Clean Energy Council submission to the AEMO / ENA 'Open Energy Networks' project

The Clean Energy Council (CEC) welcomes the opportunity to provide input to the 'Open Energy Networks' consultation paper (the consultation paper).

The CEC is the peak body for the clean energy industry in Australia. We represent and work with hundreds of leading businesses operating in solar, wind, hydro, bioenergy, marine and geothermal energy, energy storage and energy efficiency along with more than 5,000 solar installers. We are committed to accelerating the transformation of Australia's energy system to one that is smarter and cleaner.

We have structured our submission in two parts. The first is a summary of CEC members' views, elicited through workshops and other consultation. The second part consists of responses to the questions raised in the consultation paper.

CEC emphasises the following key principles and observations:

- A vision of what we seek to achieve for customers and society would help to frame the goal of the roadmap,
- Customers must be at the centre,
- Decisions on grid architectures should precede decisions on who is in control,
- Decisions on architecture must be advanced through a wider forum, and
- There are many 'no regrets' actions that can and should be taken in advance of the major decisions regarding architecture.

We would be very happy to discuss these issues in further detail with the Australian Energy Market Operator (AEMO) and Energy Networks Australia (ENA). We look forward to contributing further to this important area for policy development.

Part 1: CEC members' perspectives on key issues

1. A vision would help to frame the goal of the roadmap

The consultation paper focuses on managing emergent risks of high distributed energy resources (DER) penetration, but lacks a vision for the future. The vision outlined for the ENA / CSIRO Electricity Network Transformation Roadmap would make a good starting point:

- By 2027 almost two-thirds of customers have DER and one-third are services by a stand-alone power system
- Price and incentive reform plus optimised networks and markets means distributed energy resources adoption is enabled and delivering network capacity reduction tuned to each zone substation
- Efficient capacity utilisation is achieved through 20% adoption of electric vehicles by 2035 with managed charging
- Electricity sector decarbonisation does more than its proportional share of current national abatement targets (i.e. achieving 40% below 2005 levels by 2030) and accelerates that trajectory by 2050 to reach zero net emissions (100% abatement) due to strong power system security performance assisted by distributed energy resources orchestration

2. Customers must be at the centre

We should always consider the electricity system with the customer at the centre. References to customers being at the 'end of the line' or at the 'bottom' of the distribution system are regrettable and convey a grid-centric rather than a human-centric perspective.

This is vital if the AEMO / ENA initiative is to have maximum credibility as it will facilitate the necessary rethink of how we conceive electricity systems in a world where increasingly customers have a 'product substitution' option. In addition, in conceiving a future electricity system the first and most likely option considered should be local generation and consumption. There a range of possibilities for distribution, including via existing distribution networks, microgrids, off-grid networks, grid-connected embedded networks or off-grid, stand-alone systems. Centralised generation will increasingly become the option of last resort. If we conceive of the consumer at the centre then large generators will increasingly become 'fringe of grid'. This is important because unlike any point in the previous history of the grid, customers now have available to them viable alternatives to purchasing electricity from the grid. For the maximum benefit of all consumers (including those with and without solar), a system that encourages consumers to remain connected and to share their solar resource with the wider network is essential. Failure to keep customers at the centre of this paradigm shift could see large proportions of them 'exit' the grid, which could make grid-based electricity more expensive for those customers who are limited in their ability to access electricity from solar and energy storage.

The definition of 'optimization' needs to be framed carefully. The aim should not be to optimise for the 'grid' or the 'market'. The aim should be to optimise for a balanced scorecard of outcomes for customers and society, consistent with the goals proposed above (eg. by 2027 almost two-thirds of customers have DER and one-third are services by a stand-alone power system, price and incentive reform, managed charging of electric vehicles for efficient capacity utilisation and electricity sector decarbonisation).

We agree with the view expressed in the consultation paper[1] that customers will suffer if they are constrained regarding the amount of electricity they can take from or feed back into the grid or if they do not get permission to connect a new rooftop PV system if their local area is already saturated.

Relying on crude approaches to constraint of systems risks loss of customer confidence and may drive consumer sentiment toward grid disconnection. Dynamic strategies, which may include using and limiting exports in certain locations at certain times, are preferred to crude constraints, such as zero export requirements and other blanket limits on grid export.

Even if they are given the option of participating in wholesale markets, consumers might prefer participation in local markets, such as peer-to-peer trading within a microgrid or embedded network. Wholesale market participation and local peer-to-peer trading are not incompatible but they will be, to some extent, competing business models.

3. Decisions on grid architectures should precede decisions on who controls the system

The consultation paper dives straight into the question of who should be responsible for managing the future high-DER electricity system. Prior to tackling the question of who should be performing the various distributed system operator (DSO) roles, it is important to more comprehensively understand what changes to grid architecture Australia will need. This critical content is addressed in significantly more detail by the Newport Consortium[2] and Pacific Northwest National lab than in the AEMO and ENA consultation paper.

It is noteworthy that the consultation paper states: "A number of technology vendors and retailers are active in developing aggregation and market platforms and retail offers. Although the platforms and offers are not yet mature, the market is developing rapidly and competition appears to be sufficient to drive it forward". While this may be true at one level, the statement seems to imply that no structured consideration of grid architecture will be required at a national or societal level. In other words, the implication is that the shared electricity system will re-architect itself under the influence of market and proprietary forces without 'rail gauge' decisions needing to be made at a societal level. We believe that such an approach would be grossly simplistic and will result in a system that is ill-equipped to support competition in the longer term.

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[1] AEMO and Energy Networks Australia 2018, *Open Energy Networks*, consultation paper

[2] De Martini P., Kristov L., Higgens M., Asano M., Taft J. and Beeman E. 2018, *Coordination of Distributed Energy resources: International System Architecture Insights for Future Market Design*, prepared for AEMO by Newport Consortium

An important insight from three of the Newport Consortium authors, De Martini, Kristov and Taft, is that there are essentially two approaches to design of transactive energy systems: 'grand central optimization' versus 'layered decentralized optimization'[3]. The 'Single Integrated Platform' model proposed in the consultation paper is an example of the former approach. The 'Two Step Tiered Regulated Platforms' model and the 'Independent DSO' model are examples of the latter approach. It is particularly noteworthy that elseweher they suggest that the 'layered decentralized optimization' model may be the only plausible approach of the two[4]. We are not aware of any jurisdictions known to be seriously contemplating the "grand central optimisation" model.

4. Decisions on architecture must be advanced through a wider forum

The CEC welcomes the initiative by AEMO and ENA to initiate a conversation on the architecture needed to support high DER penetration. Ultimately, however, decisions of this magnitude must be advanced through a wider forum and decided upon by governments (through the COAG Energy Council) and the Australian Energy Market Commission (AEMC). We note that the Australian Renewable Energy Agency (ARENA) has also initiated a collaborative forum to consider market and structural reform to enable high DER penetration.

5. Support for 'no regrets' actions in the shorter term

The CEC agrees with the position put forward in the consultation paper that there are actions we should take now in advance of decisions about the possible end point for market reforms. We note the actions proposed in the consultation paper, namely:

- Reviewing registration frameworks to allow large DER providers to participate in the central dispatch process,
- Developing better criteria for the participation of VPPs in central dispatch,
- Examining expanded information sharing between distribution network businesses and AEMO,
- Continued work with local platform solutions to determine how best to integrated aggregated resources into the system,
- Improved information sharing on the current bilateral agreements for DER services,
- Building a better understanding of network constraints for individual distribution network business,
- Developing standards for DER monitoring and management, and
- Continued development of market design to support demand based resource participation into the market.

[3] Kristov L., De Martini P. and Taft J. 2016, *Two Visions of a Transactive Electric System*

[4] ibid

In addition to these measures, other 'no regrets' measures could include:

- Reviewing the extent to which the capabilities enabled by AS4777.2 have been utilised by networks and understanding why networks have not utilised capabilities designed to assist with DER integration.
- Reviewing AS4777.2 and how it could be improved in future.
- Agreeing on standards for 'VPP-compatibility' to reduce the risk that investments in batteries could rapidly become obsolete.
- Standardising connection requirements for DER, such as Energy Networks Australia's proposed 'National Connection Guidelines'.
- Developing a portal that provides up-to-date information regarding proposals by networks to change grid connection requirements and dynamic DER management regimes, such as SA Power Networks' requirement for embedded generators capable of exporting more than 200 kW to have supervisory control and data acquisition (SCADA) and to use a 'standard protocol translation device'.

Part 2: Responses to consultation questions

1. ***Are these sources of value comprehensive and do they represent a suitable set of key use-cases to test potential value release mechanisms?***

Electricity grids that leverage DER offer an economically better alternative to centralised design. DER assets reduce emissions, reduce the cost of electricity, improve customer choice and improve flexibility in grid planning and operation.

A value overlooked in the consultation paper is the sense of control and independence enjoyed by owners of DER. These benefits will become more tangible and affordable in future. The psychology of DER owners should be carefully considered in the design of trials and programs.

The sources of value described in the consultation paper represent a suitable set of key use-cases. It would be instructive to model the potential value a customer could receive from peer-to-peer trading within a local microgrid that is not connected to the National Electricity Market (NEM) versus the value that the microgid could receive by participating as a Virtual Power Plant (VPP) within the NEM. In other words, as the cost of DER reduces in future and microgrids have the option of disconnecting from the main grid, will the benefits of NEM participation exceed the costs of maintaining a grid connection?

2. ***Are stakeholders willing to share work they have undertaken, and may not yet be in the public domain, which would help to quantify and prioritise these value streams now and into the future?***

Yes

3. ***Are there additional key challenges presented by passive DER beyond those identified here?***

All installed passive DER assets, such as rooftop solar PV, have their output regulated by inverters to stay within specified voltage and frequency ranges – as required by AS4777.2-2015. The network benefits associated with DER can be maximised through the transition to active DER, but passive DER does not cause considerable local network challenges.

The lack of monitoring capability on the low voltage network requires distribution businesses to take a more conservative position on DER integration than would otherwise be the case. In the absence of their own monitoring capability distribution businesses have utilised data available from smart meters. However, in jurisdictions outside of Victoria the smart meter rollout is incomplete and relies on retailers and voluntary action for its implementation.

4. ***Is this an appropriate list of new capabilities and actions required to maximise network hosting potential for passive DER?***

It is unclear whether the consultation paper is suggesting that these capabilities are a requirement for dynamic management or merely 'nice to have'. However the fact that SA Power Networks is already moving toward active management (with its proposal to require exporting DER to utilise SCADA and a 'standard protocol translation device') implies that this list is a set of 'nice to have' capabilities.

5. ***What other actions might need to be taken to maximise passive DER potential?***

The potential of passive DER can be maximised by price incentives that encourage behaviour change and load shifting to optimise self-consumption and exports to the grid. Victoria's support for time-varying feed-in tariffs is an example.

There is also a need to plan for the uptake of electric vehicles (EVs). Smart EV charging can provide important network support through frequency/watt responses that ensure charging from the grid is reduced when local frequency dips are detected.

Alternatives to the current network planning approach should also be considered. Current approaches favour networks investing in traditional network infrastructure.

6. ***Are these the key challenges presented by active DER?***

The consultation paper has identified some of the key challenges presented by active DER. Other challenges, in addition to those identified, include:

- How do we minimise the risk that investments made today will not become rapidly obsolete? For example, are there standards for 'VPP compatibility' that could guide purchasers of batteries?
- What new standards will be required and how can industry assist with the adoption or development of new standards so that this does not become a bottleneck?
- What are the cyber security challenges and how should they be addressed?

7. ***Would resolution of the key impediments listed be sufficient to release the additional value available from active DER?***

No. A significant potential source of value from active DER is enabling the more widespread use of microgrids. In some situations these will be stand-alone networks and in other situations they will be embedded networks connected to the main grid. The consultation paper does not consider use of active DER in stand-alone microgrid networks and the barriers to that approach.

8. ***What other actions might need to be taken to maximise active DER potential?***

As noted above, there is also significant potential for cost reductions arising from use of microgrid or off-grid supply. The absence of jurisdictional energy-specific consumer protections (including reliability standards) for customers served by a microgrid supply was a key reason cited by the Australian Energy Market Commission (AEMC) for delaying a decision to allow network service providers to provide microgrid or off-grid supply as a distribution service.

In the final report of its Retail Electricity Pricing Inquiry the Australian Competition and Consumer Commission (ACCC) also recommended changes to electricity laws and rules to allow distributors to develop off-grid supply arrangements for existing customers or new connections where efficient.

The CEC supports the proposals to allow network service providers to provide microgrid or off-grid supply as a distribution service. There will be areas (such as rural or remote locations) where a stand-alone microgrid is the superior solution with respect to safety, affordability, sustainability and reliability. We are pleased to note that the Essential Services Commission of South Australia (ESCoSA) has recommended changing reliability standards from feeder-type categories to region-based categories. This approach could accommodate the performance of off-grid supply with region-based categories of reliability standards that would apply equally to all types of feeders. Other state-based regulators should introduce consumer protections for customers serviced by microgrids.

9. ***What are the challenges in managing the new and emerging markets for DER?***

Regulators are struggling to keep up with the pace of change.

The process for developing Australian Standards is based on volunteer labour and is too slow to meet the needs of a system in the process of rapid evolution.

The nature of future energy services markets, their scale and the rules of engagement are unclear at this stage, making investment uncertain and risky.

10. ***At what point is coordination of the Wholesale, FCAS and new markets for DER required?***

This is a difficult question to answer because the optimal point for coordination of wholesale, FCAS and new markets for DER will be determined by whether the architecture chosen is ‘grand central optimization’ or ‘layered decentralized optimization’.

Coordination should take place at a level commensurate with the size of the market, grid or microgrid under consideration. Governance structures should be fit for purpose and appropriate to the scale of the system.

11. How do aggregators best see themselves interfacing with the market?

A consensus view on this matter has not yet emerged. Some aggregators are attracted by the notion of selling directly to a centralised operator and view DSOs as an unnecessary intermediary. Others have acknowledged that the question of grid architecture is more complex than simply 'cutting out the middle man'. Further exploration of the pros and cons of various grid architectures would assist the development of a better understanding of the roles of intermediaries and why they might be required in future.

12. Have the advantages and disadvantages of each model been appropriately described?

The discussion should commence with consideration of architecture, and the merits and disadvantages of each model before considering roles and who should be responsible for discharging those roles. The paper commissioned by AEMO for this project[5] gives an excellent overview of the system architecture issues and would make a better starting point for consideration of the various models. Jumping straight to a discussion of who does what unnecessarily complicates the discussion. It would make more sense to proceed by firstly identifying the system architectures that could be considered, their pros and cons, and the roles that need to be allocated. Only after identifying appropriate system architecture and roles should the discussion move on to who could or should fulfil each of the roles identified.

13. Are there other reasons why any of these (or alternative) models should be preferred?

The paper commissioned by AEMO for this project (ibid.) makes some important observations about the 'grand central optimization' (or Total TSO) model versus the 'layered decentralized optimization' (or Total DSO) model.

There are some fundamental issues regarding the functionality of TSO dominant models and the conclusions of the report are worth repeating:

> "The present and future models involve two schools of thought regarding coordination structure: 1) a centralized approach where the TSO performs all coordination, and 2) layered approaches where a DSO has a significant role in coordination.
>
> Determination of the choice of centralised or layered structure is an early architectural decision that has significant impact on the downstream decisions for architecture, design and implementation of market mechanisms, control systems, communication networks, and organisational roles and responsibilities (and consequently industry structure).

[5] De Martini P., Kristov L., Higgens M., Asano M., Taft J. and Beeman E. 2018, *Coordination of Distributed Energy Resources; International System Architecture Insights for Future Market Design,* prepared for AEMO by Newport Consortium

An important architectural issue is the need to coordinate and optimise significant amounts of DER for participation in both wholesale markets and distribution network services, while simultaneously respecting/mitigating transmission and distribution level constraints. This will require high levels of visibility into the operation of the distribution network, including physical switching coordination and distribution level nodal state estimation.

TSO dominant models will need to address these requirements as failing to do so may lead to:

- Distribution tier bypassing,
- Hidden coupling of operational controls,
- Inherent operational process and related technological designs that limit the ability to support large scale DER market participation, and
- Cybersecurity vulnerability from unregulated DER with unknown protection.

The DSO model resolves these issues through an architecturally simpler and more robust structure, but is more complex in practice to develop give the industry structural starting point for most power systems in developed countries."[6]

14. Are these the right actions for the AEMO and Energy Networks Australia to consider to improve the coordination of DER?

The CEC welcomes the initiative by AEMO and ENA to initiate a conversation on the architecture needed to support high DER penetration. However, care is needed since in future they (or ENA's member) might enjoy commercial or organizational advantages from decisions taken regarding the preferred grid architectures for Australia. Ultimately decisions of this magnitude would need to be advanced through a wider forum and decided upon by governments (through the COAG Energy Council) and the Australian Energy Market Commission (AEMC). We note that the Australian Renewable Energy Agency (ARENA) and SA Power Networks have also initiated collaborative fora with a broad spectrum of stakeholders to consider market and structural reform to enable high DER penetration.

[6] De Martini P., Kristov L., Higgens M., Asano M., Taft J. and Beeman E. 2018, *Coordination of Distributed Energy Resources; International System Architecture Insights for Future Market Design,* prepared for AEMO by Newport Consortium (p.14)

15. Are there other immediate actions that could be undertaken to aid the coordination of DER?

Yes. Look at what SA Power Networks is doing with SCADA requirements for systems that are capable of exporting more than 200 kW. Consider whether this should be part of the ENA's National Connection Guidelines.

There should also be consideration as to whether the metering and communications infrastructure of distribution networks is capable of supporting this visions and, if not, what investments will be needed in future.

Sources

AEMO and Energy Networks Australia 2018, *Open Energy Networks*, consultation paper

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De Martini P., Murdock D. and Chew B. 2016, *Evolving Distribution Operational Markets*

De Martini P., Kristov L., Higgens M., Asano M., Taft J. and Beeman E. 2018, *Coordination of Distributed Energy Resources; International System Architecture Insights for Future Market Design,* prepared for AEMO by Newport Consortium

Kristov L., De Martini P. and Taft J. 2016, *Two Visions of a Transactive Electric System*

Taft J. 2016, *Transactive Grid Codes for DER Integration*