equal. Approximately 30% of households rent, and this percentage is rising – there's a split incentive problem if any hardware investment is needed in the home to enable this solution, which we have seen clearly in relative rates of rooftop solar uptake. Approximately 13% of Australians live in flats or apartments, where the electrical installation to enable V2G may prove more complex. This percentage is also rising because we're building as many apartments as houses today.

The EVC would recommend more modelling of the probable contribution of V2G, taking into account externalities such as those noted above. Dispatchable capacity will be crucial to the transition to net zero. V2G will very likely play a significant part, but 7.2GW may prove to be an overly ambitious target in the 2050 timeframe.