Consumer
Challenge
Panel

Customer Export Curtailment Value (CECV) Methodology

Response to the AER Issues Paper, December 2021

AER Consumer Challenge Panel – DER workgroup

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17 December 2021

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Acknowledgement of country

We recognise the traditional owners of the lands on which the CCP operates. We respect the elders of these nations, past and present along with the emerging leaders.

Confidentiality

We advise that to the best of our knowledge this Advice neither presents any confidential material nor relies on confidential information.

About the Consumer Challenge Panel sub-panel

The AER established the Consumer Challenge Panel (CCP) in July 2013 as part of its Better Regulation reforms. These reforms aim to deliver an improved regulatory framework focused on the long-term interests of consumers. The CCP assists the AER to make better regulatory determinations by providing input on issues of importance to consumers.

The expert members of the CCP bring consumer perspectives to the AER to contribute to the range of views considered as part of the AER's decisions.

The Distributed Energy Resources (DER) CCP is a sub-panel of the AER's Consumer Challenge Panel. The AER established the sub-panel to focus specifically on the AER's considerations related to the Network Service Providers' DER investment proposals and the development of networks to meet the future energy landscape.

Introduction

The AER Distributed Energy Resources Consumer Challenge Panel (DER-CCP) is pleased to contribute to this next stage of work to support the development of Distributed Energy Resources (DER) in the community. We recognise that this Issues Paper complements the Methodology Study into the Value of Distributed Resources (VaDER) by the CSIRO and CutlerMerz in October 2020 and the AER Draft Guidance Note for Distributed Energy Resources Integration Expenditure of July 2021.

The CCP shares the general expectation that by 2050, rooftop solar systems and other types of DER will contribute more than 45 per cent of Australia's electricity supply.[1] Distribution Network Service Providers (DNSPs) clearly have an obligation to support the growing customer demand for more distributed energy resources, including embedded generation, energy storage and intelligent demand response.

Our initial view is that the Customer Export Curtailment Value (CECV) is a relatively straightforward concept and its application in guiding network businesses' investment is useful. However, the energy and customer environment in which the CECV is being considered is highly complex and incredibly dynamic, with many variables and issues to consider.

We believe that there will be significant difficulty in not only accurately modelling the value of energy curtailed, but also to meaningfully relate that value back to a diverse range of energy customers. There is a high risk that the value of curtailed energy, and hence the benefit of network investment to increase hosting capacity, can be easily over-estimated. In addition, there are many initiatives in play that will encourage consumers to almost 'self-curtail' and avoid the export of excess energy, such as falling feed-in tariffs, increased benefits of energy storage, electric vehicle charging and energy tariffs that reward reducing energy consumption at peak times such as the early evening.

From the energy consumer point of view, there are many 'moving parts' which can greatly influence the way CECV can be viewed. The Energy Consumers Australia Customer Behaviour Survey notes [2]:

"People's attitudes to energy are as diverse as the community itself with just as many consumers expressing a desire to adopt and engage with energy technology as those who do not. One thing that is consistent is that people's activities and priorities with energy are changing. This change includes structural and long-term shifts such as the greater reliance on smart, digital and energy efficient technology."

In such a vigorous situation, we encourage the AER to continue to test any initiatives against the fundamental goals of the ESB recommendations and the AEMC *Draft rule determination for Access, Pricing and Incentive Arrangements for DER of March 2021* for guidance, which encourages, over time, that more electricity consumers can access more distributed energy resources, while keeping the cost of supplying network services as low as possible. Without these changes, distribution networks may constrain the continued adoption of distributed energy resources.[3]

This advice is presented in two sections. Firstly, we have several comments regarding how CECV can be defined and applied. The second section responds to the questions asked in the issues paper.

It is important to note that the CECV is just one of a few significant emerging parameters from a customer perspective. DER export charging, metering upgrades providing better usage information, new tariff arrangements and new energy demands through electric vehicles, local storage and electrification mean that

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[1] AEMC, Access, pricing and incentive arrangements for DER, Rule determination, 12 August 2021

[2] Energy Consumers Australia (2021). Household Topline Results presentation. *Energy Consumer Behaviour Survey*.https://ecss.energyconsumersaustralia.com.au/behaviour-survey-oct-2021/

[3] AEMC, A*ccess, pricing and incentive arrangements for distributed energy resources,* Draft rule, 25 March 2021

the CECV consideration must be viewed through the lens of all these simultaneous influences not only on the market and networks but also on the ultimate investor in DER - the consumer.

Factors to consider regarding the CECV - general comments

The issues paper considers that CECVs will (at least partly) inform a number of functions: [4]

a) demonstrate the extent to which network investments to enable more DER exports are valued by customers and the market, and therefore assist in the cost / benefit assessment of network investment to increase the hosting capacity of networks,

b) assist the development of incentive arrangements for networks to provide export services,

c) capture the detriment of export curtailment to the customers using the export service and

d) capture the potential detriment to all energy customers from lower levels of customer exports.

We also understand that the AER is seeking advice around some of the fundamental parameters that would apply in setting a CECV, including:

a) How does it displace utility generation and if so, what is the value of that generation ?

b) Should the valuation consider generation bidding behaviour ?

c) Should the CECV vary by region or time of day ?

d) Should it be a short term or long-term calculation ?

To assist in our assessment of the AER's Issue Paper, it is useful to clarify our interpretation of some of the key terms, as noted below.

a) What is 'curtailment?'

It may be useful to put some definition around what is meant by the term 'curtailment' to assist in setting the scope of the application of CECV.

Under a revenue-capped regulatory regime, network service providers are not explicitly encouraged to embrace DER or to actively pursue better network utilisation. This initially led to a largely risk-averse approach to DER integration, with complex connection arrangements and conservative feed-in energy limits, based on preserving network supply quality, in particular voltage. A regime of *'static curtailment'* of DER capability became common, as networks introduced long-term, significant limitations on the benefit of DER by:

b) rejecting a customer's the DER connection application outright; or

c) applying a blanket (24/7) maximum power export limitation on the proposed generator.

These limitations have been based on broad network analysis to consider the ability to always remain within legislated voltage and network quality limits under all network and generation conditions. Broad use of the term 'hosting capacity', as the key determinant of the need to curtail feed-in energy, became the primary consideration for DER implementation.

In recent years however, as networks invest in meter network data and monitoring, better network data (including metering and network monitoring in near-real time), improved network modelling through the

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[4] AER, 'Customer export curtailment value methodology - Issues paper', October 2021, p. 7.

application of ‘digital twins’, more informed risk assessments, newer technologies and more maturing customer expectations has significantly changed the nature of curtailment. Developments based on network investments such as enhanced network monitoring and control systems mean less frequent, more nuanced *dynamic* curtailment such as:

d) applying dynamic (seasonal or time-varying) energy export limitations based on better forecasting of network conditions *(advanced connection agreements)*.

e) introducing near-real time or day-ahead export constraints based on forecast or actual network conditions, for the customer to respond to or for direct control of the customer equipment *(Dynamic Operating Envelopes)*.

f) *introducing charges* that incentivise customers to avoid energy export at times of and to take action to self-consume generated energy.

g) for non-DER consumers, consume energy at times of high availability *(solar soak tariffs*).

h) directly or indirectly *controlling loads* through connection or tariff arrangements to implement a demand response to balance energy exports *(solar soak, or advanced demand response).*

i) requiring the installation of automatic or remote controls to *immediately reduce export* or even interrupt the generation system itself in times of network stress *(emergency backstop).*

Clearly, each are forms of curtailment, and present different customer impacts, incentivise different responses, and have significantly different influences on the core objectives of DER investment, such as reduced bills for the owner, the benefits of a greater proportion and involvement in renewables in the energy mix, reduced network investment and importantly a step towards a low-carbon economy.

Considering how CECV may influence each response, almost like a *load-at-risk analysis*, is a necessity. *Hosting capacity* must be viewed as a dynamic network variable.

b) The role of the DER customer

Whilst the issues paper rightly focuses on network export services, we continue to emphasise the importance of non-network solutions and customer engagement in the role of optimising the service of DER in the energy community.

We strongly support Recommendation 7 of the Energy Security Board (ESB), that states, in part:

- Consumers are rewarded for their flexible demand and generation, have options for how they want to engage, and are protected by a fit-for-purpose consumer protections framework (recommendation 7A), and
- Networks are able to accommodate the continued uptake of DER and two-way flows and are able to manage the security of the network in a cost-effective way (recommendation 7C)

c) Considering value to whom ?

Whilst agreeing that a measure of curtailed energy is useful in assisting the assessment of the value of network investments to increase DER export capability, it is important to examine the customer view of the DER investment.

The first question to ask is “value to whom?” Curtailment presents different benefits to the various sectors of the energy environment, such as:

a) *To the 20 percent of the residential or commercial customer base that are DER producers / consumers (often called ‘prosumers’*), curtailment (particularly export limitation) generally means a reduction in the excess energy produced net of consumption. This largely leads to a reduction in economic return from the feed-in tariff - nowadays a generally small consideration in the economic return of their DER investment. Otherwise, the prosumer is largely unaffected.

More and more, the concept of curtailment encompasses the reduction of the level of DER generation to below that of local consumption (such as the case of emergency backstop), exposing consumers to the purchase of full-rate tariff energy. This is a significantly different situation, both commercially and emotionally for the DER investor, than an export limit, and is likely to generate considerable consumer backlash.

b) *To consumers who are looking to invest in DER* and contribute to the forecast growth of rooftop renewables, curtailment can mean an opportunity to enter the ranks of prosumers by 'sharing the available capacity around'. Once the investment is made, these consumers are largely insulated from changes to the wholesale price of daytime energy.

c) *To all other consumers*, curtailment may mean a lower level of renewables in the energy mix and may lead to slightly higher energy costs (dependent on modelling and assumptions.) These customers are also likely to be exposed to the full impact of increasing costs, such as the additional investments in network assets (transmission and distribution.)

d) *To networks*, where the best outcome for consumers is for networks to avoid network investment, improve the utilisation of existing assets and reduce or even avoid investment to meet 'peak demand'. In many ways, increasing DER hosting capacity is equivalent to initiative to minimise the impact of peak demand and encourage better network asset utilisation through improved load factors. A measure of efficient network investment related to DER is the operation of an effective demand (generation) response plan, encouraging greater energy throughput with a minimal investment in assets.

This may involve greater investment in 'smart networks', such as enhanced network monitoring and Dynamic Operating Envelopes (DoEs), as opposed to hard network assets of poles, wires and transformers.

e) *To the market, and hence (hopefully) all energy customers*, essentially in the form of lower energy prices. Several recent regulatory proposals have focussed on the value of reducing demand from non-renewable grid energy sources as the basis of valuing increased DER exports. However, this value must be challenged as:

    i) The amount of existing and new renewable generation, particularly solar PV, is significant, resulting in low daytime energy prices. and

    ii) The market operator is now raising the value of large rotating plant, in the form of large generators or new network investments, as a source of system inertia to maintain a stable electricity grid.

d) Curtailment itself may be valuable

In the short couple of years since the issues of DER curtailment were taken to the AEMC and formal consideration of the value of exported energy, several significant developments that influence the basic premise of 'more DER export is valuable.'

2. Several market developments including export tariffs are encouraging customers with DER to self-consume and even store their generated energy. The fall in the feed-in tariffs reduces the value of exports. Stored energy will play a role in reliability for remote customers.

3. The level of network investment, particularly transmission and system services, required to support an increasing level of DER is not insignificant and challenges the expectation that increasing DER will mitigate the overall Network use of System (NUoS) component of a consumers electricity bill.

4. DER curtailment at critical times is necessary to preserve network security; by which curtailment could be seen as providing value (as opposed to cost) to consumers by preserving supply security.

a. Emergency backstop is not considered

There are emerging reasons why a customer's generator may need to have its output reduced dynamically to the level where the customer is no longer self-consuming but actually required to draw energy from the network, such as in the current emergency backstop initiatives.

CECV may be applicable to this situation but is not specifically considered in this advice.

5. Response to Questions

Q1: Do you agree with our interpretation of export curtailment in the context of calculating CECVs?

The proposed methodology is not to estimate instances of curtailment, but rather assume that curtailment is a scenario where a lower level occurs relative to an ''expected level'. Central to the discussion is 'what is the expected level' - is it a local condition, derived from measurement and the exhaustion of all non-network options, or a more generalised 'calculated' level by, say, network type ?

In terms of what constitutes the expected level, AER suggests it will look to use assumptions published by AEMO as part of the ISP.

This is quite different from the methodology set forth in the CSIRO/Cutler Merz plan which effectively seeks to assess the relative costs and benefits of additional DER capacity to consumers, networks and society. The CECVs could be used to assess whether proposed steps to reduce export curtailment (such as increasing DER hosting capacity) can be economically justified.

An issue with using ''expectations" is that it implicitly assumes that the AEMO's Integrated System Plan is accurate and that alternative estimates of curtailment based on the information and estimates provided by DNSPs is less accurate than those developed by AEMO. Ultimately this is an empirical issue which should be validated by comparing estimates of curtailment developed by AEMO with alternative estimates derived by the DNSPs.

In addition, the concept of 'curtailment' is evolving. Whilst initially the idea of export limitation was largely based on estimates and assumptions that influenced the ability for DNSPs to maintain voltages within statutory limits, curtailment is now being considered as a key tool to maintain overall network security (backstop), network performance optimisation (such as the AEMO / VPP trial for network support in SA) or optimising the customer benefit in the market (VPPs).

As noted earlier in this advice, a number of practical issues cloud the interpretation of export curtailment, including:

a) From whose perspective is value considered - Customer, prosumer, network or market ? Each varies considerably.

b) What options such as optimising self-consumption and storage have been undertaken by consumers to reasonably avoid curtailment or to minimise its (cost) impact ?

c) Is curtailment defined as merely limiting exports to the network, or alternatively reducing inverter output overall and requiring the customer to import energy from the grid despite having a DER investment such as in the emergency backstop ?

d) Against what baseline of export capability are benefits of investment measured, given the variability and many technical and customer influences to what is an 'expected level' of hosting capacity ?

Our advice is for the AER to be more explicit in what is meant by curtailment - is it related to long-term fundamental network hosting capacity (such as a non-coincident maximum demand) , or is it a much more dynamic, time varying value that reflects local network conditions, demand and generation diversity, inbuilt control mechanisms and customer self-consumption incentives ?

Q2: Which value streams should be captured in the CECV?

Clearly, this is a complicated question given the value stack is complicated and has heterogenous costs and benefits impacting multiple stakeholders. In tackling this issue, the AER needs to have properly defined objective function – i.e., have a clear idea of what consumption and investment behaviour the CECV is designed to incentivize. Including multiple arguments into the objective function could hamper the effectiveness of the CECA as no one value may optimally accommodate all value streams.

When considering the value stack, the AER could prioritize value streams by considering how much uncertainty is associated with each stream and whether the benefits delivered by the value stream are realized immediately or may take time to be realized. This would help ensure the methodology is in line with standard assumptions made about consumer risk preferences and a tendency to discount benefits and costs that are realized in more distant periods (standard in cost benefit analysis). Clearly there are important differences in the value streams in terms of the certainty that the benefits are realized and the time frame in which the benefit will be delivered (for example impact of SRMC vs avoided replacement).

We note the AER mentions Increased DER exports reduces load and can reduce peak demand, leading to avoided or deferred network investment. This is in line with the CSIRO/CutlerMerz report that states:

> *"Flexible energy services will be enabled by investments that increase the overall capacity of active DER (e.g. batteries or V2G EVs) in the network where these systems predominantly provide wholesale or retail price arbitrage. This may be either by creating incentives which give rise to more and/or larger active DER systems and/or by directly enabling additional export capacity for active DER."*

Note the causal process envisaged here: i.e. more network investment stimulates consumers to adopt batteries that enables them to store energy generated by solar PV and export them to the network during peak times. Export curtailment represents a barrier to achieving flexible energy services if it takes place during peak time when battery-stored energy is exported into the network.

Here is the problem: Export curtailment during the midday could incentivize prosumers to invest in batteries (for example: reduced rooftop solar tripping as discussed in 5.3.3 of CSIRO Cutler Mertz report – page 40). If export curtailment occurs during daytime when prices are low, this would prevent consumers with solar PV from realizing revenues via the feed-in tariff. They have a greater incentive to invest in battery systems which allows them to store excess energy that is not consumed to use it later (for example during peak times). Export curtailment during the midday should be considered as a non-price incentive which encourages prosumers to invest in DER technology (e.g., batteries) that enables them to smooth out their use of energy generated from solar PV. It is a form of demand rationing[5] that encourages solar PV owners to store energy.

[5] Wilson, R. (1989). Efficient and competitive rationing. *Econometrica: Journal of the Econometric Society*, 1-40.

This approach is cost effective in the sense that it does not require network investment into DER integration which has the potential to increase network charges for all consumers.

Considering the duck curve, it is important to note that not all export curtailment is necessarily ''bad" – it is only bad if

- if export curtailment takes place during peak times, thereby inhibiting reductions in peak load.
- During periods of excess energy production, export curtailment is only "bad" in a situation where there are conditions which prevent prosumers to invest in batteries in which case excess solar PV could be exported to commercial battery operations.

It may therefore be prudent for the AER to consider separate CECV for different types of DER integration. For example, integration of batteries (rather than solar PV) into the network is exempt from the problem outlined above. As such it is likely that the optimal CECV for battery integration is quite distinct from the CECV for rooftop solar. Given the wider range of network investment associated with different types of DER and the heterogeneous effects these have on peak wholesale prices, establishing separate CECVs for i) rooftop solar, ii) batteries, iii) EVs and iv) energy management systems.

We support AER's view that CECV methodology will provide the methodology for calculating wholesale market benefits. At the same time, it is important to consider that DER has two distinct impacts on wholesale prices:

- There is a large literature that shows that an increase in near-zero-marginal-cost renewable output will result in a reduction in the wholesale price at the time the output is generated (the merit-order effect)[6]
- solar penetration has the potential to increase peak prices at times of the day when renewables sources are energy are less prevalent (for example greater ramp up and ramp down costs for coal and gas generator units)[7]

Therefore, CECV methodology should use a definition of wholesale prices that is not solely focused on the average price at a certain time of day. Rather it is important to consider the impact of DER on both average prices and the variance in price across the day (i.e., difference between peak and off-peak wholesale prices on a given day.

It is also important to consider the DER value streams provided by AER guidance (Table 2) through the customer lens. Avoided generation capacity investment will in some ways be balanced by the need for local and grid-scale storage with higher rates of depreciation. Until a significant shift in consumer-level trust, DER technical capability and adequate reward mechanisms exists, the involvement by consumers in essential systems services is likely to be very limited. The benefit in avoiding network investment can be challenged by the significant long-term capital requirements considered by the ISP. Reliability will largely only be improved through customer 'behind the meter' investment in the short to medium term.

There is value in considering a carbon price, as it reflects the bulk of community sentiment regarding the importance of a low-carbon future. However, this is a qualitative benefit, as there is no clear link between the value of carbon and the actual benefit to consumers in relation to the energy price. Consideration of the role of DER in delivering a lower-carbon future, whilst important, should not be quantified without considerable research.

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[6] Csereklyei, Z., Qu, S. and Ancev, T. (2019), 'The Effect of Wind and Solar Power Generation on Wholesale Electricity Prices in Australia', Energy Policy, 131, 358– 369

[7] Gonçalves, R., & Menezes, F. (2021). Market-wide impact of renewables on electricity prices in Australia. *Economic Record*.

We do not disagree in principle with the value streams noted in the Issues paper, however we strongly caution that adopting the various benefits without close scrutiny into consumer behaviour and overall investment needs will not lead to an accurate outcome.

We are aware of a number of studies that have been undertaken recently, and one that is currently underway for delivery in Q1 2022,for use in a number of analyses including the draft ISP. We look forward to that work with interest.

Q3: Should CECVs reflect the detriment to all customers from the curtailment of DER exports, or particular types of customers?

Our response to Q2 suggests caution in the assignment of wholesale market benefits to all consumers, including non-DER customers. We agree that over the long term all energy customers benefit from

reduced curtailment of DER, but the benefits in lower bills will be subject to many variables such as new market costs to maintain a stable and reliable electricity supply, the diversity in energy utilisation across many customer cohorts and the relative infrequency and extent of curtailment.

The broader benefits to the community of maximising the extent and amount of DER in local grids such as the support of a low carbon economy and greater access to DER for all cannot be ignored.

It is appropriate that the CECVs are considered separately for prosumers (DER customers) and non-DER customers, as the impacts are quite different. For a prosumer (assuming curtailment means export limitation), the impact of curtailment is predominantly the loss of feed-in tariff for the period.

Considering CECV should not mean expanding cross-subsidies to those who are most able to install DER, particularly when those who are not benefiting from DER (and may be paying for a cross subsidy) are vulnerable customers, perhaps renters, or unable to afford DER investments. It should be clear in the engagement processes that a wide spectrum of community is engaged, and that there are likely to be 'net winners and losers'. That is, while there may be an overall benefit to the community (however the community is bounded geographically), there may be sectors where the estimated benefits in wholesale prices are more than offset by the shared increases in network prices.

Q4: How should CECVs be expressed?

We broadly agree that a CECV expressed in terms of dollars per Megawatt-hour ($/MWh) **at a particular time (say hourly)** is most appropriate for its application in network investment analysis.

In line with comments above in response to Question 3, it is important to emphasize the importance of expressing $/MWh along the duck curve, so that differences in value across peak/off peak times are appropriately captured. This would impact different DER integration in different ways.

For example, as battery integration and energy management systems grow the flexibility of exporting energy during peak times, the CECV for these integration project will be relatively high compared to other DER integration related to reduced rooftop solar tripping as discussed in 5.3.3 of CSIRO Cutler Mertz report – page 40). This is in line with the suggestion for the AER to consider separate CECV for different types of DER integration.

Q5: Do you agree with our overall interpretation of CECV?

Consistent with several recent regulatory revenue proposals from DNSPs, most have taken a similar approach in determining the value for expanding hosting capacity, being:

> *Incremental increase in energy to be fed into the grid, multiplied by the value of that energy per unit of energy.*

Whilst this concept of valuing the ability for additional energy to be exported by prosumers into the grid is straightforward, establishing the two terms of the equation are, as the issues paper notes, incredibly complex and subject to many poorly defined variables.

Overall, we support the interpretation of CECV, yet consider that the comparison of more or less DER exports may occur relies on a couple of key pieces of information:

1) what is the base 'hosting capacity' and have the input assumptions to that been tested with consumers as being realistic and appropriate ?
2) Have the market benefits and costs been considered ?
3) Have all consumer and demand side options been pursued before the curtailment is valued ?

In relation to the comment "*Value represents the detriment to all customers from the curtailment of customer exports*" : As per our response to Question 3 above, we suggest would be appropriate that the CECVs are considered separately for prosumers (DER customers) and non-DER customers.

Q6: Should there be a more explicit link between CECVs and export tariffs?

No. We agree with the AER that whilst the two are related, a causal relationship between the two is difficult to define. Similarly, there is a lot of water to pass under the bridge before export tariffs will be well considered and usefully applied.

We draw the AER's attention to the NER principle "Tariff structures must be reasonably capable of being understood" (by customers). In introducing two-way pricing, this will increase the average complexity of tariffs faced by DER customers.

Consideration should be given to what reasonable steps can the AER undertake to ensure that these more complex tariffs are reasonably understood by customers. This could involve undertaking a study and holding focus groups featuring representative customers who would be asked to read and tested on whether they understand the new (more complex) tariff structure.

Q7: How could we estimate CECVs across different customer groups?

As the AER notes in the issues paper and we have noted in our initial comments, the impact of export energy curtailment is different for different customer cohorts - particularly DER (prosumer) and non-DER (consumer) customers. We do not believe that prosumers should be considered in the aggregated calculation of CECV in a business case, as they are much less exposed to wholesale price issues.

Concerning the costs of curtailment discussed in section 3.1, it is accurate that prosumers with rooftop solar PV may forgo revenue from feed-in tariff when exports are curtailed during that daytime <u>in the short run</u>.

In the long run, DER customers may adjust to export curtailment by investing in battery storage systems that allow for more flexible dispatch in energy. Since peak wholesale prices are relatively high, it may be the case that export curtailment increases revenues from feed-in tariffs and reduces their exposure to peak tariffs <u>in the long run</u>.

The AER should consider investigating further how export curtailment may impact investment DER investment decisions by rooftop solar PV customers to accurately assess the short run and long run costs (and potential benefits) of curtailment of exports. This will help ensure CECV methodology is not focused on a short run interpretation of customer costs, but also consider long run substitution effects and price elasticity on the demand side.

We support the idea that the VCR methodology based on Willingness -to-pay (WTP) and choice modelling is a good starting point to considering how CECVs vary across customer groups. In VCRs:

- Contingent valuation is used to determine the willingness to pay (WTP) to avoid a baseline outage scenario (defined as two localised one-hour outages in a year, occurring in winter in off-peak times)
- Choice modelling is used to determine the increment (or decrement) in value respondents placed on specific outage attributes in addition to the baseline outage scenario. Attributes tested in the choice model were peak (7-10 am and 5-8 pm) and off-peak time of day, season (winter / summer), day of week (weekday / weekend), severity (localised / widespread) and duration (1 hour, 3 hours, 6 hours, 12 hours).

Instead of focusing on outage scenarios, WTP studies for CECVs should focus on export curtailment scenarios. Key cohort would include DER and non-DER customers. In terms of DER customers, this should include i) solar PV only customers, ii) solar PV + battery owners, iii) solar PV + EV owners. For DER customers, the study should focus on examining how export curtailment may incentivize investment in batteries. For EV owners with solar PV, the study should examine how export curtailment may incentivize changes in the times that they choose to recharge their EVs.

For non-DER customers, WTP studies should focus on reductions in wholesale price driven DER integration may stimulate a rebound effect.[8] Lower wholesale price may stimulate future increases in energy demand that may increase the need for future network investment. This would help ensure investment decisions take into account the long run price elasticity of demand.

Q8: Should CECVs be estimated by NEM region?

No. There are many variables that influence the ultimate impact of DER on customers across various jurisdictions and by different retailers. Splitting CECVs into regional assessments is well below the levels of uncertainty and precision of other calculations impacting customer energy prices.

Q9: Should CECVs for a particular NEM region reflect the impact of DER export curtailment that occurs in other NEM regions?

Yes. To optimize incentive arrangements, it is critical that CECVs consider differences in wholesale price across the day. (See previous responses above) . At a minimum they should reflect differences between peak and off-peak wholesale prices.

Q10: What is the appropriate temporal aggregation for estimating CECVs?

At a minimum they should reflect differences between peak and off-peak wholesale prices.

We believe CECVs should be time sensitive based on the arguments made in prior questions . As per our conversation about the duck curve, there could be value in curtailment during the middle of the day when prices are negative. Curtailment could act as a signal to solar PV owner to invest in storage or demand response if they can no longer get the feed-in tariffs.

CECVs need to reflect this , at a minimum different CECVs value for peak / off peak.

[8] Dimitropoulos, J. (2007). Energy productivity improvements and the rebound effect: An overview of the state of knowledge. Energy policy, 35(12), 6354-6363.

Q11: Should we also estimate CECVs into the future, or allow DNSPs to forecast changes in CECVs over time?

Clearly, the impact of CECVs will change forecasts into the future. Because more investment will encourage more demand, which will require more investment – see point made in chapter 4 AEMC. The investment should roughly align with the asset life of any investment planned by the NSP, allowing for different approaches for technological investments (monitoring, communications control) and asset-based investment (poles and wires)

Q12 : Do shorthand approaches provide sufficient forecasting ability or is electricity market modelling necessary for calculating CECVs?

No response.

Q13: How should generator bidding behaviour be modelled?

We do not believe generator bidding should be modelled. It is too variable, too dynamic, also subject to many other external factors. Certainly, though, the costs of generator operation and higher night-time prices must be considered,

Q14: How should interconnector behaviour be modelled to determine regional CECVs?

See Q13 above.

6. Appendices

a. Acronyms and abbreviations

Acronym/Abbreviation	**Meaning**
ADMD	After Diversity Maximum Demand
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMI	Advanced Metering Infrastructure
Augex	Augmentation expenditure
capex	Capital expenditure
CCP	Consumer Challenge Panel
DER	Distributed energy resources
DB / DNSP	Distribution Network Service Provider
DM / DR / DRM	Demand Management / Demand Response
DUOS	Distribution Use of System
DVMS	Dynamic Voltage Management System
EDPR	Electricity Distribution Price Review
EV	Electric Vehicle
FCAS	Frequency control ancillary services
GWh	gigawatt hours
HV	High voltage
ICT	Information and Communication Technologies
LV	Low voltage
MW	megawatt
NMI	National Metering Identifier
NSP	Network Service Provider
Opex	Operating and Maintenance Expenditure
PV	Photovoltaic (Solar PV)
RAB	Regulatory Asset Base
Repex	Replacement capital expenditure
TUOS	Transmission Use of System
VCR	Value of Customer Reliability
VPP	Virtual Power Plant