

NEMMCO

National Electricity Market
Management Company Ltd

ABN 94 072 010 327

Sydney Office

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Dr John Tamblyn
Chairman
Australian Energy Market Commission
PO Box H166
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Dear John

Technical Considerations for Region Boundary Changes

I refer to recent discussions between officers of the Commission and NEMMCO concerning the Ministerial Council on Energy's proposal to reform the process for changing region boundaries of the National Electricity Market, and the need for technical criteria to be met for any proposed boundary change. Following those discussions, the Commission has requested NEMMCO's advice on the criteria that would need to be included in the National Electricity Rules (**Rules**) and how those criteria might be expressed.

In preparing this advice, we have reviewed the existing criteria in clause 3.5.1(b)(2) of the Rules and suggested which of these should be retained.

In summary, we see no need to retain criteria relating to loss-related impacts provided they are considered as part of an economic evaluation of a proposal. Similarly, any technical criteria relating to network constraints need not be retained. However, we do believe there would be benefit in retaining criteria relating to topology of regions, load and generation centres, and measurement and description of transfers and transfer limits.

The attachment provides more detail on our advice. Should you require any further information on this, please contact Mr Brian Nelson, Head of Regulatory Affairs and Compliance on 02 9239 9132.

Yours faithfully


Brian Spalding
Chief Operating Officer

Attach.

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Current Requirements of the Rules

Clause 3.5.1(b)(2) of the Rules¹ provides seven principles (in order of priority) on which NEMMCO must base any recommendations on region boundaries. In 2002, NEMMCO consulted on proposed changes to the region boundaries. Part of that consultation included the methodology for interpreting the principles and assessing a proposal against those principles.

The following draws on the outcomes of that consultation and outlines NEMMCO's interpretation of the principles and the form in which the principle might be retained.

Principle 1- Topology and Size of a Region

"The boundary of a region will be closed and will enclose at least one significant load centre and/or generation centre." (emphasis added)

The Glossary of the Rules includes the following relevant definitions:

"region, regional

An area determined by NEMMCO and approved by the AEMC in accordance with clause 3.5, being an area served by a particular part of the transmission network containing one or more major load centres or generation centres or both." (emphasis added)

"load centre

A geographically concentrated area containing load or loads with a significant combined consumption capability." (emphasis added)

"generation centre

A geographically concentrated area containing a generating unit or generating units with significant combined generating capability." (emphasis added)

NEMMCO concludes that this principle means that a region should not be fragmented into two or more 'islands' because:

- the term 'closed' suggests the boundary should be continuous and there is no reference to the possibility of multiple boundaries;
- the definition of a region is in terms of a single 'area', suggesting it should not include two or more areas. This is also supported by the requirement that a region be served by a 'particular part' of the transmission network; and
- Allowing multiple islands within a region would be inconsistent with the NEM pricing model.

References to 'significant' and 'major' in the principle and the definitions suggest that larger regions would in general be preferred over smaller regions.

Recommendation: NEMMCO believes this principle should be retained. We do not believe it would be necessary to change the way the criteria is expressed, preferring instead to rely

¹ Because clauses 3.5.2 and 3.5.3 have not yet commenced, clause 3.5.1(b) is in effect also inactive.

on a guideline that outlines considerations (such as those above) that would be applied in deciding whether a proposed boundary was closed.

Principle 2 - Constraints Influencing Dispatch

“Where practicable significant generation and/or load centres separated by network constraints should be located in separate regions where those network constraints are likely to influence the optimal dispatch of generation and/or scheduled load in the order of 50 hours or more in the financial year for which the intra-regional loss factors were pre-determined.”

NEMMCO understands the MCE's proposal is intended to remove this principle and replace it with economic considerations. Consequently, we believe this principle is no longer required.

Principle 3 - Definition of Transfer Limits, Measurement of Transfers

“The region boundaries should be located so that transfer limits between regions can be clearly defined, and transfer flows across regions easily measured, at the region boundary.”

The two aspects of this principle, namely definition of transfer limits and measurement of transfer flows will be dealt with separately.

Definition of Interconnector Limits

NEMMCO relates this principle to interactions between inter- and intra-regional constraints. A poor regional structure will reduce the clarity of constraints in a number of ways, including:

- The dispatch and pricing outcomes are made too complex to be usefully interpreted;
- The limit restricting interconnector flows is embedded within a region such that it cannot be reliably or meaningfully referred to the region boundary;
- The limit restricting interconnector flows does not directly relate to the physical capability of the transmission elements crossing the region boundary. Flows are maintained within network capability by formulating the constraint equations using surrogate values (such as a proportion of the region's demand) to do this;
- The interconnector limit is heavily dependent on the dispatch of other scheduled generation (the gatekeeper issue);
- The flows on individual lines crossing the region boundary are poorly correlated with the overall interconnector flow;
- The interconnector limit requires different assumptions for dispatch and pre-dispatch timeframes, particularly in limits that are dependent on a “sub-regional” demand that cannot be accurately modelled in the pre-dispatch timeframe.

NEMMCO interprets this principle as follows:

- Whether a boundary (or a prospective boundary) allows transfer limits to be ‘clearly defined’ will be used to determine or check the location of a boundary;

- To the extent possible, region boundary locations will be selected to address the factors mentioned above (and others which may be relevant).

Recommendation: NEMMCO believes this principle should be retained in its current form. Again, we believe a guideline would be appropriate to assist proponents ensuring the principle would be achieved.

Measurement of Transfers

The Rules distinguish between monitoring (in the context of *remote monitoring equipment* as defined in the Glossary) and *metering*. Both issues should be considered in any proposal to change boundaries. Although the technologies for each have much in common, the two are principally distinguished by the different accuracies required, and whether the energy (in MWh) is measured directly or by integrating a point-in-time power (in MW) measurement. "Revenue" metering is generally more expensive than SCADA² monitoring. As a minimum, SCADA monitoring of inter-regional transfers is necessary for dispatch, secure operation, regional demand forecasting etc.

Although revenue class interconnector metering at region boundaries does not appear to be a requirement of the Rules, NEMMCO believes it should be.

NEMMCO considered that the Rule's requirements for inter-regional metering lack clarity. It may be more consistent with the National Measurement Act for all the settlement of energy quantities (including the Settlement Residue Auction) to be based on an appropriate measurement. Some alternatives, such as using SCADA data, may not be consistent with the settlement of energy. NEMMCO concludes that revenue billing for interconnector flows need to be supported by an energy measurement system, albeit at a lesser accuracy using available primary metering installation equipment.

Recommendation: The region boundaries should be located such that inter-regional transfers can be easily measured with both SCADA and revenue metering. Proponents should also be required to fully describe the boundary (including diagrams), taking into account any underlying distribution network boundaries, metering points, and any loop flows created by the boundary.

Principle 4 - Loss Factor issues in Dispatch

"The application of pre-determined static intra-regional loss factors within the proposed region and the application of a pre-determined inter-regional loss factor equation will not impact significantly on the central dispatch of generation and/or scheduled load that would result from a fully optimised dispatch process taking into account the effect of losses."

NEMMCO interprets this principle as follows:

- 'Fully optimised dispatch' is interpreted as being dispatch in accordance with clause 3.8 of the Code, but using a "dynamic" rather than "static" loss model;
- Comparing actual and optimal dispatch will require consideration of both dispatch and price impacts;
- A 'significant' impact would only be an adverse or detrimental impact that is important, notable or of consequence having regard to its context or intensity.

² Supervisory Control and Data Acquisition

NEMMCO believes this issue would still need to be considered as part of any proposed region boundary change. However, this could be achieved as part of an economic evaluation of an option or through a technical requirement on proposed boundaries as a surrogate for consideration in the economic evaluation.

Recommendation: NEMMCO believes that this principle would no longer be required provided the effect on efficient dispatch of losses were considered as part of the economic evaluation of the proposed boundary change. The MCE proposal, which is based on economic principles, would then adequately cover these principles.

Principle 5 - Loss Factor issues across trading intervals

“NEMMCO must aim to minimise the variation between the set of pre-determined loss factors and the resultant averaged intra-regional loss factors, and also any errors in the inter-regional loss factor equation across the trading intervals in the financial year for which the intra-regional loss factors were pre-determined.”

This principle considers two issues over (in this case) the next financial year:

- The variations between half hourly loss factors and the corresponding weighted average (static) loss factors; and
- The accuracy of inter-regional loss factor equations.

Variation of static loss factors

If the energy flows within a region are predictable, or flows in the network are not affected by ‘tidal flows’³, the difference in outcome between the application of a static marginal loss factor, calculated as a weighted average loss factor, and the half hourly loss factors from which the static loss factor is derived is likely to be small. If network flows – and therefore losses - are unpredictable, the dispatch and pricing outcomes could differ substantially for the averaged static loss factors and the individual half hourly loss factors.

This can be assessed using the standard deviations of the half-hourly loss factors about the average static loss factor. An improvement in the standard deviations would contribute to the case for a change in the boundary.

Accuracy of inter-regional marginal loss factor equations

The marginal loss factor equations used to derive inter-regional loss factors are determined from the regression of inter-regional losses against regional demands and inter-regional flows. A poorly correlated inter-regional loss model will tend to adversely impact on central dispatch and pricing, which could be expected to be identified in an economic evaluation.

Loop flows, where there is a departure from the existing linear region structure, can also have a significant detrimental impact on the modelling of losses. NEMMCO's initial development of a looped region model have indicated that loop flows using a regional model do not work well. This would need to be considered for central dispatch and any simulations done as part of a region boundary proposal.

³ ‘Tidal flows’ are flows on interconnectors which periodically change direction. For example, a region may typically import energy during the day and export power overnight.

The cost to the industry of modifying dispatch and pricing systems to accommodate loop flows should be incorporated where relevant in any economic assessment.

Recommendation: As with Principle 4, this principle would no longer be required if the issues was considered as part of an economic evaluation.

Principle 6 - Assignment of Connection Points

“Where a connection point can be assigned to more than one region such that the criteria set out in clause 3.5.1(b)(2)(ii), (iii) and (iv) can each be met in either region, then the transmission network connection point will be assigned to the region such that the variation between the set of pre-determined intra-regional loss factors and the resultant averaged loss factors is minimised.”

Some connection points, particularly those close to region boundaries, could meet the specified principles to an equivalent degree. This principle requires that if this is the case, the variability of the static loss factor should be used as a means of selection.

NEMMCO interprets this principle as follows:

- This principle provides particular guidance in “fine tuning” the location of a region boundary;
- For existing regions and connection points, a change would only be recommended if the variability of a connection point’s static loss factor would be reduced by a threshold amount; and
- For the creation of new regions or changes to the location of existing region boundaries, the connection should be allocated to the region where the standard deviation of the loss factor is minimised.

Recommendation: This principle should be retained to allow fine tuning of the location of a region boundary.

Principle 7 - Minimising the Number of Regions

“Within the requirements of 3.5.1(b)(2)(i) to 3.5.1(b)(2)(v), the number of regions created should be minimised.”

This principle is the lowest ranked principle and is not technical. This principle would act to restrict the creation of a new region where the need - as assessed against the other principles - is marginal.

We note the AEMC's consideration of issues relating to inter-regional trading and risk management in the draft determination on the Abolition of Snowy Region proposal. Arguably, this could be expected to favour fewer regions, other things being equal.

Recommendation: This principle is not required on technical grounds.

Other Considerations

NEMMCO believes a number of other issues need to be considered as part of a proposal to change boundaries. Not all of these are “technical” in nature and may not need to be a principle in the Rules but may be more appropriate in a guideline to assist people proposing region boundary changes.

- Implementation - we believe proponents should be required to consider implementation issues, possibly through some form of consultation with affected parties (including NEMMCO).
- Location of the regional reference node - we note that it appears that the MCE has proposed that NEMMCO would determine the location of the regional reference node. It may be appropriate to include technical criteria as part of this issue in addition to the location of the boundaries;
- Impacts on individual participants - it may be appropriate to require a proponent to include consideration of the effect of a change to a region boundary on individual participants as part of a more general economic evaluation of a proposal;
- Network Connection issues - some performance standards of connected generators are concerned with impacts on inter-regional transfer capabilities and these might be affected by a change to the regional structure. It may also be appropriate to undertake a general review of Chapter 5 of the Rules to identify any areas where references to regions are used inappropriately. Some areas of Chapter 5 have in the past used the term "inter-regional" where "inter-network" may be more appropriate. The new process proposed by the MCE might have unintended consequences if this is not carried out;
- Jurisdictional issues - this particularly relates to derogations or areas of the Rules that may use "region" as a surrogate for "State";
- Reliability Panel considerations (PASA, frequency standards, reliability standards, FCAS requirements) - a proposed region change should give consideration to how issues normally considered by the Reliability Panel would be affected;
- Negative Inter-Regional Settlement Residue - a proposal should identify whether the change will alter the occurrence of negative residues between the proposed regions.