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Mr John Pierce
Chair
Australian Energy Market Commission
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Dear Mr Pierce

Transmission loss factors (Adani Renewables Rule change requests) – AEMO Submission

AEMO welcomes the opportunity to contribute to the Commission's consultation paper that consolidates two rule change requests submitted by Adani Renewables relating to the transmission loss factor framework.

AEMO's position on the Rule change is summarised as:

- While AEMO recognises the commercial risk posed by variations in year to year changes in Marginal Loss Factors (MLF), the Rule change proposal would distort the efficient functioning of the Spot market and result in higher transmission use of system charges for consumers. It is for these primary reasons that AEMO does not support the Rule change;
- AEMO supports increased transparency in the market to allow prospective investors to make informed decisions on the locational investment decisions. Hence, we have proposed two initiatives. Firstly, AEMO will publish quarterly indicative MLF updates which will provide the likely trend of MLFs in the current financial year. Secondly AEMO will run a formal consultation on the methodology for determining MLFs to ensure that it remains fit for purpose. AEMO has also proposed a set of principles that should underpin a transmission loss factor framework;
- MLFs reflect physical losses in the transmission system as the generation mix and transmission network changes over time. AEMO highlights that the Integrated System Plan (ISP) provides valuable information on the impact of additional generation located at Renewable Energy Zones. This will provide prospective investors an indication of how MLFs are affected over time as more generators locate in the same location;
- AEMO believes that any major change to the transmission loss factor framework must be considered with the broader market reform work underway. This should include the AEMC's work on the coordination of generation and transmission investment (COGATI), transparency of new projects rule change, and the Energy Security Board's work on post-2025 NEM market design; and
- With respect to COGATI, AEMO believes that transmission access reform should consider the merits of using a Full Nodal Market with Financial Transmission Rights

model instead of retrofitting changes to the current NEM design. AEMO believes a Full Nodal Market with Financial Transmission Rights will allow Market Participants to manage the risk associated with changing MLFs and transmission losses.

AEMO welcomes the opportunity to discuss our submission further with the Commission if required. Should you have any questions on the matters raised in our submission, please contact Kevin Ly, Group Manager Regulation at Kevin.Ly@aemo.com.au

Yours sincerely



Peter Geers
Chief Strategy and Markets Officer

1. The current forward-looking transmission loss factor framework

1.1. Marginal loss factors (MLFs) and marginal pricing in the NEM

As electricity flows through the transmission and distribution networks, energy is lost due to electrical resistance and the heating of conductors. Energy losses on the network must be factored in at all stages of electricity production and transport (as well as electrical energy prices) to ensure the delivery of adequate supply and efficient pricing.

In a power system, electrical losses are a function of the consumption, network topology and generation mix which can change from year to year. The marginal loss at a location is the incremental change in total losses for each incremental unit of electricity supply required to meet the demand at another location. In the NEM, MLFs represent electrical losses between a connection point and a regional reference node (RRN). MLFs are average values calculated from adjusted historical network flow data from the previous financial year taking into account expected changes in the upcoming financial year.

The NEM uses marginal prices as the basis for setting spot prices. The spot price for electricity is set by the central dispatch process and represents the marginal value of supply, that is the price of meeting an incremental change in load at the regional reference node. MLFs maintain consistency between central dispatch and pricing by representing the marginal value of losses.

AEMO determines and publishes annual marginal loss factors in accordance with the National Electricity Rules (NER) as per Forward Looking Loss Factor Methodology (the Methodology) developed in accordance with the Rules consultation procedures. AEMO acknowledges that in recent years larger changes in calculated MLFs have been observed year-on-year by a number of factors that have occurred over this time in the NEM including:

- Increases in the volume of generation connections:
 - 4,500 MW across 46 new generators expected in the 2019/20 financial year;
- Increases in generation in areas of low load;
- Increases in generation in areas of low transmission capacity;
- Increases in distribution-connected generation; and
- Increases in generation clusters of the same output profile (e.g. rooftop solar photovoltaics (PV) 1,500 MW in 2018 alone).

1.2. Roles and responsibilities of calculating MLFs in the current framework

The NER outlines the framework under which loss factors are to be calculated for the NEM.

Specifically, clauses 3.6.1 and 3.6.2 of the NER require AEMO to calculate annually, intra-regional loss factors and interregional loss factor equations for a financial year and publish the results by April 1. Clause 3.6.2A requires AEMO to prepare load and generation data to calculate the MLFs. Clauses 3.6.1(c), 3.6.2(d), (d1) and (g) and 3.6.2A(b) of the NER require AEMO to detail the methodology to be used in these calculations.

The methodology¹ applies to AEMO and any Registered Participants who are required to provide information and assistance to AEMO in the calculation of MLFs and the preparation of load and generation data for those purposes. This document was last updated in 2017 to reflect the outcomes of a consultation undertaken in 2016 on aspects relating to generation forecasting.

AEMO also publishes guidelines on its website to provide some assistance on:

- How loss factors have been treated in the NEM – Treatment of Loss Factors²; and
- How the MLF between adjacent RRNs (inter-regional loss factors) are determined – Proportioning of inter-regional losses within regions³.

The above guidelines were last updated in 2012 and 2009 respectively.

2. AEMO's improvements to the current process

As the NEM continues to transform, particularly since the last updates of the methodology and guidelines, AEMO is embarking on a number of improvements to the current loss factor calculation process (within the methodology and guidelines). These include:

- Publication of indicative MLFs throughout the year (for all regions of the NEM) based on the most recent information available, such as changes to the Generator information page⁴;
- Updating AEMO's MLF calculation tools and processes to better handle the increased calculation complexity associated with changing power system conditions.

The above changes combined with the proposed changes in Section 3 below will improve transparency and replicability of the calculation of annual MLFs and therefore enable existing and potential investors within the NEM to better gauge their future MLF.

3. Proposed changes to the current framework

Section 5.3 of the Consultation Paper asks stakeholders to suggest improvements that could be made to the loss factor framework.

AEMO would like to highlight that there are elements of the MLF framework that require the MLF calculation, as prescribed in the Methodology, to be highly complex and difficult to replicate. Further, AEMO believes there is a practical limitation on the degree of accuracy of the calculated MLFs to represent actual marginal losses for the year ahead due to numerous items specified in the Methodology in accordance with the NER. These include:

- Assumptions on future demand patterns of which inherent uncertainty exists;
- Historical generation profiles to be applied;

¹ Methodology for calculating forward-looking transmission loss factors available at: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Loss_Factors_and_Regional_Boundaries/2017/Forward-Looking-Loss-Factor-Methodology-v70.pdf

² http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Loss_Factors_and_Regional_Boundaries/2016/Treatment_of_Loss_Factors_in_the_NEM.pdf

³ <http://www.aemo.com.au/-/media/Files/PDF/0170-0003-pdf.pdf>

⁴ <http://www.aemo.com.au/-/media/Files/PDF/0170-0003-pdf.pdf>

⁴ Aligning with the new requirements proposed through the Transparency of new projects rule change in progress; <https://www.aemc.gov.au/rule-changes/transparency-new-projects>

- The averaging process which combines marginal losses from a variety of different system conditions.

AEMO believes that some parts of the current framework, as specified in the NER, is in need of change to allow AEMO to work with all stakeholders, through formal consultations on the Methodology (as required in 3.6.1(c) and 3.6.2(d) of the NER), to modify the loss factor calculation process as specified in the methodology, to ensure it is as simple and flexible as practically possible. For example:

- Clause 3.6.1(d)(5) of the NER requires AEMO to use regression analysis to reflect inter-regional losses between nodes (as per clause 3.6.1(d)(3)(i)). However, AEMO believes the flexibility to consult with stakeholders on alternative techniques to reflect inter-regional losses could produce more optimal results and therefore proposes that the relevant clause is removed.
- Clause 3.6.2(e) of the NER currently requires the MLF calculation to be performed on a 30-minute 'Trading Interval' basis, which means over 17,500 individual calculations are required to determine the MLFs each year.⁵ AEMO therefore suggests that the 30-minute 'Trading Interval' requirement is reconsidered.
- Clause 3.6.2(e) also requires that AEMO treat MNSPs as invariant in the MLF methodology. Given that changing generation patterns between regions, for example due to new entrants, may require load balancing in the calculation, treating the flow as invariant may no longer be practical or appropriate. We therefore propose that this clause is removed.

The purpose of the above changes is not to make modifications to the way AEMO calculates MLFs, but rather to allow AEMO and stakeholders the flexibility to modify the calculation process through a formal Rules consultation on the Methodology so that it remains fit-for-purpose.

Following the conclusion of this rule change process, AEMO will run a formal consultation on the Methodology as per the NER requirements. The suggested changes outlined above will provide additional scope to this consultation and potentially allow better implementation of any resultant rule changes.

4. Response to specific aspects of the Consultation Paper

AEMO is of the view the following principles should be part of a transmission loss factor framework:

- **Transparent** – Given the sensitivity and importance of MLFs on generator revenue, the loss factor methodology must be transparent for all parties.
- **Simple and Replicable** – The loss factor process, including the calculation must be easy to understand and able to be replicated by accredited consultants to inform potential investors on indicative MLFs.

⁵ As part of the 5 minute settlement and global settlement implementation rule change request AEMO recommended that the MLFs be determined for each 30-minute period instead of each trading interval. This was to avoid the unintended requirement for MLFs to be determined for each 5-minute period. The rule change request is available at: <https://www.aemc.gov.au/rule-changes/5-minute-settlement-and-global-settlement-implementation>

- Fit-for-purpose – With the dramatic changes that have occurred in the NEM since the loss factor framework was designed, namely changes to generation resource-type and demand profiles, it is imperative a framework that is relevant and fit-for-purpose can be applied.
- Flexible – A framework that is less prescriptive and more flexible allows for MLFs of improved accuracy to be calculated in accordance with the NEM conditions at the time and going forward.

The consideration and application of the above principles would enable a transmission loss factor framework to provide the appropriate balance between certainty and accuracy of MLFs in the NEM. These principles would also allow:

- Economically efficient spot pricing signals for loads and efficient generation dispatch;
- Efficient cost-recovery;
- Efficient locational signals for network development and investment;
- Appropriate risk allocation for all parties; and
- No unreasonable administrative burden or implementation costs.

4.1. Marginal loss factors vs average loss factors

Adani Renewables have proposed that the marginal loss factor calculation is changed to an average loss factor calculation.

AEMO would like to note that a move to average loss factors would see a reduction in revenue collected from Market Customers, which may result in significant under-recovery and negative inter-regional settlement residue (IRSR) under some conditions. In the long run, and under circumstances where average loss factors could be calculated exactly, average loss factors would be expected to result in a zero average IRSR as prices would no longer reflect the marginal value of losses. However, in practice this may result in an increased risk of negative IRSR across the NEM and potentially lead to settlement periods when insufficient revenue is recovered from customers to pay generators.

While AEMO acknowledges that average loss factors should result in higher pool payments which could offset the impact of negative residues, AEMO suggests that the risk of increased negative IRSR is considered by the Commission as part of its assessment of this aspect of the rule change request.

4.2. Allocation of intra-regional settlement residue

AEMO acknowledges that Adani Renewables has proposed that part of the intra-regional settlement residue is allocated to generators as well as customers.

AEMO would like to highlight that some regions, notably South Australia, currently predominantly results in negative settlement residues and therefore should the Commission decide to adopt Adani Renewable's proposal, generators in South Australia would receive a bill, rather than a positive allocation. AEMO would also like to note this proposal would increase the transmission use of system charges (TUoS) as a result of the reduction of the allocation to customers. Therefore, the benefits of this proposal must be considered against the achievement of the National Electricity Objective (NEO).

4.3. Frequency of MLF publication

As outlined in Section 2, AEMO plans to undertake improvements relating to the current loss factor calculation process which include increasing the frequency of producing indicative marginal loss factors. AEMO believes this will give guidance to existing and potential investors on future MLFs that consider changes to NEM conditions which impact the calculation of MLFs since their last publication.

As some information required in the MLF calculation is provided by generators through the generator information page, AEMO has proposed to calculate indicative MLFs quarterly which aligns with our recommendation in the transparency of new projects rule change. AEMO is of the view that the outcomes of this rule change are considered in any changes made by the Commission to the frequency of MLF calculation to ensure the provision of information does not become duplicative or an administratively burdensome task.

5. Implementation of changes

AEMO is of the view that major changes to the transmission loss factor framework should be considered as part of the broader market reform work already underway, rather than through the Adani Renewables rule change. That is, the time and cost required to implement any material changes resulting from this rule change should be considered by the Commission. For instance, any change that requires fundamentally rebuilding AEMO's calculation tools, altering the NEM dispatch engine or participants' bidding software will require a multi-year implementation time frame. This means that the broader market reform work will be unable to have regard to the impact of the loss factor framework changes and a holistic assessment of the NEM design will not be possible.

6. Conclusion

As transmission loss factors play an important role in the planning of investments and commercial operations of market participants, AEMO believes the framework that underpins MLFs must be unambiguous and flexible. This will ensure the MLFs produced for a financial year are as reflective as possible of the NEM environment at the time. As such we have highlighted areas of the NEM that should be revisited so that the loss factor calculation process is able to take into account the changing NEM.