Wholesale Electricity Market Rule Change Proposal Submission

RC_2018_03
Capacity Credit Allocation Methodology for Intermittent Generators

Submitted by

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Submissions on Rule Change Proposals can be sent by:

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Post to: Rule Change Panel
Attn: Executive Officer
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1. Please provide your views on the proposal, including any objections or suggested revisions.

AEMO welcomes the opportunity to provide this submission in respect of Collgar Wind Farm's proposal to amend the Relevant Level Methodology, which is used in the Reserve Capacity Mechanism (RCM) to determine the capacity value of Intermittent Generators.

In summary, AEMO considers that:

- Collgar's proposal would reduce the ability of the RCM to support whole-of-system reliability when compared with the current Relevant Level Methodology; and
- it would be better to defer any decision on Collgar's proposal until the Economic Regulation Authority (ERA) has completed its 2018 review of the Relevant Level Methodology, which is required under clause 4.11.3C of the Market Rules.

Context

The primary purpose of the RCM is to ensure there is sufficient generation and demand side management (DSM) capacity to deliver a reliable supply of electricity for consumers.

The reliability requirement is expressed through the Planning Criterion in clause 4.5.9 of the Market Rules, which sets the Reserve Capacity Requirement (RCR) for a Capacity Year. The Planning Criterion requires sufficient capacity to:

a. meet extreme (one-in-ten-year) peak demand conditions, plus a margin for reserve and system support; and

b. satisfy year-round electricity demand, with unserved energy[1] capped at 0.002% of total annual demand.[2]

AEMO must assess the ability of each individual generation and DSM facility to contribute to satisfying the RCR. Certified Reserve Capacity is then assigned to these facilities according to methodologies in the Market Rules, including the Relevant Level Methodology for Intermittent Generators.[3] Certified Reserve Capacity (generally) entitles these facilities to receive Capacity Credits.

To determine whether the RCR will be satisfied, and whole-of-system reliability objectives will be met, AEMO compares the total allocation of Capacity Credits to the RCR. If the RCR has not been met, AEMO may procure supplementary capacity to ensure whole-of-system reliability.

The Reserve Capacity Price (RCP), paid to all generation capacity providers, is determined according to an administered pricing formula. The RCP will reduce as the total quantity of capacity increases beyond the RCR.

Power system reliability and valuation of Reserve Capacity

In principle, the quantity of Certified Reserve Capacity assigned to a facility should be proportional to its contribution to delivering whole-of-system power system reliability; in other words, the ability of a facility to support additional customer demand and avoid involuntary load shedding.

Viewed simplistically, involuntary load shedding will occur when demand exceeds available capacity. Historically, when the power system was almost exclusively supplied by conventional scheduled generation, the risk of involuntary load shedding was greatest during the highest demand periods.[4] Collgar's proposal is premised on this historical assessment of reliability risk.

[1] Unserved energy refers to customer demand that cannot be satisfied due to insufficient generation and DSM capacity.
[2] AEMO notes that Collgar's suggestion that the RCM seeks to "provide capacity support to the system at times of the highest demand for capacity" does not account for the Planning Criterion requirement to satisfy year-round electricity demand.
[3] Any applicant for Certified Reserve Capacity may nominate to be assessed under clause 4.11.2(b) of the Market Rules (utilising the Relevant Level Methodology), but this option has only been exercised by Intermittent Generators to date.
[4] This assumes that the risk of plant outage or loss of fuel supply is not correlated with peak demand periods. This is a common assumption in academic literature about capacity valuation of intermittent resources. For example, see Zachary and Dent, *Estimation of Joint Distribution of Demand and Available Renewables for Generation Adequacy Assessment*, 2014.

However, the increasing level of variable renewable generation is shifting the greatest risk of involuntary load shedding from the highest demand periods to those of high (but not necessarily highest) demand and reduced capacity availability. This risk-shifting will increase where the output of multiple Intermittent Generators is highly correlated, particularly where this combined output does not completely align with periods of highest demand. This emphasises the need for dispatchable firming capacity to ensure that reliable supply is maintained when capacity availability is reduced.

The use of 'Load for Scheduled Generation' (LSG) in the existing Relevant Level Methodology accounts for this by assessing the performance of Intermittent Generators in periods where the demand for dispatchable scheduled generation and the loss of load probability (i.e. the risk of involuntary load shedding) are greatest, rather than simply the periods where customer demand is greatest.

By changing the Relevant Level Methodology from periods of highest LSG to periods of highest demand, Collgar's proposal would remove the consideration of reduced capacity availability. Collgar's proposal would redefine the Relevant Level Methodology so that it merely considers facility load factor rather than the facility's contribution to whole-of-system reliability. This shortcoming was discussed by Dent, Keane and Bialek (in the context of wind generation):

> It is a truism that load factor is essentially an energy metric; it is defined as the actual energy generated as a percentage of theoretical maximum. It therefore gives very limited information on generation adequacy risk, which is a matter of capacity rather than energy. In particular, system risk levels are generally determined by probability of either very low generation availability or very high demand, whereas load factor by definition considers typical conditions only. Load factor-based approaches are therefore unlikely to deliver a sufficiently comprehensive picture of wind's contribution to securing demand.[5]

Consequently, Collgar's proposal is likely to overvalue the contribution of Intermittent Generators to whole-of-system reliability. This would have the effect of undervaluing dispatchable capacity:

- If the increased valuation of Intermittent Generators causes the RCR to be satisfied where it otherwise would not[6], then AEMO would be unable to procure Supplementary Reserve Capacity to address reliability shortfalls that may arise when intermittent generation is low. This would signal a reduced requirement for dispatchable capacity and could lead to increased risk of involuntary load shedding.

- The increased allocation of Capacity Credits to Intermittent Generators would also cause the RCP to decrease, reducing the signal for investment in additional capacity to support whole-of-system reliability.

Collgar's proposal would also remove or reduce other valuable investment signals that are provided through the use of LSG in the Relevant Level Methodology:

- The use of LSG provides higher values for diverse, non-correlated sources of intermittent generation, reflecting the greater contribution that this diversity makes to

[5] Dent, Keane and Bialek, *Simplified Methods for Renewable Generation Capacity Credit Calculation: A Critical Review*, 2010.
[6] This would occur where the number of Capacity Credits above the RCR is less than the increase in Capacity Credits assigned to Intermittent Generators because of Collgar's proposal.

whole-of-system reliability. Conversely, it provides lower values to Intermittent Generators that are strongly correlated. This is conceptually consistent with capacity valuation concepts discussed in literature, which confirms that the capacity value of intermittent generation (as a proportion of nameplate capacity) decreases with increasing levels of correlated intermittent generation.[7]

- The use of LSG provides incentives for Intermittent Generators to invest in firming capacity or other measures that will increase their availability (and may provide dispatchability) when their contribution is most needed to support whole-of-system reliability.

For these reasons, **AEMO considers that Collgar's proposal would reduce the ability of the RCM to ensure the reliable supply of electricity in the South West Interconnected System (SWIS) when compared with the current Relevant Level Methodology**.

AEMO disagrees with Collgar's assertion that the use of LSG to assess the capacity value of Intermittent Generators is inconsistent with the treatment of Scheduled Generators, which are assessed based on the de-rated capacity of their facilities at 41 degrees Celsius. The dispatchability of Scheduled Generators means that they are likely to be able to generate at this level (or greater) in all Trading Intervals at or below this temperature (subject to mechanical availability), including the periods of highest LSG. The choice of reference temperature does not necessarily align with the periods used for allocation of capacity costs through the Individual Reserve Capacity Requirement calculation.

Timing

Clause 4.11.3C of the Market Rules requires the ERA to periodically review the Relevant Level Methodology. The ERA has advised that it will complete this review in 2018.[8]

To avoid the risk of conflicting decisions between the Rule Change Panel and the ERA, AEMO considers it would be preferable to defer any decision on Collgar's proposal until the ERA has completed its Relevant Level Methodology review.

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[7] For example, see:

- Sapere Research Group, *Capacity value of intermittent generation: Public report*, 18 August 2011, available at https://www.erawa.com.au/cproot/17792/2/[RC_2010_25]%20Capacity%20Value%20of%20Intermittent%20Generation%20Report%20by%20Sapere%20Research%20Group.pdf.
- California Public Utilities Commission, *Effective Load Carrying Capacity and Qualifying Capacity Calculation Methodology for Wind and Solar Resources*, p5, 16 January 2014, available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6555.
- Zachary and Dent, *Probability theory of capacity value of additional generation*, 22 May 2011, available at http://dro.dur.ac.uk/11699/1/11699.pdf?DDD10+DDC189+mjww84+d700tmt.
- Dent et al, *Capacity Value of Solar Power, Report of the IEEE PES Task Force on Capacity Value of Solar Power*, 15 July 2016, available at http://dro.dur.ac.uk/19243/1/19243.pdf?DDD10+mjww84+d700tmt.

[8] This intention was expressed in a presentation to the Market Advisory Committee in February 2018. Presentation slides available at https://www.erawa.com.au/cproot/18726/2/MAC%202018_02_14%E2%80%94Agenda%20Item%204a%E2%80%94ERA%20Market%20Reviews%20Update%20(ERA).pdf.

2. Please provide an assessment whether the change will better facilitate the achievement of the Wholesale Market Objectives.

AEMO considers that Collgar's proposal would be detrimental to the achievement of all market objectives other than market objective (e).

(a) to promote the economically efficient, safe and reliable production and supply of electricity and electricity related services in the South West interconnected system

As noted above, AEMO considers that Collgar's proposal would reduce the ability of the RCM to ensure the reliable supply of electricity in the SWIS when compared with the current Relevant Level Methodology. Collgar's proposal would lessen the focus on whole-of-system reliability within the Relevant Level Methodology and the Reserve Capacity Mechanism more broadly.

Further, economic efficiency would be weakened through overvaluation of the capacity value of Intermittent Generators and corresponding undervaluation of dispatchable capacity.

(b) to encourage competition among generators and retailers in the South West interconnected system, including by facilitating efficient entry of new competitors

AEMO is concerned that Collgar's proposal would diminish the investment signal for dispatchable capacity to support the reliability of the power system. This would hinder the ability of the RCM to facilitate efficient entry of new competitors.

(c) to avoid discrimination in that market against particular energy options and technologies, including sustainable energy options and technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions

As noted above, AEMO considers that Collgar's proposal would be likely to overvalue the contribution of Intermittent Generators to whole-of-system reliability, while simultaneously undervaluing the necessary contribution of dispatchable capacity. AEMO considers this to constitute discrimination against the reliability contribution made by dispatchable capacity options (which may include dispatchable renewable resources).

(d) to minimise the long-term cost of electricity supplied to customers from the South West interconnected system

As explained above, AEMO considers that Collgar's proposal would increase the risk to power system reliability in the SWIS. Higher costs to consumers could result from the increased risk of involuntary load shedding.

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3. Please indicate if the proposed change will have any implications for your organisation (for example changes to your IT or business systems) and any costs involved in implementing these changes.

AEMO would need to implement moderate changes to the Relevant Level Calculation Tool. The tool was developed to automate the calculation of the Relevant Level in accordance with Appendix 9 of the Market Rules. AEMO has estimated the cost of implementing its component of the rule change at $160,000.

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4. Please indicate the time required for your organisation to implement the change, should it be accepted as proposed.

The proposed changes, if accepted, would take approximately 9 weeks to implement from the date of publication of the Final Rule Change Report.
