6 May 2022

Dr Kris Funston
Executive General Manger, Network Regulation
Australian Energy Regulatory (AER)
GPO Box 520
Melbourne Vic 3001

Dear Dr Funston,

AER ISSUES PAPER: DRAFT CUSTOMER EXPORT CURTAILMENT VALUES METHODOLOGY

Endeavour Energy welcomes the opportunity to provide this response to the AER's Draft Customer export curtailment value (CECV) methodology (the draft methodology). The development of a CECV methodology is an important step toward a complete Value of DER (VaDER) framework, and a critical input in guiding efficient investment decisions that cater for increasing volumes of customer-driven exports into the grid.

Key aspects of the draft methodology include:

- CECVs reflect the detriment to all customers from the curtailment of DER exports with no separate estimates for DER customers and non-DER customers.
- CECVs are estimated on a half-hourly basis estimated over a 20 year forecast period based on the Australian Energy Market Operator's (AEMO) Draft 2022 Integrated System Plan (ISP) for a single "step change" scenario.
- CECVs are estimated by NEM region with distribution network service providers (DNSP) expected to apply the CECVs for their own region.
- A requirement for DNSPs to develop an alleviation profile reflecting the curtailment of exports in the absence of the proposed investment.
- The AER's "DNSP model" provides options for distributors to aggregate CECVs to support their practical application in business cases as an alternative to estimating the quantum of incremental export enabled by the proposed investment for each half-hour period.

Whilst these elements of the draft methodology are generally sound and supported, there are opportunities to refine the methodology to ensure the values produced are robust. Our concerns with the draft methodology are as follows:

- **Avoided generation investment:** the AER do not include avoided generation investment impacts in the CECV in the absence of an assumed alleviation profile which is required to understand the avoided investment. Avoided generation investment could be a significant portion of CECV and we would encourage the AER to revisit this decision. Otherwise the AER should allow for DNSPs to include this as part of their broader VaDER estimate.
- **Modelling methodology and scenarios:** the longhand market modelling approach lacks transparency making it difficult to determine the sensitivity of estimates to market modelling design versus the input assumptions. Further, we note the AER rely only on AEMO's step change scenario. Using a single CECV estimate over 25 years is unlikely to adequately account for the uncertainties in how the NEM will transit. We recommend having regard to a broader range of methodologies, such as those provided by networks, and multiple scenarios to reduce this forecasting risk.
- **Updating of scenarios and demand:** the AER will review the CECV methodology every five years and only make annual updates where there is a material change to the AEMO step change scenario. Per the above points, we consider the draft CECV is incomplete and the

reliance on a single scenario increases the risk of forecasting error. We recommend a review of the CECV methodology is triggered if material errors are identified or there are changes to the underlying assumptions or the ISP scenarios developed by AEMO. We also recommend having regard to other ISP scenarios or variations to the step change scenario.

- **Bidding behaviour and granularity of data:** while economically sound, the assumption that all generators will bid at their short-run marginal cost (SRMC) does not hold in practice. Analysis of FY21 data shows a weak relationship between bid price and generator SRMC. As the market becomes increasingly renewable post-2030 the use of SRMC as the basis for bidding behaviour becomes volatile and less reflective of actual market dynamics. We also note the reliance on half-hourly data, to reduce complexity, creates more inaccuracy as the NEM shifts to 5-minute settlement and fast-response technologies become more prominent.

The NEM is at a critical juncture, in the coming decades material investment in centralised renewable generation and the associated transmission network is envisaged along with individual customers continuing to make significant investments in DER. It is important that distribution networks support this transition in an efficient and timely manner in accordance with the expectations of customers and National Electricity Objective (NEO). As per the above, we are concerned that the draft CECV is likely to understate the wholesale market value of DER and the reliance on a single model and set of assumptions results in an unreasonable level of forecasting risk.

To address these concerns we recommend avoided generation costs are included in the CECV and a broader set of scenarios and assumptions are considered. If this is cannot be done robustly in the limited time available to the AER to publish the final CECV methodology, or without adding undue complexity, a flexible approach that allows DNSPs to tailor the model to their circumstances or complement it with adjustments to the modelling methodology or assumptions to account for uncertainty or material changes in market conditions would be preferable.

In Appendix A below we provide a more detailed response on some of the matters outlined above. If you have any queries or wish to discuss our submission further please contact James Hazelton, Future Grid Strategy Manager at Endeavour Energy at [redacted]

Yours sincerely

[redacted]

Colin Crisafulli
Head of Network Regulation

Appendix A: Detailed response

The CECVs should capture all the wholesale market value streams

The AER's methodology to date has been guided by the CSIRO/Cutler Merz VaDER final report. This includes deriving CECV estimates based on a longhand or NEM market modelling approach that is focussed on capturing wholesale market benefits comprising of the following value streams:

- Avoided marginal generator short-run marginal costs (i.e. dispatch benefits) which arise through avoiding short-run costs of the marginal generator, such as fuel and operation and maintenance costs, principally due to reduced need for grid-scale generation of electricity;
- Avoided generation capacity investment (i.e. investment benefits) which arise through avoiding the cost of constructing new generators and storage due to less demand for electricity capacity;
- Avoided Essential System Services (ESS), which arise through avoiding costs associated with the provision of a range of services including frequency control ancillary services (FCAS).

We accept that network sector benefits in particular are likely to have significant spatial and temporal variation and it would neither be appropriate or practical for the CECVs to capture all value streams attributable to network DER enablement. Nevertheless, to deliver on the objective of integrating DER more efficiently into the electricity grid it is important that the CECVs reflect the full impact to centralised generators operating in the wholesale market as much as can reasonably be achieved through modelling. To our concern, the draft methodology fails to include the impact of incremental DER exports on generation investment costs.

Capturing the avoided generation investment value stream is particularly important in the present context, owing to the significant level of future generation and transmission investment and the role that the CECV in ensuring efficient investment trade-offs are made between reducing curtailment compared to investing in new generation. These benefits are important in a market environment where significant investment is required to replace retiring large-scale coal fired generation assets to meet energy demand, stability and security requirements.

In NSW, this can be most readily observed via the large pipeline of large-scale generation projects[1] spearheaded by the establishment of Renewable Energy Zones (REZ) under the NSW Government's Electricity Infrastructure Roadmap (the Roadmap). Supported by a legislated framework to coordinate investment in transmission, renewable generation, storage and firming infrastructure, the Roadmap is expected to attract up to $32 billion in private investment in electricity infrastructure by 2030.

We note the AER's consultants Oakley Greenwood expect that avoided generation investment benefits will be small, reasoning that curtailment only occurs in the middle of the day when solar output is high. We believe this logic is potentially flawed with AEMO's ISP "step change" assumptions indicating just under 2GW of solar generation in NSW in 2021, with an additional 1.3GW committed which then increases to 7GW by 2030. In other words, there is forecast to be substantial investment in capacity which generates in the middle of the day which could be avoided. Curtailed rooftop PV during these periods could have significant impacts on this expected generation capacity investment.

Further, Oakley Greenwood's assertion that DER curtailment is unlikely during peak periods relies on assumptions around DER being rooftop PV alone. Critically, this ignores any impacts on generation investment through how developers perceive the impacts from the growth in DER. In the future, more dispatchable technologies such as electric vehicles (EV) and batteries could mean significant export during peak times which could face curtailment. Also the timing of peaks could change as the nature of electricity demand changes through EV and electrification trends and the behavioural response to changing price signals.

As the market progresses towards increasingly ambitious emissions reduction goals, the cost of new generation capacity increases as lower quality and more remote renewable energy resources (requiring additional transmission infrastructure) are required to meet increasing demand and emission targets.

[1] As at August 2018, there is around 14,000 megawatts of projects with investment value of around $18 billion progressing through the NSW planning system.

The value proposition of network investment to unlock higher levels of relatively cheap customer exports that can avoid these increasingly costly sources of marginal generation could become progressively material and represent a larger proportion of the value stack. Subsequently, the appropriateness of relying only on avoided dispatch costs and FCAS as the main drivers of the CECVs – as proposed by the AER draft methodology – will diminish over time.

In our view, investment benefits represent a material value stream. To promote a holistic and consistent approach to valuing wholesale market benefits, we consider it preferable for avoided generation costs be included in the CECVs. The AER's proposal to provide guidance in the final DER integration guidance note on valuing value streams including investment benefits separately to the CECVs is inconsistent with the intention to ensure that wholesale market benefits from a singular set of common assumptions and will introduce uncertainty and variability into inputs and outcomes.

Alternative approaches to modelling capable of estimating avoided generation investment benefits should be considered

The decision to not include avoided generation investment value stream in the CECVs follows advice from the Oakley Greenwood that doing so would require a "with/without" approach to modelling the marginal value of additional DER exports which does not accord with their preferred "marginal" approach. Oakley Greenwood explains:[2]

> *Generation and transmission investments are lumpy decisions, and their associated cost impacts cannot be reliably estimated with the current marginal CECV approach. To fully quantify the changes in investment outcomes would require a with/without approach described earlier that makes use of an explicit alleviation profile for the wholesale market modelling and repeated runs. This is not suitable for the application of the CECV as it is currently conceived (i.e., a value that can be applied by DNSPs to calculate the value created by a specific project aimed at increasing DER hosting capacity) and would add significant complexity to the process and uncertainty regarding the resulting CECV itself.*

There is a range of potential methods which could be used to quantify individual sources of market benefits, with no industry consensus on a single proprietary model that should be relied on and applied exclusively. Given this, we have collaborated with HoustonKemp and KPMG as part of joint-DNSP and individual engagements respectively to derive alternative CECV methodologies and estimates to be used as potential inputs in developing our DER investment plans for the 2024-29 regulatory control period. These alternative approaches may help inform the AER's final CECV methodology or the VaDER used by networks in deriving DER hosting expenditure plans.

Longhand approaches

Like the Oakley Greenwood approach, HoustonKemp's proposed methodology applies a full market model of the NEM which reflects the same conceptual framework and assumptions adopted by AEMO in its modelling for the ISP. It incorporates functionality to project the lowest cost level of investment required across the NEM to meet future demand and allows for the simulation of price outcomes for each dispatch period, which are not typically reported in the context of the ISP.

Critically, HoustonKemp has included avoided generation investment benefits within its methodology by applying the "with/without" approach, with the "marginal approach" applied separately to value avoided dispatch costs.

Given HoustonKemp has developed a pathway to value investment benefits, we consider it prudent for the AER to test similar alternative modelling methodologies including shorthand approaches with a view to combining them in a final methodology (potentially assigning a weighing to the resultant half-hourly CECVs) to mitigate the risk of inaccurate, volatile or unworkable CECVs. On this issue we note the draft CECVs become particularly and unexpectedly volatile into the middle and latter stages of the forecasting period for reasons that remain unexplained. Failure to investigate alternatives would suggest the trade-off between a simple methodology and accurate CECVs is not currently appropriately balanced.

[2] Oakley Greenwood, CECV Methodology, Interim Report, 6 April 2022, p.14

In addition, HoustonKemp also evaluated the contribution of avoided investment costs to total avoided system costs, noting the materiality of these benefits would be an important factor in determining whether they should be included in the methodology. Their analysis subsequently indicated that avoided investment costs are present from avoided curtailment during periods of peak demand and also during periods of peak rooftop solar PV export, owing to:

- a reduction in demand from other generation sources during the period of peak demand reduces the need for investment in other forms of large-scale capacity to meet peak demand (e.g. storage), as well as reducing the electricity generation required to charge those storage assets; and
- avoided curtailment of DER during periods of solar PV output leading to avoidance of the need to invest in large-scale solar PV generation capacity and supporting transmission capacity.

The materiality of benefits valued by HoustonKemp further supports accounting for avoided generation investment in any assessment of the CECV. If the AER's final CECV methodology does not account for this value stream we consider DNSPs should be afforded the flexibility to include it using this alternate approach (or others as informed by expert analysis).

Shorthand approaches

The draft methodology assumes a market model of the NEM the most comprehensive and appropriate approach to quantifying wholesale market benefits. In practice, market modelling has limitations that should be considered before discounting the use of shorthand methods. This is not to suggest a fundamental change is required to the AER's draft CECV methodology. Instead, it highlights the value of having regard to multiple approaches to address the known limitations of any preferred approach.

For instance, a longhand approach risks a lack of transparency around the mechanics of the model being used and the detailed input assumptions into the model – not insofar as AEMO's ISP assumptions, but assumptions around how investment and planning decisions are made internal to the model, as well as optimisation procedures and impacts on dispatch. Under a full market modelling approach, it can hard to distinguish the extent to which the estimates are driven by the market model design versus the input assumptions.

Full-scale market models can produce substantially different results depending on these mechanics, and without full access to the model, DNSPs have uncertainty around whether the CECV estimates reflect a wide range of scenarios and views. An example of this poor transparency is the lack of reasoning for the low and volatile draft CECVs estimated post-2030 which we would expect to be larger and more stable against a backdrop of demand growth from a general trend towards more electrification and system transformation driving DER growth acceleration. Without a clear understanding of the factors underpinning these values, the view that market modelling provides accurate CECV inputs cannot be tested or challenged.

In contrast, shorthand modelling provides a number of benefits in terms of transparency and simplicity. KPMG has provided a shorthand methodology which has several benefits that can be used to inform or at a minimum provide a cross-check of market modelling outcomes. For instance, their shorthand approach:

- is reliant on AEMO's ISP assumptions for generator SRMC, generator build-out and interconnector build-out
- requires no internal modelling on investment decision for new generators
- can provide disaggregated results by season and weekday/weekend
- accounts for disparities in SRMC and bidding behaviour of existing generators
- runs simulations quickly

Notably, this methodology also includes avoided generator investment benefits. This is estimated by considering the incremental change in LRMC attributed to the marginal generator on a time-of-day basis which contrasts to HoustonKemp's "with/without" approach.

The value of sensitivity and scenario testing should be elevated in the AER's final methodology

Consistent with good regulatory and investment practice, there may need to be consideration of sensitivities and ranged approaches to inputs in order to provide a confidence band of CECV estimates rather than relying upon a single set of values over a long period. Deploying a wider range of different methodologies and approaches can provide more reference points and add credibility to the CECV estimates through addressing any concerns about biases, lack of transparency or inconsistencies when relying on a single approach.

In the context of scenario testing within the draft methodology, we note the AER propose to use only the AEMO ISP "step change" scenario for the CECV outputs, with updates limited to "material changes" to the step change scenario in future ISPs outside of the scheduled five-year cycle review. It is unclear what would constitute a material change, as there are a wide range of updated assumptions and projections each ISP. The final methodology would benefit from clarifying when a material change in the ISP will trigger an update.

We also suggest that modelling of additional scenarios would provide additional insight into the appropriate values for CECV given the sensitivity of estimates of the CECV to the scenario adopted, noting there is a high impact of system demand on the CECV estimates. It is unclear how this has been estimated in the current draft CECV estimates and we also note that the various ISP scenarios have substantially different views on demand from sources such as aggregated and disaggregated DER. This means that the draft methodology is potentially discounting high demand scenarios such as the high electrification "hydrogen superpower" ISP scenario, which could risk network underinvestment.

Only in the draft 2022 ISP was the "step change" scenario seen as the most likely scenario. In regard to this scenario we note the NSW Government has recently focussed efforts on unlocking the potential benefits of hydrogen through the NSW Hydrogen Strategy which has the ambitious aim of transitioning NSW into a global hydrogen superpower. We note the strategy was published around the time voting on the most likely scenario was being undertaken by AEMO. It is plausible that in light of the recent policy direction take by NSW and other states on hydrogen, views on the most likely scenario have altered.

Furthermore, it is plausible that future ISPs will introduce other scenarios which may be more likely to occur or even potentially rename the "step change" scenario as has been the case with other scenarios. Being bound to a single scenario will lose a large amount of flexibility in the CECV calculation. The AER should consider either providing estimates for other ISP scenarios or a weighted approach to account for the uncertainty which spans across all ISP scenario outcomes.

Using sensitivities to manage uncertainty is embedded into the NEM economic regulatory framework through the AER RIT-D guidelines and approach to investment evaluation. More broadly, networks are encouraged to test a range of feasible sensitivities and scenarios as part of good decision making practice. The methodology for CECV should be consistent with the approaches to other value streams under the VaDER framework.

The prudent way to help manage such uncertainties is through running multiple scenarios and taking a weighted average or banded approach. This provides a level of insurance against forecasting risk in the single estimate under the draft CECV methodology.