NEMMCO

**National Electricity Market Management Company Limited**
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# Methodology for Calculating Forward-Looking Transmission Loss Factors: Draft Methodology

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## 1. Purpose of this document

In March 2002 NECA submitted Stage 1 of the Review of the Integration of the Energy Market and Network Services (RIEMNS) package of Code changes to the ACCC for authorisation. This package includes the requirement for NEMMCO to consult on a forward-looking methodology for calculating loss factors for the transmission network. In particular:

- the methodology for determining the inter-regional loss factor equations (clause 3.6.1(c));
- the methodology for determining intra-regional loss factors (clause 3.6.2(d)); and
- the methodology for forecasting and modelling the load and generation data used to calculate the inter-regional loss factor equations and intra-regional loss factors (clause 3.6.2A(b))

The ACCC are currently consulting on the RIEMNS Stage 1 Code change package. The ACCC has granted interim authorisation to Code changes that require NEMMCO to develop the forward-looking methodology but retain the backward-looking methodology[1]. On 4 September 2002 the ACCC published their draft determination on the RIEMNS Stage 1 Code Changes. The draft determination does not otherwise impose any significant conditions on NEMMCO.

NEMMCO cannot develop a methodology through consultation, implement changes to its systems, audit and test the new method in time to publish the new loss factors by 1 April 2003. However, in an effort to expedite the development of the methodology, NEMMCO commenced the consultation on the methodology ahead of the ACCC authorisation of the Code changes and may also commence development of their Market Systems.

NEMMCO prepared and published an Issues Paper [1] in April 2002. Submissions closed and NEMMCO received 10 submissions. A Public Forum was held by NEMMCO in Sydney on 12 July 2002. NEMMCO has considered the issues raised in the consultation and the public forum, and has prepared this draft methodology for further consultation.

Therefore, the purpose of this document is to:

- describe the consultation process NEMMCO is following to fulfil the requirements of clauses 3.6.1(c), 3.6.2(d) and 3.6.2A(b) as proposed in the NECA drafting submitted to the ACCC [see footnote 1];
- discuss the issues NEMMCO has considered in developing its draft loss factor methodologies;
- address the issues raised in the consultation on the Issues Paper [1]; and
- describe the draft methodology that NEMMCO is initially proposing.

[1] The clauses 3.6.1(c), 3.6.2(d) and 3.6.2A(b) of the RIEMNS Stage 1 Code changes that require NEMMCO to develop the forward-looking loss factors correspond to clauses 3.6.2A(c), 3.6.2A(e) and 3.6.2A(g) of the interim Code changes. Throughout this document the clause numbers refer to RIEMNS Stage 1 Code changes referred by NECA to the ACCC.

## 2. Consultation Process

As discussed above clauses 3.6.1(c), 3.6.2(d) and 3.6.2A(b) of the RIEMNS Stage 1 Code change package require NEMMCO, in accordance with the Code consultation procedures, to develop, subsequently publish and maintain the methodology which is to apply to the calculation of transmission loss factors.

NEMMCO must perform the consultation in accordance with the Code consultation procedures in clause 8.9 of the Code.

Figure 2.1 illustrates the Code consultation process.


Figure 2.1 Code Consultation Procedure defined in Clause 8.9

### 2.1 Notice

NEMMCO announced that the consultation commenced on 24 April 2002. The associated notice was sent to all Code Participants, Intending Participants and interested parties.

NEMMCO invited submissions on the issues associated with the Code changes for the calculation of forward-looking transmission loss factors. In particular, NEMMCO sought comment on the proposed methodology for calculating the marginal loss equations and the static marginal loss factors for

transmission connection points and the method used to establish the data sets used for these calculations.

Submission closed on 3 June 2002. This provided the consulted parties more than the 25 business days minimum requirement specified in clause 8.9(a).

NEMMCO received eights submissions by the due date and accepted two late submissions.

## 2.2 Review Submissions Received

Clause 8.9(f) requires that as the consulting party, NEMMCO must consider all valid submissions within a period of not more than a further 20 business days after the close of the consultation period.

On 28 June 2002NEMMCO published a matrix of issues raised in the submissions. A detailed discussion of these issues is presented in Appendix A.

## 2.3 Meetings and Public Forum

NEMMCO held a Public Forum to discuss the methodology for calculating forward-looking transmission loss factors in Sydney on 12 July 2002. NEMMCO received no requests for individual meetings.

## 2.4 Draft Decision Sent to Consulted Parties

Following the consideration of all valid submissions and holding the public forum NEMMCO is publishing this draft methodology.

NEMMCO invites submissions on this draft methodology for the calculation of forward-looking loss factors. To be valid, a submission must be received before the closing date of 18 October 2002. This gives the consulted parties at least the 10 business days minimum specified in clause 8.9(i).

Unless a submission contains confidential information and the submitter requests that NEMMCO does not publish their submission, NEMMCO will publish submissions on the NEMMCO website and send a notice to the consulted parties.

## 2.5 Review Submissions

Clause 8.9(j) requires NEMMCO to consider all valid submissions within a period of not more than a further 30 business days.

## 2.6 Final Decision

NEMMCO will publish a final report on their website following the consideration of all valid submissions. Clause 8.9(k) requires that the draft report set out:

- NEMMCO's conclusions and any determinations on the matter under consultation;
- its reasons for those conclusions;
- the procedure followed by NEMMCO in considering the matter; and
- summaries of each issue that NEMMCO reasonably considers to be material and the response to each such issue.

NEMMCO will not publish its final report until NECA have gazetted the ACCC authorised RIEMNS Stage 1 Code changes.

# 3. Background

## 3.1 Forward-looking Loss Factor Issues Paper

NEMMCO published a detailed background to the forward-looking loss factor consultation in Section 3 of their Issues Paper [1]. The section included:

- a discussion on locational pricing and how losses are treated in the NEM;
- an overview of the present methodology for calculating loss factors;
- a brief history of the review of the integration of the energy market and network Services (RIEMNS) process;
- a discussion on the requirement for NEMMCO to develop methodologies to calculate forward-looking inter-regional loss factor equations; and
- a report on the activities of the forward-looking loss factor reference group that was established by NEMMCO to assist in their preparation of the Issues Paper [1].

## 3.2 Interim Code changes

Since the publication of the NEMMCO Issues Paper [1] the ACCC has granted interim authorisation to Code changes that require NEMMCO to develop the forward-looking methodology while retaining the backward-looking methodology. NECA gazetted these Code changes on 27 June 2002.

The NEMMCO consultation to develop the forward-looking loss factors is derived from clauses 3.6.1(c), 3.6.2(d) and 3.6.2A(b) of the RIEMNS Stage 1 Code changes. These clauses correspond to clauses 3.6.2A(c), 3.6.2A(e) and 3.6.2A(g) of the interim Code changes.

## 3.3 ACCC Draft Determination

The ACCC published their draft determination on the RIEMNS Stage 1 on 4 September 2002. The draft determination imposes the condition of authorisation that clause 3.6.2A(c) be amended as follows:

> The methodology developed and published by NEMMCO under clause 3.6.2A(b) must specify information reasonably required by NEMMCO to fulfil its obligations under clause 3.6.2A, including without limitation historic load and generation data, forecast energy and maximum demand data for a connection point and forecast data for any new loads. In particular, the methodology must specify information to be provided by Code Participants that is in addition to the information provided by those Code Participants under other provisions of the Code.

NEMMCO considers that this condition of authorisation does not materially change the issues being consulted on.

# 4. Issues being considered by NEMMCO

This section discusses the issues NEMMCO considered when developing this draft forward-looking loss factor methodology.

## 4.1 Principles from the Methodology

Clauses 3.6.1(d), 3.6.2(e) and 3.6.2A(d) of the RIEMNS Stage 1 Code changes submitted to the ACCC require NEMMCO to consider a number of principles when developing the forward-looking loss factor methodology. These principles are contained in clauses 3.6.2A(d), 3.6.2A(f) and 3.6.2A(i) of the interim Code changes gazetted on 27 June 2002. The same principles are presented in section 4.1 of the NEMMCO Issues Paper [1].

Section 4.1 of the Issues Paper also includes some principles that were introduced by NEMMCO. These principles include:

- minimal extrapolation
- using the best approximation to Full Nodal Pricing as a guide to comparing alternative approaches;
- calculating the loss factor for each connection point based on the derivative of losses with respect to demand at that connection point;
- calculating the loss factors for a full year's data (rather than a representative sample); and
- balancing the supply and demand by making minimal changes to the historical generation data.

## 4.2 Transmission Network Model

Section 4.2 of the NEMMCO Issues Paper [1] discusses the aspects of the methodology that relate to the transmission network model used when calculating the forward-looking loss factors.

The following questions need to be considered.

### 4.2.1 How many network configurations are required?

At present NEMMCO calculates the transmission loss factors using a single network configuration based on the normal network configuration at high load conditions. Specifically, in Victoria, the power system will be modelled in radial mode[2] and the special arrangements applying to Yallourn Unit 1 will be represented. This is discussed more fully in section 4.2.1 of the NEMMCO Issues Paper [1] and in section 7.19 of Appendix A.

2 Radial mode refers to operation of the 500kV and 220kV networks between Melbourne and the Latrobe Valley. The two networks can be operated either radially or in parallel, with radial mode used to reduce the severity of potential faults to within the capability of circuit breakers to interrupt the fault.

Section 4.2.2 of the Issues Paper discusses the option of dividing the financial year in which the loss factors apply into two components (July to October and November to June). This would allow different network configurations to be used – if required – to represent possible changes in the network configuration through the year. This option was proposed as it would provide a potential improvement in the accuracy.

The Powerlink submission was the only submission that supported dividing the year into two components and no other submissions addressed the issue.

NEMMCO considers that the advantages using two different network representations for the two parts of the year is not justified as:

- only a relatively small number of additional augmentations would be included for the second portion of the financial year as the majority of network augmentations are commissioned in time for the summer and would be included for the entire financial year; and
- there would be added complexity in the calculation process because the current software package, TPrice, is currently only able to consider a single network configuration.

Therefore, NEMMCO will now use a single network configuration in the methodology and would include any project that is committed to be commissioned prior to 31 December in the financial year in which the loss factors are applied.

When NEMMCO reviews the methodology at some time in the future then the option of using more than one network model for different portions of the year would be re-considered.

### 4.2.2 How are future network augmentations verified?

NEMMCO believes it is appropriate to incorporate only committed network options in the loss factor calculations.

NEMMCO will require the TNSPs to indicate that each included network project meets the commitment criterion in section 9.3 of the NEMMCO SOO [2] to ensure consistency across the different jurisdictions. The criteria are:

1. the proponent has purchased/settled/acquired land[3] (or legal proceedings have commenced) for the construction of the proposed development;

2. contracts for the supply and construction of the major components of plant or equipment (such as generators, turbines, boilers, transmission towers, conductor, terminal station equipment) should be finalised and executed, including any provisions for cancellation payments;

[3] Purchase of land or acquisition of easements, if required, do not imply by themselves a binding financial commitment but are a pre-requisite for commitment.

3. the proponent has obtained all required planning consents, construction approvals and licences, including completion and acceptance of any necessary environmental impact statements;

4. the financing arrangements for the proposal, including any debt plans, must have been concluded and contracts executed; and

5. construction of the proposal must either have commenced or a firm commencement date must have been set.

Considering that the loss factor calculations will only require network developments within the next 12-18 months, there should be little difficulty evaluating the criteria for commitment.

## 4.3 Forecast Connection Point Loads

The annual energy in the NEM may grow by several percent per year, and this will impact on transmission flows and the dispatch of generation throughout the interconnected power system. To include this effect in marginal loss factor calculations, historical load data should be scaled up to the demand and energy levels expected for the financial year for which the marginal loss factors apply.

Clause 3.6.2A(d)(1) requires load data that is representative of the expected load in the financial year in which the loss factors and loss factor equations are to apply, having regard to the most recent actual data available and the projected load growth.

### 4.3.1 TNSPs to Provide NEMMCO with Connection Point Load Forecasts

NEMMCO and the TNSPs believe that the connection point load forecasts should be provided by the TNSPs based on the detailed information available to them, including that provided by the DNSPs. The provision of connection point loads by TNSPs was supported by the consultation on the NEMMCO Issues Paper [1].

If a TNSP is unable to supply NEMMCO with connection point load forecasts by trading interval for their respective jurisdiction then NEMMCO will generate the connection point forecasts. NEMMCO would use the simple push-pull algorithm described in Appendix A of the NEMMCO Issues Paper [1] to match the associated forecast in the latest SOO [2]. NEMMCO would consult with the associated TNSP to prevent scaling of known fixed loads such as smelters.

The accuracy of the loss factors will be enhanced if detailed connection point forecasts are provided and it is NEMMCO's clear preference that the TNSPs provide these forecasts. The option of NEMMCO scaling loads is considered an option of last resort.

### 4.3.2 Historical Connection Point Load Data

Section 4.3.1 of the NEMMCO Issues Paper [1] shows that the most recently available historical data that can be readily used to calculate

forward-looking loss factors is the data from the previous financial year. This data, which is based on settlements data, is only considered to be fully finalised after 6 months have elapsed. This allows sufficient time for any disputes on the data to be identified.

Since the publication of their Issues Paper, NEMMCO has made further investigations with the TNSPs, as the entities that will supply NEMMCO with the forecast load traces. The TNSPs have advised that they will require several months to prepare the scaled connection point load data. Therefore, NEMMCO intends to use connection point load data from the most recent financial year as the base for the connection point load forecasts.

However, the TNSPs may elect to examine the behaviour of the connection points after the end of the financial year when estimating the connection point annual energy and maximum demand forecasts used to scale the individual connection point loads.

Connection point load and demand forecasts will thus be based on the previous financial year load levels but will take into account more recent trends when preparing the forecast.

### 4.3.3 Method of Scaling

The 12 months of actual load data from the previous financial year needs to be modified to include the effects of load growth and any large known changes. These modifications include:

- large load changes (increase and decrease) at specific transmission connection points, including the anticipated timing as advised by the DNSPs and other participants; and
- scaling of the remainder of the load data to meet the forecast annual energy and the seasonal peak demands.

Appendix A of the NEMMCO Issues Paper [1] contains a discussion on some of the possible algorithms and NEMMCO invites submissions on these algorithms.

NEMMCO believes that the TNSPs are in the best position to choose a scaling method that is appropriate for each connection point, depending on its individual connection point characteristics.

### 4.3.4 Treatment of New Connection Points

Section 4.3.5 of the NEMMCO Issues Paper [1] discusses the forecasting of connection point load data for new connection points.

Confirmation of new or modified connection points by the beginning of January each year will allow NEMMCO sufficient time to include the modification in the loss factor calculations for the following financial year. The profile for the new or modified load at each trading interval, including possible impacts on adjacent connection points due to load shifting, should be provided by the relevant TNSP.

In the Issues Paper it was proposed that where the TNSP using reasonable endeavours is unable to provide an estimate of the profile by the end of January, a default load of not more than 1 MW would apply for each trading interval. The submissions to the consultation on the Issues Paper opposed this proposal and NEMMCO has therefore not included it in the draft methodology. It will thus be essential for the TNSP to provide a load profile estimate for each new connection point.

### 4.3.5 Treatment of MVAr

The load data used to calculate the loss factors and the loss factor equations must include forecasts of the connection point reactive power in addition to the real power. Section 4.3.6 of the NEMMCO Issues Paper [1] discussed the options for forecasting the connection point load reactive power requirements. NEMMCO considers that forecasting the reactive power requirements is integral to the forecasting the connection point real power and, therefore, the TNSPs would be best placed to forecast the reactive power requirements.

The TNSP would be required to consider the growth of the load, including new loads, and the likely operation of any embedded capacitor banks. One simple approach would be to assume that the additional capacitor banks and increased utilisation of existing capacitors would offset the additional reactive power requirements due to load growth.

## 4.4 Flows in Market Network Service Providers Networks

Section 4.4 of the NEMMCO Issues Paper [1] discusses forecasting the flows in existing and new MNSPs, including the proposed Basslink interconnector.

NEMMCO stated in their Issues Paper that they believe that the MNSP interconnector flows for the year in which the loss factors are to apply should be equal to the flows that occurred historically. That is, the MNSP flows would remain unchanged from the historical metered values corresponding to the trading periods associated with the historical transmission connection point load traces. This ensures that the relationship between the historical load traces and MNSP flows are maintained. Similarly, NEMMCO stated that they believed that the most appropriate approach is to assume zero flow (not more than 1 MW) on a new MNSP interconnection in the year in which the loss factors and loss factor equations apply.

Some of the submissions to the consultation on the Issues Paper supported NEMMCO's proposed approach while others proposed alternate approaches. NEMMCO believes that using purely historical flows for existing MNSPs and zero flow (not more than 1 MW) for new MNSPs is the approach that is most consistent with the principle of minimal extrapolation. Sections 7.10 and 7.11 of Appendix A discuss this further.

The Issues Paper also discussed the proposal of treating Basslink as a special case. The majority of submissions considered that Basslink should be treated the same way as other new MNSP projects. That is, the Basslink flow will be assumed to be zero until there is historical flow data. Section 7.12 of Appendix A discusses this further.

## 4.5 Issues Associated with Forecasting Generation Data

Clause 3.6.2A(b) requires the development of a methodology for forecasting generation data for the financial year in which the loss factors and loss factor equations apply. The following issues need to be considered when forecasting the generation data.

### 4.5.1 The Minimal Extrapolation Approach to Forecasting Generation Data

Section 4.5.2 of the NEMMCO Issues Paper [1] discusses the market simulation and minimal extrapolations approaches to forecasting generating data. The submissions to the consultation on the NEMMCO Issues Paper [1] all support the minimal extrapolation approach. This is discussed further in section 7.13 in Appendix A.

### 4.5.2 Historical Generation Data

Under the minimal extrapolation approach the forecast generation data is based on the historical generation data. The historical generation data will be obtained from the previous financial year to be consistent with the connection point load data and MNSP flow data.

### 4.5.3 Creating Generating Data for New Generating Units

Section 4.5.3 of the NEMMCO Issues Paper [1] discusses a number of approaches to forecasting the output of new generating units. One of the submissions proposed an alternate approach that NEMMCO believes is better than the proposals in the Issues Paper, as discussed in section 7.16 in the Appendix A.

NEMMCO is proposing to adopt the following approach for new generators:

(1) identify all the generating units in the NEM that are similar to the new unit (ie similar technology and fuel costs that are within about 20 %);

(2) determine the historical generation for each of the units identified in (1) for each trading interval as a proportion of the winter rating specified in the NEMMCO SOO [2]; and

(3) calculate the output of the new generating unit from the volume weighted average of the units identified in (1).

Exceptions to this approach are required for energy limited generators and generators that utilise a previously unused technology or fuel source.

The generation pattern for new energy limited generators, such as hydro or wind powered generators, would be more difficult to forecast. For new run of river hydro and wind powered generators NEMMCO proposes to use a profile equal to the average anticipated generation for each trading interval. For new hydro generators with significant energy storage NEMMCO proposes to consult with the proponent to determine an estimated generation profile. The proponents of new energy limited generating units will be obliged to provide to NEMMCO the anticipated utilisation of the generator.

For new generators that utilise a previously unused technology or fuel source then it would be necessary to identify existing generators that would have similar behaviour to that anticipated for the new generator. The proponents will be obliged to assist NEMMCO identify a similar generating unit or, failing that, to provide NEMMCO an estimate of the anticipated utilisation.

For both new energy limited generators and generators utilising new technology NEMMCO would adopt the mechanism described in Appendix C of the Issues Paper [1] to ensure the information supplied by the proponent is reliable.

### 4.5.4 Verification of New Generating Units

It is important that the list of new generators is accurate. Where either a generator is:

- included in the list but not subsequently built; or
- not included in the list but subsequently built,

then the flows in the network and the associated loss factors could be significantly different to those that would arise from a correct list of generators.

Including a generator that is not subsequently built will tend to incorrectly lower the loss factors of neighbouring connection points. Similarly, not including a generator that is subsequently built will tend to incorrectly raise the loss factors of neighbouring connection points. In the case of a very large generator the impact on losses may be significant.

As discussed in section 4.5.4 of the NEMMCO Issues Paper [1], NEMMCO believes that only the generating units that are included in the latest NEMMCO SOO or an Addendum [2] as existing or committed generators should be included in the generating data.

### 4.5.5 Reducing Generation to Restore Supply/Demand Balance

Section 4.5.2 of the NEMMCO Issues Paper [1] discusses how the minimal extrapolation methodology would be applied for the trading intervals where the forecast dispatch of new generation has exceeded the load growth.

The historical output of the existing generators and the anticipated output of the new generators need to be scaled in proportion to the historical output of the units. Energy limited plant such as hydro or transmission connected wind farms would not be adjusted.

NEMMCO did consider whether to impose a form of merit order by scaling back different generators by different proportions depending on fuel type or technology. However, NEMMCO decided against this because it would require subjective judgements on generator behaviour.

### 4.5.6 Increasing Generation to Restore Supply/Demand Balance

Section 4.5.2 of the NEMMCO Issues Paper [1] also discusses how the minimal extrapolation methodology would be applied for the trading intervals where the forecast dispatch of new generation is less than the load growth.

Increased generation can be achieved by scaling the differences between the historical output and the capacity of each existing generating unit. This approach would recognise the unit capabilities and would not attempt to scale generator output to above the offered capacity. The definition of unit capacity is discussed further in section 4.5.8.

Intuitively, increases in generation would be expected from base load generators, then intermediate generators then peaking generators. However, NEMMCO considers that imposing such a merit order would not be appropriate as:

- the cost of increasing the output of a coal generator depends significantly of the current level of output and may exceed a gas turbine at high output levels; and
- generators may be dispatched out of an assumed merit order because of their trading or network support contracts.

Therefore, NEMMCO decided against dispatching to an assumed merit order as it would require too many subjective judgements on generator behaviour.

Out or merit order dispatch is discussed further in section 4.5.10 of the NEMMCO Issues Paper [1].

### 4.5.7 Differentiating Between ON and OFF Generators

An alternative approach to assuming a merit order is to characterise generators as:

- generators that were operating at that trading interval (“ON”);
- generators that were not operating at that trading interval (“OFF”) and offered as available;
- generators that were not operating at that trading interval (“OFF”) and offered as unavailable;
- energy limited generators; or
- generators at the regional reference nodes (RRN) offered at VoLL (equivalent to load shedding).

NEMMCO considers that dispatching of the generators at the RRN should only be performed as a last resort and that it is unlikely to occur when applying the methodology. Similarly, energy limited generators should only be adjusted when all other generating sources has been fully dispatched. The dispatch of a VoLL generator and energy limited plant is discussed in section 4.5.5 and 4.5.9 of the NEMMCO Issues Paper [1].

Dispatching generators that are ON before those that are OFF would be appropriate for an incremental increase in demand. However, in general it is not possible to assume that larger increases in demand will always be met by generators that are currently ON as their incremental cost of production may exceed generators that are currently OFF. This would tend to dispatch coal power stations that are generally dispatched all the time in preference to other types of plant.

The option of not differentiating between ON and OFF generators means that for every trading interval where it is necessary to increment generation all non-energy limited generators, including the most expensive peaking plant, would be dispatched.

Both extremes, differentiating and not differentiating between ON and OFF generators, could lead to bias in some trading intervals.

NEMMCO considers that differentiating between ON and OFF generators is preferred as it will reduce excessive and unexpected generation by peaking generators.

NEMMCO is seeking submissions on this issue.

### 4.5.8 Generator Capacity

When scaling up generation it is necessary to assume a maximum capacity for each generating unit. Possible definitions include:

- the maximum historical output produced by the generator in that season (separate values for summer and winter);
- the historical availability offered into the pool by trading interval; or
- the maximum output values specified in the NEMMCO SOO [2] for summer and winter.

Using the maximum generation from the previous financial year or the historical availability offered into the pool by trading interval can be problematic if a particular generator did not operate because of a prolonged outage or, in the case of a peaking generator, a low peak demand.

NEMMCO believes that the most robust approach is use the maximum output values specified in the NEMMCO SOO, using separate values for summer and winter. This may lead to cases where the actual generation exceeds the SOO values by a small amount because of short-term overload operation. In these instances, the actual generation values will not be modified.

The maximum output values specified in the NEMMCO SOO are on a generator terminal basis while the loss factors are calculated on a sent out basis[4]. Therefore, NEMMCO will estimate the auxiliaries requirements for each unit at peak conditions using historical data from the NEMMCO energy management system (EMS) and settlements database.

[4] The definitions of generator terminal and sent out are given in the NEMMCO SOO [2].

NEMMCO considers that it is not practical to use the historical availability offered into the pool by trading interval because this value is on a generator terminal basis while the loss factors are calculated using sent out quantities.

NEMMCO is seeking submissions on the definition of generator capacity and the estimation of generator auxiliary requirements.

### 4.5.9 Minimum dispatch levels

Many generating units in the NEM have technical limits on their minimum dispatch levels. Typical minimum dispatch levels for black and brown coal generating units are approximately 40% and 70 % respectively [4].

NEMMCO recognises that the methods for adjusting generation described in sections 4.5.5 and 4.5.6 may cause some generating units to be dispatched below their minimum dispatch levels, however, NEMMCO considers that the effect on the resulting loss factors would not be material because the primary exercise is to forecast network flows rather than the output of specific generating units.

### 4.5.10 Mothballed generation

The opportunity also exists to set to zero the output of generators that will be mothballed during the year for which the marginal loss factors apply. The list of mothballed plant, and the associated timing, would be verified by the latest SOO or the latest Addendum [2].

### 4.5.11 Accounting for Interconnector Limits

Section 4.5.8 of the NEMMCO Issues Paper [1] and section 7.21 of Appendix A discuss the impact of interconnector limits on the methodology.

The first issue discussed in the Issues Paper was whether each of the regions should be treated separately or whether the interconnector flows should be allowed to vary from their historical values. The submissions indicated that the interconnector flows should be allowed to vary from their historical values but kept within their respective limits.

Possible methods for calculating the interconnector limits are:

- using the historical interconnector limits for each trading interval from the previous financial year;
- simplifying the actual interconnector equations to represent system conditions; or
- using the fixed limits obtained from the SOO [2].

As stated in section 7.21 of Appendix A, NEMMCO believes that the interconnector limits used to calculate forward-looking loss factors need to be independent of network outages and generation dispatch, and include relevant future augmentations.

Therefore, NEMMCO considers that the simple fixed interconnector limits for the financial year the loss factors apply should be obtained from the latest SOO. This will include the additional interconnector capability associated with any committed interconnector augmentations. Separate values should apply for summer and winter, where summer would be defined as 1 December to 31 March.

### 4.5.12 Generator Planned and Forced Outages

Section 4.5.11 of the NEMMCO Issues Paper [1] and section 7.15 of Appendix A discuss the treatment of generator outages.

To calculate forward looking loss factors it is necessary to forecast the output of each generator at each trading interval for the year in which the loss factors apply. The two general approaches for considering generator unit outages are:

- to use the actual historical generation by trading interval to define the outages; and
- to attempt to forecast the pattern of outages for the year in which the loss factors apply.

As discussed in section 7.15 of Appendix A, NEMMCO considers that using the actual generation by trading interval to define the outages is the most robust approach as it require no subjective assumptions while providing the correct long term signals.

### 4.5.13 Generator MVAr and Voltage Profile

NEMMCO, the Reference Group[5] and the submissions recommend allowing the reactive output of generators to be determined automatically as part of the load flow solution. This is discussed further in section 4.5.12 of the NEMMCO Issues Paper [1] and section 7.20 of Appendix A.

## 4.6 Connection points defined after the loss factors are published

### 4.6.1 Code requirements

Clause 3.6.2(i)(1) of the RIEMNS Stage 1 Code changes requires NEMMCO to determine the intra-regional loss factor for a transmission network connection point that is established in the financial year in which the intra-regional loss factor is to apply, provided that NEMMCO did not determine the loss factor in the financial year preceding that in which the connection point is established. Similarly, clause 3.6.2(i)(2) of the RIEMNS Stage 1 Code changes requires NEMMCO to revise an intra-regional loss factor in the financial year in which it applies where, in NEMMCO's reasonable opinion, the modification to the connection point results in a material change in the capacity of the connection point.

Clause 3.6.2(j) requires that the NEMMCO methodology used to determine the intra-regional loss factor for a new or modified transmission

[5] NEMMCO established a reference group to in the preparation of the Issues Paper [1].

network connection point be, as far as practicable, in accordance with the methodology used by NEMMCO to calculate the loss factors published by 1 April.

Clause 3.6.2(k) requires that:

> for the purposes of 3.6.2(j), the forecast load and generation data used to calculate the intra-regional loss factor for the transmission network connection point must be determined using the forecast load and generation data determined by NEMMCO under clause 3.6.2A for other transmission network connection points in the same region for that financial year adjusted to take into account the effect of the established or modified connection point.

Clause 3.6.2(n) requires that when NEMMCO determines a loss factor for a new or modified transmission network connection point under clause 3.6.2(i) the intra-regional loss factors for all other transmission network connection points for that financial year must remain unchanged.

### 4.6.2 Issue

The draft methodology being proposed by NEMMCO for calculating the loss factors considers the NEM as a whole. That is, the supply/demand balance is restored by ignoring regions and adjusting generators across the NEM. Regions are only considered to the extent that interconnector flows are kept within their limits. Therefore, the same data set is used for all regions.

Therefore, there are two possible interpretations of clause 3.6.2(k):

- the forecast load and generator data used for connection points in the same region is in fact the whole data set used for all connection points; or
- the loss factor for the new or modified connection point is calculated from only the forecast load and generator data for that region.

The first approach spreads the effect of the new or modified connection point across all regions and is consistent with clause 3.6.2(j). The second approach assumes that the impact of a new connection point is only felt in that region and is not consistent with clause 3.6.2(j).

NEMMCO believes that the first approach is most appropriate as it gives the closest answer to the loss factor that would have been calculated if the new or modified connection point had been anticipated in th previous year when the loss factors for the other connection points are calculated.

NEMMCO is seeking submissions on this interpretation.

## 4.7 Volume Weighting the Intra-regional MLFs

Section 4.6.1 of the NEMMCO Issues Paper [1] discusses the weighting of the intra-regional loss factors.

The Network Losses Working Group (NLWG) [3] considered various forms of weighting of the loss factors and concluded that connection point volume

weighting should be used as it provides the closest zonal approximation to full nodal pricing. This is consistent with clause 3.6.2(e)(5) of the RIEMNS Stage 1 Code changes.

Section 4.6.2 of the Issues Paper discusses including the spot price into the loss factor weights. NEMMCO considers that weight by the price as well as the volume is not compliant with clause 3.6.2(e)(5) of the RIEMNS Stage 1 Code changes.

Section 4.6.3 of the Issues Paper and section 7.22 of Appendix A discuss the possibility of giving a time weighted average loss factor for generators or loads that operate infrequently. NEMMCO agrees with the submissions that the loss factors should always be volume weighted. The only exception to this would be as a last resort when the forecast generation for a unit is zero for every single trading interval.

## 4.8 Estimating Inter-regional Marginal Loss Factor Equations

A single static loss factor between adjacent RRNs does not adequately define the loss factors between regions because of the variability of the associated inter-regional flows. Therefore, the inter-regional loss factors are represented by equations, known as inter-regional loss factor equations, which are solved for each dispatch interval using key power system variables.

Section 4.7.1 of the NEMMCO Issues Paper [1] examines the use of regression analysis to estimate the inter-regional marginal loss factor equations from the TPrice output, while section 4.7.2 provides the process involved.

## 4.9 Modelled Generator and Load Data

Section 4.7.3 of the Issues Paper considers modelling generator and load data. Under clause 3.6.2A(d)(2), modelled data is required where the range of forecast load and generation data is not sufficient to derive inter-regional loss factor equations to apply over the full range of transfer capability of the regulated interconnector.

The interconnector flows can be manipulated by scaling the generation or load data to change the interconnector flow to the desired value. This distorts the flows in the associated regions but is necessary when the range of forecast flows is too small, for example a new regulated interconnector. Where modelled flows are required a random distribution of flows would be used.

NEMMCO considers that if the forecast interconnector flows cover more than approximately 75% of the technically available range of the interconnector flows then modelling data is unnecessary.

## 4.10 Other Methodology Issues

### 4.10.1 Multiple Connection Points at the Same Physical Connection

Section 4.8.2 of the NEMMCO Issues Paper [1] examines the situation where multiple participants are connected to the same physical

connection point. As discussed in section 7.25 of Appendix A, NEMMCO believes that separate loss factors provide a better approximation to nodal pricing but can also lead to perverse outcomes. Therefore, NEMMCO, for simplicity, NEMMCO will continue with the present arrangements.

### 4.10.2 Pump Storage Schemes and MNSPs

Section 4.8.3 of the NEMMCO Issues Paper [1] discusses whether pump/storage schemes should have separate loss factors for pumping and generating. The similar issue of whether MNSPs should have separate loss factors for each direction of power transfer was raised in consultation.

NEMMCO considers that providing a separate loss factor for each direction of power flow for MNSPs and pump/storage schemes is a form of dynamic intra-regional loss factors. Therefore, NEMMCO does not propose to pursue separate loss factors as dynamic loss factors were specifically removed from the RIEMNS Stage 1 Code changes following the NECA consultation.

These issues are discussed further in sections 7.23 and 7.24 of Appendix A respectively.

### 4.10.3 New and Modified Connection Points

Section 4.8.4 of the NEMMCO Issues Paper [1] indicates that the loss factor methodology will need to include provisions for new connection points (loads or generators) that are defined after 1 April as new connection points can be defined at anytime and often only a few months before they are utilised.

### 4.10.4 Applying Loss Factors from 1 October rather than 1 July

Section 4.8.7 of the NEMMCO Issues Paper [1] discusses the option of changing the year in which loss factors apply from year ending 30 June to year ending 30 September. This is discussed further in section 7.27 of Appendix A.

NEMMCO is currently bound to develop the methodology on the basis that the loss factors apply for a financial year.

# 5. Draft Forward-looking Loss Factor Methodology

This section contains the draft methodology proposed by NEMMCO. Options are identified In some instances.

NEMMCO is seeking submissions on every aspect of the draft methodology.

## 5.1 Network representation

### 5.1.1 Identify Future Augmentations

NEMMCO will consult with the TNSPs to develop a list of transmission augmentations that are committed to be commissioned during the financial year the loss factors apply.

The TNSPs must confirm that the transmission augmentations have satisfied the commitment criterion in the NEMMCO SOO [2].

The TNSP must supply NEMMCO with sufficient network data for the augmentation to be represented in the network model.

### 5.1.2 Prepare the Base Case Load Flow File

A snapshot of the NEM transmission network would be taken from the NEMMCO energy management system (EMS). NEMMCO will modify the snapshot to:

- include all known connection points (existing and planned);
- represent system normal operation;
- include all committed network augmentations; and
- have a voltage profile that is representative of high load conditions.

The network model needs to contain all registered connection points, including those not currently represented in NEMMCO's EMS.

## 5.2 Connection point load data

### 5.2.1 Obtain historical data

NEMMCO must provide the draft connection point data for the previous financial year to the relevant TNSP by 15 October each year. The final connection point data must be provided by 15 January each year.

### 5.2.2 TNSP forecasting connection point data

The TNSPs must produce their draft connection point load forecast data for each load connection point in their jurisdiction by 15 January each year. These forecasts should:

- be based on the historical connection point data (the data would not be adjusted for the new financial year);
- be consistent with the latest annual regional load forecasts prepared by the TNSP;
- be based on 50 % probability of exceedance and medium economic growth conditions, as described in the SOO [2];
- include the impacts of any known new loads; and
- provide an estimate of the real and reactive power at each connection point for each trading interval.

Appendix A of the NEMMCO Issues Paper [1] contains a description of a number of methods for scaling historical connection data to match annual energy and maximum demand forecasts. NEMMCO believes that the TNSP should select the methodology that they believe is most appropriate for each individual connection point.

### 5.2.3 NEMMCO due diligence

NEMMCO must perform due diligence checks of the data supplied by the TNSPs, including:

- ensure that the aggregated connection point load annual energies (accounting for estimated transmission losses) match the latest SOO or SOO Update;
- ensure aggregated maximum demand matches the latest SOO (accounting for estimated transmission losses and generator auxiliaries); and
- checks of the differences between the historical and forecast data for selected connection points.

NEMMCO must consult with the associated TNSPs to resolve any apparent discrepancies in the connection point data.

### 5.2.4 Absence of forecast data from a TNSP

NEMMCO will generate the forecasts of the connection point load data for a jurisdiction if the relevant TNSP is unable to supply NEMMCO with the connection point load data by 15 January each year i.e. in sufficient time to calculate and publish the loss factors by 1 April.

The methodology NEMMCO would use to scale the connection point load data is to:

- determine the increase in the annual energy and maximum demand for the relevant jurisdiction from the most recent SOO [2];
- net out the fixed loads (eg smelters);
- allocate the increase in the annual energy and maximum demand to the individual connection points in proportion to the historical annual energy and maximum demand;

- scale the historical connection point loads using the "linear proportional push-pull" methodology described in section 6.4.2 of Appendix A in the NEMMCO Issues Paper [1]; and
- assume that the additional capacitor banks and increased utilisation of existing capacitors would offset any change in the reactive power requirements of the load.

## 5.3 MNSP Flows

### 5.3.1 MNSPs with historical flow data

NEMMCO will assume that the MNSP flows are unchanged from the historical flows.

### 5.3.2 New MNSPs

NEMMCO will assume that the MNSP flow is zero (not more than 1 MW) when there is no historical flow data for a new or recently commissioned MNSP for the whole previous year.

## 5.4 Estimate new generator output and retired generating units

The initial estimate of the new generator dispatch will be determined from the generation patterns of similar generating units. The following procedure will be used.

### 5.4.1 Obtaining a list of committed new generators

NEMMCO is obliged to publish an update to the SOO by 31 January each year. NEMMCO will calculate loss factors based on the list of committed and existing generators published in the most recent SOO and update to the SOO.

### 5.4.2 Estimating the dispatch

The output of a new committed generating unit will be assumed to be zero for trading intervals prior to the committed commissioning date reported in the SOO update.

The process for calculating an initial estimate of the output of the committed new generators following their commissioning will be:

- identify similar existing generating units in the NEM that use similar technology and fuel type, and are up to 10 years old;
- find the average output of the similar generating units as a percentage of their winter rating from the SOO [2]; and
- determine the output of the new generating units by scaling the average output profile by the nameplate rating of the new unit.

### 5.4.3 Transmission connected hydro and wind generating units

NEMMCO will use a flat generation profile equal to the product of the anticipated utilisation factor and the nameplate rating for new run of river hydro units and wind powered units. For new hydro generators with significant energy storage NEMMCO will consult with the proponent to determine an estimated generation profile.

NEMMCO will adopt the mechanism described in Appendix C of the Issues Paper [1] to ensure the information supplied by the proponent is reliable.

### 5.4.4 Previously unused technologies and fuel types

For new generators that utilise a new technology or fuel type NEMMCO will adopt the mechanism described in Appendix C of the Issues Paper [1] to ensure the information supplied by the proponent is reliable.

### 5.4.5 Retired generating units

The generating units that are retiring in the financial year in which the loss factors apply are identified in the latest NEMMCO SOO [2] or an update. Retiring plant will be represented by setting their forecast MW and MVAr output to zero from the retirement date specified in the SOO.

NEMMCO will consult with the operators of the retiring generating unit if the information in the SOO is insufficient to provide an exact retirement date.

## 5.5 Extrapolating the generation to balance supply and demand

The output of the generating units needs to be adjusted to restore the balance of supply and demand following the updating of the network model, the scaling of the connection point loads and the inclusion of committed new generating units.

### 5.5.1 Trading intervals of excess generation

There will be an excess of generation for each trading interval where the forecast connection point loads have grown by less than the initial forecast of the output of the new generating units[6]. For these trading intervals the net generation will need to be reduced by scaling the output of all the generators in proportion to their historical output.

The output of energy limited generators would not be adjusted.

The initial estimate of the output of the new generators would be scaled in the same manner as the historical output of the existing generators.

[6] Network augmentations also affect the supply/demand balance by altering the network losses.

### 5.5.2 Trading intervals with a shortage of generation

There will be a shortage of generation for each trading interval where the connection point loads have grown by more than the initial estimate of the output of the new generating units [see footnote 6]. For these trading intervals the net generation will be increased using the following priority:

- the spare capacity of non energy limited generating units that are currently running (ON) is dispatched in proportion to the spare capacity of each unit;
- the capacity of the non energy limited generating units that were not running (OFF) but is available is dispatched in proportion to the capacity of each unit;
- the capacity of the non energy limited generating units that were not running (OFF) and is unavailable is dispatched in proportion to the capacity of each unit;
- the spare capacity of hydro generating units is dispatched in proportion to the spare capacity of each unit; then
- VoLL generators are dispatched at the reference nodes.

The output of transmission connected wind farms would not be adjusted.

The initial estimate of the output of the new generators would be scaled in the same manner as the historical output of the existing generators.[7]

### 5.5.3 Generator capacities

The maximum capacity of each of the NEM generators will be set equal to the value specified in the latest SOO [2]. A separate value should be used for summer and winter, where summer would be defined as 1 December to 31 March.

The historical dispatch is on a sent out basis, as defined in the NEMMCO SOO. The estimated sent out value capacity equals the generator terminal capacity less an estimate of the auxiliaries. NEMMCO will need to estimate the auxiliaries from the difference between the SCADA generator terminal output, as obtained form the NEMMCO EMS, and the settlements value for the same trading interval.

### 5.5.4 Interconnector limits

The inter-regional transfers will be maintained within the summer and winter interconnector limits specified in the NEMMCO SOO [2] for the year in which the loss factors apply.

If required, the generation in different regions will be adjusted to keep inter-regional flows within the respective transfer capabilities. This requirement could arise through the interaction of the interconnector limits with the patterns of load growth and new generation.

[7] As an option, it may be desirable not to categorise the non-energy limited generators at all. That, is where the generation needs to be increased then the output of all non-energy limited generators whether running or not would be increased. NEMMCO is seeking submissions on this issue.

### 5.5.5 Treatment of generators and load that can switch between connection points

A generator or load may be switchable between two (or more) physical connection points. An example is Yallourn unit 1 that can either be connected to the Victorian 500 kV or 220 kV networks. Generally, the load or generator metering data can be separated into the data for each of the physical connection points. Separate loss factors are calculated for the physical connection points and these loss factors are later volume weighted to give a single loss factor for the unit. This is discussed more fully in section 4.2.1 of the NEMMCO Issues Paper [1] and in section 7.19 of Appendix A.

For the trading intervals where the unit is ON it is assumed that the connection point is unchanged from the state in the historical generator data. When the unit is OFF but is required to be dispatched then it is assumed that the connection point state has not changed since the last known state.

## 5.6 Calculating the intra-regional static loss factors

NEMMCO will use TPrice[8] to calculate loss factors. The TPrice algorithm can be summarised as:

- a load flow is solved for each trading interval;
- the marginal loss factors defined with respect to the load flow swing bus (usually Murray power station)[9] are calculated for each connection point and trading interval from the Jacobian matrix;
- the marginal loss factors defined with respect to the associated regional reference node (RRN) are calculated for each trading interval as the ratio of the connection point loss factor to the associated RRN loss factor; and
- for each connection point, the marginal loss factors (with respect to the RRN) for each trading interval are volume weighted by connection point MLFs (with respect to the RRN) to give the static MLF.

## 5.7 Estimating the inter-regional static loss factor equations

### 5.7.1 Regression procedure

The inter-regional marginal loss factor equations will be estimated using linear regression analysis.

The marginal loss factors for each of the RRNs, defined with respect to the swing bus are extracted from the output of the TPrice run used to

[8] The TPrice application calculates the loss factor for each connection point and regional reference node (RRN) referred to the load flow swing bus defined in the network model. The loss factor of connection point A referred to connection point B is defined as the ratio of their respective loss factors with respect to the swing bus.

[9] The selection of swing bus does not directly affect the marginal loss factors with respect to the assigned regional reference node. There is a small effect on the flows in the network flows from changing the swing bus and this has a small indirect affect on the loss factors.

calculate the intra-regional loss factors. Then for each pair of adjacent RRNs:

- the inter-regional marginal loss factors are calculated for each trading interval as the ratio of marginal loss factors of the associated RRNs; and
- the inter-regional loss factor equations are estimated by regressing the inter-regional marginal loss factors against the associated interconnector flow and selected regional demands.

The regional demands will be included in the inter-regional loss factor equations if they significantly improve the fit of the regression equation.

### 5.7.2 Inter-regional loss factors in the presence of loop flows

At present the regional model of the NEM is linear as the interconnectors between the regions do not form loops. Loop flows may be introduced in the future if additional interconnectors are built between regions that are not currently interconnected or the region model is modified.

If loops are introduced into the NEM regional model then the forward-looking loss factor methodology may need to be revised. The RIEMNS Stage 1 Code changes require NEMMCO to use the Code consultation procedures when modifying this methodology.

### 5.7.3 Modelled generator and load data

Where the range of interconnector flows is less than approximately 75 % of the technically available range of the interconnector flows then the load and generator data would be scaled to produce a set of randomly distributed flows covering the technically available range of the interconnector flows and the regression analysis repeated.

The modelled generator and load data would not be used for calculating intra-regional loss factors.

## 5.8 Connection points that arise during the year

NEMMCO calculates loss factors for each connection point and loss factor loss factor equations for each interconnector each year and publishes the loss factors by 1 April prior to the financial year the loss factors apply. It is only possible for NEMMCO to calculate loss factors for connection points and interconnectors that are known to NEMMCO.

If a loss factor or a loss factor equation is required after NEMMCO has calculated and published the loss factors then a separate calculation is required. The proposed procedure for calculating such a connection point is:

### 5.8.1 Network representation

The network representation used to calculate the loss factors for the new connection point should be based on the network used to perform the most recent annual loss factor calculation.

The network representation will be modified to incorporate the new connection point. This may include addition transmission elements or modifications to existing connection points.

### 5.8.2 Determine connection point data

The connection point load and generator data used to calculate the loss factors for the new connection point should be based on the connection point data used to perform the most recent annual loss factor calculation.

If the new connection point is a load then the relevant TNSP will need to supply NEMMCO with the load data for each trading interval following the commissioning of the connection point. If the new connection point is a generator then NEMMCO will determine an estimate of the dispatch for the new generator using the procedure in section 5.4.

### 5.8.3 Methodology

The procedure in section 5.5 will be applied to restore the supply/demand balance. This is the same procedure used by NEMMCO to perform the most recent annual loss factor calculation. The intra-regional loss factor for the new connection point is calculated using the procedure in section 5.6. The loss factors for all existing connection points remain unaffected.

### 5.8.4 Time requirements

Clause 3.6.2(l)(2) requires NEMMCO to use reasonable endeavours to determine and publish the intra-regional loss factor at least 45 business days prior to the commencement of operation of the established connection point.

For a new load connection point the relevant Code Participant needs to inform NEMMCO and the relevant TNSP that a new connection point is being established and a loss factor is required. The TNSP will require up to 45 business days to estimate the connection point load data. NEMMCO will require up to a further 30 business days to calculate and publish the loss factor.

For a new generator NEMMCO will require up to a 40 business days to calculate and publish the loss factor.

The time is in this section are estimates only. NEMMCO and the TNSPs will use reasonable endeavours to expeditiously perform the necessary calculation but the process relies on the relevant Code Participants supplying the necessary information promptly.

## 5.9 Methodology Flow Charts

This section contains indicative flow charts that represent the process to perform the forward-looking loss factor calculations.

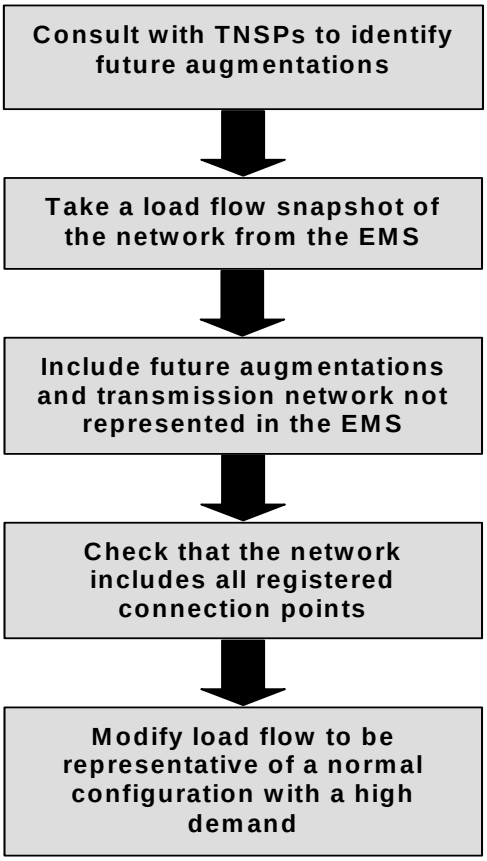


Figure 5.1 Developing the network representation

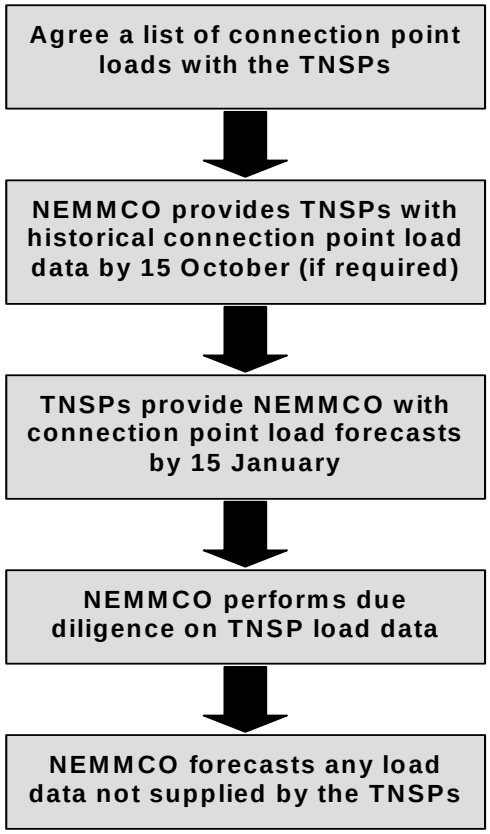


Figure 5.2 Process to forecast the connection point loads

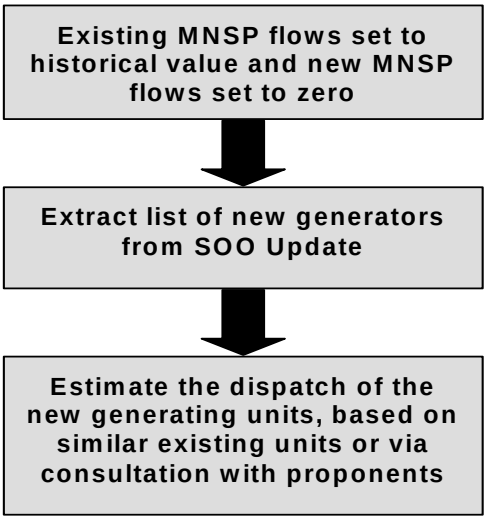


Figure 5.3 Process to determine MNSP flows and new generators

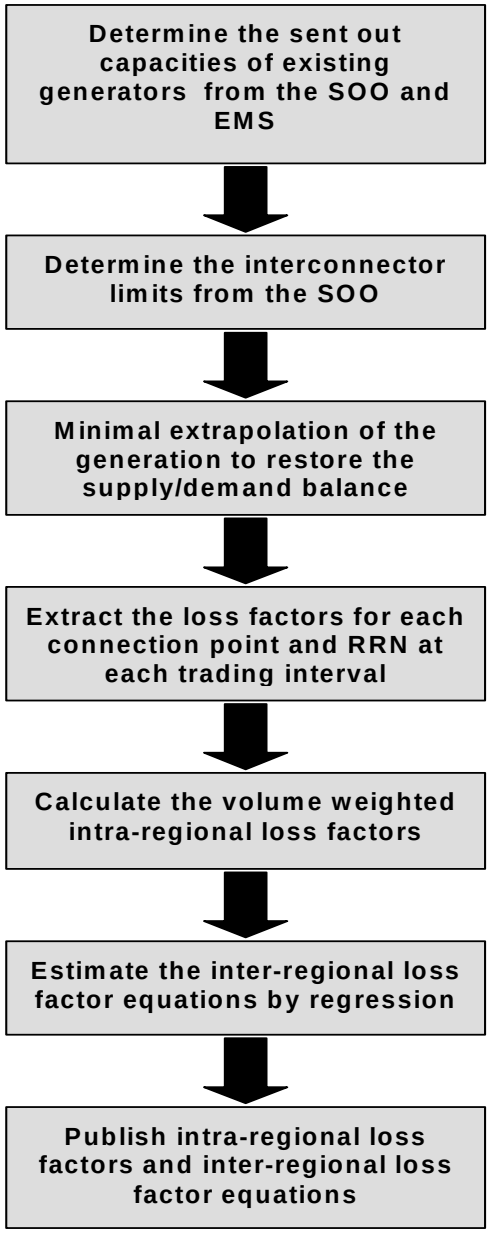


Figure 5.4 Process of minimal extrapolation, and loss factor calculation and publication.

## 6. References

[1] "Methodology for Calculating Forward-looking Transmission Loss Factors: Issues Paper", April 2002, published by NEMMCO on their internet site.

[2] "Statement of Opportunities", published by NEMMCO each year in accordance with clause 5.6.4, ISSN 1443-9050. Information to obtain the latest version of the SOO or Addendum is available on the NEMMCO internet site.

[3] "Forward-Looking Method for Calculating Marginal Loss Factors in the NEM", prepared by the Network Losses Working Group and submitted to NECA in January 2000, and resubmitted in June 2001 following minor revision.

[4] ""IRPC Stage 1 Report - Proposed SNI Interconnector" version no: V014, 26 October 2001, available on the NEMMCO internet site.

# 7. Appendix A: Issues Raised from the Consultation on the Forward-looking Loss Factor Issues Paper

On 24 April 2002 NEMMCO published an Issues Paper [1] as part of their consultation on the methodology for calculating forward-looking transmission loss factors. The consultation on the Issues Paper closed on 3 June 2002.

The following table list the interested parties that made submissions to NEMMCO. The table identifies the abbreviations used in the issues matrix below.

| Interested Party | Abbreviation |
|---|---|
| Delta Electricity | D |
| Ergon Energy | E |
| Hazelwood Power | H |
| Hydro Tasmania | Hy |
| NRG Flinders | N |
| Powerlink Queensland | P |
| Snowy Hydro Trading | S |
| TransGrid | T |
| VENCorp | V |
| Yallourn Energy | Y |

These submissions raise a number of issues that are reference in the following issues matrix.

| No. | Issue | D | E | H | Hy | N | P | S | T | V | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Is there general agreement to the principle of forward looking loss factors? | X | X | | | | | | | | |
| 2 | Should the MLF calculation methodology be in the Code? | | | | | | X | | | | |
| 3 | Does the methodology include suitable commitment criteria for future network? | X | | X | X | X | | X | | | X |
| 4 | Should different network models be used for different portions of the year? | | | | | | X | | | | |
| 5 | Should TNSPs provide the connection point forecasts? | X | | | | | X | X | X | X | |
| 6 | Is the proposed methodology for scaling load profiles appropriate? | | X | | | X | | X | | | |
| 7 | Does the methodology adequately scale the reactive | | | | | | | | | X | |

| No. | Issue | D | E | H | Hy | N | P | S | T | V | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | power of the connection point loads? | | | | | | | | | | |
| 8 | Does the methodology correctly consider disputed historical data? | | | | | | | X | | | |
| 9 | Should a default load be used for new loads? | X | | X | | | X | | | | |
| 10 | How should the transfers for existing MNSPs be forecasted? | X | | X | | | X | X | | | |
| 11 | How should the transfers for new MNSPs be forecasted? | X | | X | | | X | | | | |
| 12 | Should Basslink have specific treatment? | | | X | | | X | | | X | X |
| 13 | Is minimum extrapolation the appropriate approach? | X | | X | | X | X | X | | | |
| 14 | How should the output of existing generators be adjusted? | X | | | | | X | X | | | X |
| 15 | How should generator outages be treated? | | | X | | X | | X | | | X |
| 16 | How should the dispatch of new generating units be forecast? | X | X | X | X | X | X | X | | | |
| 17 | How should the dispatch of hydro generating units be forecast? | | | | X | | | | | | |
| 18 | How should the dispatch of wind generating units be forecast? | | | | X | | | | | | |
| 19 | How should Yallourn unit 1 be treated? | | | | | | | | | | X |
| 20 | How should generator reactive power be treated? | | | X | | | | | | | |
| 21 | How should interconnector limits be treated? | X | | X | | | | X | | | |
| 22 | Should units that run infrequently be given a time weighted MLF? | | | X | | X | | | | | |
| 23 | Should MNSPs have separate MLFs for each flow direction? | | | X | | | | | | | |
| 24 | Should pump-storage schemes have separate MLFs for each flow direction? | | | X | | | | X | | | |
| 25 | Should different participants at the same connection point have different MLFs? | | | X | | X | | | | | |
| 26 | Is the statistical information provided for the inter-regional MLF equations sufficient? | X | | | | | | | | | |

| No. | Issue | D | E | H | Hy | N | P | S | T | V | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | Should loss factors apply from 1 October each year? | X | X | X | X | X | X | X | X | X | X |
| 28 | Is the NEMMCO MLF calculation process sufficiently transparent? | | | | | | | | | | X |

Discussion of Issues

### 7.1 Is there general agreement to the principle of forward looking loss factors?

View of Interested Party

Delta Electricity and Ergon Energy expressed support for the principle of forward-looking loss factors.

NEMMCO Consideration

The decision to adopt forward-looking loss factors is outside of the scope of the present consultation.

### 7.2 Should the MLF calculation methodology be in the Code?

View of Interested Party

Powerlink believes that the methodology for calculating loss factors should be included in the Code rather than developed externally.

NEMMCO Consideration

NEMMCO agrees with Powerlink and this was stated in their submission to NECA on the RIEMNS Stage 1 Code changes. However, the RIEMNS Stage 1 Code changes require NEMMCO to develop the methodology.

### 7.3 Does the methodology include suitable commitment criteria for future network?

View of Interested Party

Delta Energy, Hazelwood, Hydro Tasmania, NRG Flinders, Snowy Hydro Trading and Yallourn Energy believe that network augmentations should meet suitable commitment criterion before they are included in the network model.

NEMMCO Consideration

NEMMCO agrees that only committed future network augmentations should be included in the network model used to calculate the intra-regional loss factors and inter-regional loss factor equations.

Section 4.2.3 of the NEMMCO Issues Paper [1] lists the proposed criteria for assessing whether an augmentation is committed. These criteria are the same as those used in the NEMMCO Statement of Opportunities [2].

Therefore, NEMMCO proposes to require the relevant network service providers (TNSPs and DNSPs) to provide NEMMCO with a list of augmentations that have met the proposed commitment criterion.

### 7.4 Should different network models be used for different portions of the year?

View of Interested Party

Powerlink supports NEMMCO's suggestion of using three[10] network configurations to represent each year. Powerlink considers this approach achieves an appropriate balance between being greater accuracy and manageable levels of computation. They note however that some augmentations required before the winter season may be targeted for commissioning at the end of May rather than April.

NEMMCO Consideration

NEMMCO considers that the advantages using two different network representations for the two parts of the financial year is not justified as only a relatively small number of additional augmentations would be included for the second portion of the financial year. In addition, the current software package, TPrice, is currently only able to consider a single network configuration. This is discussed further in section 4.2.1.

### 7.5 Should TNSPs provide the connection point forecasts?

View of Interested Party

Delta Electricity, Powerlink Queensland, Snowy Hydro Trading and VENCorp agree that the relevant network service provider should provide NEMMCO with forecasts of the connection point loads because of their local knowledge.

TransGrid and VENCorp do note that generating the connection point forecasts will result in a significant amount of additional work. VenCorp also believes that this will expose the TNSPs to additional liabilities.

NEMMCO Consideration

NEMMCO agrees that the TNSPs should provide the connection point load forecasts because of their better local knowledge.

NEMMCO also acknowledges that the TNSPs will be required to perform additional work and possibly expose them to additional liabilities. NEMMCO believes these issues are outside of the scope of developing the forward-looking loss factor methodology.

[10] The NEMMCO Issues Paper considered one or two network configuration.

Relying on the TNSPs to provide the scaled connection point load traces is a potential risk to the NEMMCO process of calculating the loss factors. Therefore, the NEMMCO methodology will include provision for NEMMCO to scale the connection point loads to match the forecasts in the latest SOO. NEMMCO would only use this provision if the connection point data is late or otherwise unavailable, and then only as a last resort.

### 7.6 Is the proposed methodology for scaling load profiles appropriate?

View of Interested Party

The NEMMCO Issues Paper [1] presents a number of possible methods for scaling the connection point load traces.

Ergon Energy believes that preserving this flexibility is necessary to account for the individual circumstances of different connection points.

NRG Flinders believes that the various methodologies for scaling load profiles should be tested with historical data to select the most accurate approach.

Snowy Hydro Trading considers that the TNSPs should use a consistent scaling framework for scaling connection point loads to ensure accurate data is supplied to NEMMCO. They believe that NEMMCO should at least check that the data supplied by the TNSPs under this approach is reasonable.

NEMMCO Consideration

NEMMCO agrees that individual connection points have individual circumstances so no single methodology is likely to be suitable for every connection point. Further, NEMMCO believes that the relevant TNSP should select the algorithm based on their local knowledge.

NEMMCO agrees that that they should perform some due diligence checks of the data.

### 7.7 Does the methodology adequately scale the reactive power of the connection point loads?

View of Interested Party

VENCorp considers that the connection point reactive demands generally do not have a significant impact on the marginal loss factors and the significant effort required in forecasting the reactive demand on for each trading interval would not be justified. Therefore VENCorp suggests that constant power factors be used for the year.

NEMMCO Consideration

NEMMCO agrees that the connection point reactive demands generally do not have a significant impact on the marginal loss factors. In addition the connection point reactive demands are not easy to forecast because of the impact of future capacitor banks in the distribution network. Therefore, NEMMCO would need to rely on the judgement of the relevant TNSP when forecasting the connection point reactive demands.

In the event that the scaled connection point loads are not provided by the relevant TNSP, NEMMCO would not scale connection point reactive demands. This approach is equivalent to assuming that the DNSPs would, on average, commission sufficient capacitor banks to compensate for the additional reactive power demands.

### 7.8 Does the methodology correctly consider disputed historical data?

View of Interested Party

Snowy Hydro Trading emphasised the importance of utilising the most recent data available in the calculation of forward-looking loss factors in order to produce the most accurate outcomes possible. Snowy Hydro Trading sought clarification on the data timing issues involved.

Under the current methodology should a situation arise in January of a particular year whereby data has been disputed for the period January to June of the previous year then the default data set would become the calendar year beginning 2 years prior. This raises the question; how will NEMMCO apply this calendar year data to forecast financial year loss factors. Furthermore, is it appropriate for NEMMCO to do so?

Snowy Hydro Trading believe that NEMMCO should inform the market as to the probability of revising the data and how material the revisions are likely to be before discarding the most recent data in the forward loss factor calculation. Participants can then assess whether there is merit in using the latest information and code changes can be implemented to allow the use of the most recent data in forward loss factor calculations.

NEMMCO Consideration

There have been no disputes on the metered load data connection points in recent years, however, it is still prudent for the methodology to consider the possibility. Therefore, it is desirable to allow six months between the end of the period of historical data and the time NEMMCO would commence the loss factor calculations. This six-month period would be available to the TNSPs to prepare connection point forecasts.

### 7.9 Should a default load be used for new loads?

View of Interested Party

Delta Electricity and Hazelwood Power believe that it is inappropriate to use a default load of not more than 1 MW should the TNSP be unable to provide an estimate of the load profile. Hazelwood further believes that a load equal to the full capacity of the connection point should be used unless NEMMCO is satisfied that the participant has justified a lower load.

Powerlink believes that the TNSPs should provide the profiles for new connection points.

NEMMCO Consideration

NEMMCO agrees that a default load of no more than 1 MW should not be used if the TNSP be unable to provide an estimate of the load profile.

The TNSPs have the best information for estimating the load profiles for new connection points through their connection agreements and the load forecasting information provided under clause 5.6.1 of the Code. This is particularly true when the connection point is a new bulk supply point to an existing DNSP load centre.

The intra-regional loss factor depends primarily on the annual energy of that connection point. Therefore, NEMMCO believes that it is most important that there is an adequate forecast of the connection point energy for new connection points.

### 7.10 How should the transfers for existing MNSPs be forecasted?

View of Interested Party

Hazelwood Power and Snowy Hydro Trading agree with the proposal to use the historical MNSP flow as the appropriate forecast of the MNSP flow in the year the loss factors and loss factor equations apply. Hazelwood Power did suggest that it might be desirable under some circumstances to modify the MNSP flow to restore the supply / demand balance.

Delta Electricity disagreed and suggested that the methodology should be more pro-active in forecasting the MNSP flows. They suggest that MNSP flows could be treated in a similar way as regulated interconnectors and considered that correlations between MNSP and regulated interconnector flows should be explored.

Powerlink Queensland are not sure why the methodology treats MNSPs differently from regulated interconnectors and generators as Powerlink believe that MNSP flows are likely to change in the future. Powerlink further suggests that it is not necessary for the MNSP flow used for calculating intra-regional loss factors to also be used to inter-regional loss factor equations.

NEMMCO Consideration

NEMMCO agrees that it is unlikely that the future MNSP flows will be unaltered from their historical values, however it is not possible to predict how MNSP flows will change without using detailed market simulation. Market simulations for forecasting generator outputs and MNSP flows have not been pursued because they are not practicable for purposes of loss factor calculations without detailed and reliable bidding information.

NEMMCO has investigated the correlations between the historical Directlink flow (an MNSP) and QNI (regulated) and found that there are no consistent patterns. For some periods the MNSP flows move in proportion to QNI, for other periods the MNSP flows are zero unless QNI is near a limit, and for some periods the flows are of opposite sign. The MNSP behaviour also appears to vary over time. Therefore, NEMMCO believes that it is not possible to accurately predict the MNSP flow from the flow on a parallel-regulated interconnector.

NEMMCO believes that the same MNSP and interconnectors flows should be used for the calculation of both the intra-regional loss factors and the inter-regional loss factor equations. Flows on MNSPs and regulated interconnectors may have a significant impact on the intra-regional loss factors of connection points on the interconnector route. Similarly, connection point generation and loads will have an impact on the associated inter-regional loss factor equations. Therefore, to get an outcome that best approximates nodal pricing it is necessary to consider the interactions between interconnectors and connection points within a region. The exception to this is when the forecast interconnector flows do not span the full range of flows and modelled flows are required.

### 7.11 How should the transfers for new MNSPs be forecasted?

View of Interested Party

By implication, Yallourn Energy agrees with the proposal to assume zero flows on new MNSPs.

Delta Electricity disagrees with the proposed approach and believes that the proponents should be consulted to ascertain the forecast flows on the new MNSP projects.

Hazelwood Power also disagrees with the approach of assuming zero flow in new MNSPs, believing that it leads to a perverse incentive on new MNSPs. Hazelwood believes that it is necessary to have credible flows in both directions. In the case of an MNSP that is in parallel with a regulated interconnector Hazelwood considers that the MNSP flow should be determined from the regulated interconnector flow.

Powerlink Queensland are not sure why the methodology treats MNSPs differently from regulated interconnectors and generators.

NEMMCO Consideration

NEMMCO believes that the proponents of a new MNSP project would have an expectation of the power transfers that will occur through their link. However, the actual flows will depend on the market and system conditions that prevail. Therefore, NEMMCO does not believe that it is appropriate for the MNSP to provide an estimate of the MNSP transfer for each trading interval in the year that loss factors apply.

Also, as discussed in section 7.10, NEMMCO believes that it is not possible to reliably predict the MNSP flow from the flow on a parallel-regulated interconnector. Therefore, NEMMCO believes that an MNSP flow of zero (not more than 1 MW) is appropriate for calculating the intra-regional loss factors for the MNSP connection points.

### 7.12 Should Basslink have specific treatment?

View of Interested Party

Hazelwood Power, Powerlink Queensland, VENCorp and Yallourn Energy all consider that Basslink should not be treated differently to other new MNSP projects.

Hazelwood Power believe that the flow on Basslink should be derived from the Victorian price.

Yallourn Energy believes that the methodology should make no assumptions regarding the commercial behaviours of participants and, therefore, the flow on Basslink should be assumed to be zero in both directions until historical data is available.

NEMMCO Consideration

NEMMCO agrees that the Basslink project should not be treated specially but, rather, it should be accommodated into the general methodology for new MNSPs. However, Basslink is different to the other MNSP in the NEM because it is not in parallel with a regulated interconnector.

NEMMCO does not believe that historical Victorian prices are necessarily a reliable guide to estimating Basslink flows because:

- the presence of Basslink transfers into Victoria will lower the Victorian price and raise the Tasmanian price, while transfers to Tasmania will raise the Victorian price and lower the Tasmania price; and
- the flows on Basslink would be driven by the price difference and high Victorian prices may coincide with high Tasmanian prices.

NEMMCO considers that the methodology should include the minimum of assumptions regarding the commercial behaviours of participants.

NEMMCO also notes that the loss factor methodology and forecasts will not include generator offers and, therefore, will not estimate prices at each regional reference node.

### 7.13 Is minimum extrapolation the appropriate approach?

View of Interested Party

Delta Electricity, Hazelwood Power, NRG Flinders, Powerlink Queensland and Snowy Hydro Trading all support the minimum extrapolation approach over the use of market simulations, while none of the submissions supported the use of market simulations.

NEMMCO Consideration

NEMMCO believes that minimum extrapolation is the appropriate approach and this method is supported by the submissions.

### 7.14 How should the output of existing generators be adjusted?

View of Interested Party

Delta Electricity agrees with the proposal to scale generation differently depending on its category.

Powerlink Queensland is concerned whether the adopted methodology will allow for the displacement of existing generation by new large low cost generating units.

Snowy Hydro Trading disagreed with the proposal to scaling generating units differently depending on the characteristics of the generating unit as the characterisation would be subjective. Snowy Hydro Trading also believed that scaling generator output should not be based on the available capacity as their hydro units have relatively high capacities but operate at a low utilisation because of energy constraints.

Yallourn Energy states that when generating units offer additional capacity into the market it is very price dependent and to achieve full capacity may require auxiliary firing. Therefore, Yallourn Energy believes that it is not appropriate to scale generation in proportion to the scare capacity as it introduces a bias. Instead they propose limiting the scaling to say 90 %.

NEMMCO Consideration

NEMMCO agrees that it is not appropriate to scale generation using subjective categories. The only really objective criteria that can be used to categorise existing units are:

- whether the unit was on or off; and
- whether the unit is predominantly energy limited (eg hydro)

NEMMCO acknowledges Powerlink's concern but the proposed minimum extrapolation approach will reduce the output of existing generators if the expected output of the new generation is larger than the load growth.

Scaling of existing generation can be in proportion to:

(1) the historical generation output;

(2) the unit availability;

(3) the difference between the available capacity and the existing generation; or

(4) the difference between a portion of the available capacity and the existing generation (essentially the Yallourn proposal).

The third option acknowledges that the higher cost of increasing the output of a generating unit that is operating near to its availability by not increasing its output as much, in proportion, as a unit that is running well below its availability.

Under the fourth option the output of a generating unit is not increased above a portion of their availability, with Yallourn proposing a value of 90 %. NEMMCO considers that the difficulty of this approach is in selecting the value of this factor.

### 7.15 How should generator outages be treated?

View of Interested Party

Hazelwood Power considers that the actual forced outage rates should be used. They consider that, while it is unlikely that significant generator outages would be repeated, they believe that including the historical outages retains the effect of the outage in the long term.

NRG Flinders considers that is reasonable to exclude usual and extended outages from the generation data.

Snowy Hydro Trading advocates that average outage rates over an extended period should be used. Further they believe that forced outages should be excluded from the loss factor calculations because of their random nature.

Yallourn Energy does not believe that the methodology should rely on historical outage patterns but should rely on participants submitting projected performance data. NEMMCO would be able to adjust the outage data supplied by the participant where that participant has supplied unreliable forecasts in previous years.

NEMMCO Consideration

To calculate forward looking loss factors it is necessary to forecast the output of each generator at each trading interval for the year in which the loss factors apply.

The two general approaches for considering generator unit outages are:

(1) to use the actual historical generation by trading interval to define the outages; and

(2) to attempt to forecast the pattern of outages for the year in which the loss factors apply.

Under the first approach no attempt is made to remove any extended outages from the historical data. This is consistent with the principle of minimum extrapolation where the forecast generation is based as closely as possible on the actual historical generator output. The approach provides loss factors that are accurate over the long run but may be inaccurate where an extended outage has occurred.

Under the second approach NEMMCO would be required to modify the historical generation data to make it representative of typical generation patterns. This would require criteria for both removing extended outages, ie filling in the generation pattern, and introducing simulated outages if it is determined that the historical data contained an unusually low outage rates. To modify all the generation patterns by trading interval for all generating units to account for outages would require many assumptions and could potentially lead to biased loss factors.

NEMMCO therefore considers that using the actual generation by trading interval to define the outages is the most robust approach as it require no subjective assumptions while providing the correct long-term signals.

The approach for adjusting described in section 4.5.7 will only dispatch a unit that is unavailable when all available non-energy limit plant is fully dispatch.

### 7.16 How should the dispatch of new generating units be forecast?

View of Interested Party

Ergon Energy considers that the best approach for including new generators is option 1 in section 4.5.3, that is, for NEMMCO to classify the new unit as baseload, intermediate or peaking, then apply a fixed profile.

Powerlink Queensland considers that the best approach for including new generators is option 2 in section 4.5.3, that is, for NEMMCO to classify the new unit by fuel type and technology and then to apply an appropriate fixed profile.

Delta Electricity, Hazelwood Power and Snowy Hydro Trading support the proposal in Appendix C where NEMMCO assumes a default profile of 100 % generation unless the proponents provide credible evidence of their forecast generation profile.

Hydro Tasmania considers that the options provided do not address new hydro or wind powered generating units. They propose using the expected utilisation factor, provided by the proponent, until sufficient historical data is available.

NRG Flinders believes that the most appropriate method of considering new generating units is to assign the unit an average generation profile based on the generation pattern of similar existing units in the NEM.

Hazelwood Power raised concerns regarding the discussion of new generating units in the NEMMCO Issues Paper [1]. Firstly they considered that option 4 was not adequately described in the Issues Paper and should have described a default profile. Secondly, that options 1 and 2 were incorrectly defined as transparent and deterministic.

NEMMCO Consideration

NEMMCO does not believe that option 4 was inadequate discussed was the Issues Paper. Option 4 being expanded upon in Appendix C and several of the submissions referred to it. Options 1 and 2 are transparent and deterministic in that, once the unit is classified, the profile is known. However, Hazelwood Power is correct in that the process of classifying units may not always be transparent and deterministic. NEMMCO does not believe that either of these concerns has materially affected the consultation.

NEMMCO agrees with the approach proposed by NRG as it is based on historical data. The approach is still subjective as it relies on identifying similar existing NEM generating units. Also, the approach would not work well for hydro and wind generation where the operating is very location specific.

### 7.17 How should the dispatch of new hydro generating units be forecast?

View of Interested Party

Hydro Tasmania considers that the options provided do not address new hydro generating units. They propose using the expected utilisation factor, provided by the proponent, until sufficient historical data is available.

NEMMCO Consideration

The operation of a new generating unit is difficult to forecast because it depends on the utilisation factor and the size of the storage. Run of river hydro units operate whenever water is available while hydro units with a large storage would be expected to operate at times of high price.

NEMMCO believes that the best approach would be to represent new hydro units as a constant MW output equal to the average expected output at each trading interval. The proponents would be required to supply NEMMCO with justification of the expected utilisation factor.

### 7.18 How should the dispatch of new wind generating units be forecast?

View of Interested Party

Hydro Tasmania considers that the options provided do not address new wind powered generating units. They propose using the expected utilisation factor, provided by the proponent, until sufficient historical data is available.

NEMMCO Consideration

The operation of new wind powered generating units is difficult to forecast on a half hourly basis. Therefore, NEMMCO believes that the best approach would be to represent new wind powered units as a constant MW output equal to the average expected output at each trading interval. The proponents would be required to supply NEMMCO with justification of the expected utilisation factor.

### 7.19 How should Yallourn unit 1 be treated?

View of Interested Party

Yallourn consider that they are disadvantaged financially when their unit 1 is connected to the 220 kV network, instead of the 500 kV network where it is normally connected. They propose some options for resolving this by separate 500 kV and 220 kV connected loss factors for unit 1, or by assuming that all forward-looking dispatch of unit 1 is unconstrained into the 500 kV network.

NEMMCO Consideration

A number of generating units in the NEM are affected by intra-regional constraints and it is both impractical, and not necessarily appropriate, for NEMMCO to correct the historical generation dispatch to remove the effects of

these intra-regional constraints. Therefore, NEMMCO considers that loss factors should not be used as a mechanism for addressing any disadvantage caused by system directions to alleviate system constraints. Rather, forward looking loss factors should be calculated reflecting the expected dispatch pattern based on the historical dispatch.

NEMMCO believes that using separate 220 kV and 500 kV loss factors for unit 1 would give equivalent financial outcomes to the proposed arrangement where the loss factor is a weighted average of the 220 kV and 500 kV loss factors calculated from the respective power injections.

### 7.20 How should generator reactive power be treated?

View of Interested Party

Hazelwood Power supports the proposal for the automatic determination of reactive power for generators by modelling AVR operation in the TPrice load flow.

NEMMCO Consideration

NEMMCO agrees.

### 7.21 How should interconnector limits be treated?

View of Interested Party

Delta Electricity do not think that it is appropriate to using the fixed interconnector limits in the SOO as they believe that they seldom represent the actual limits that are imposed. Delta proposes the use of the historical limits that reflect actual system conditions.

Hazelwood Power recognises that some degree of interconnector limit may be needed to avoid an iterative process.

Snowy Hydro Trading considers that it is not appropriate to treat interconnector flows as fixed by using the historical interconnector and solving each region separately because this would not capture the increased interconnector capability of new projects such as SNOVIC 400.

NEMMCO Consideration

In practice the interconnector limits can be complicated functions of the system variables, including the regional and connection point demands, generation dispatch and line outages. Therefore, an iterative process would be required if detailed modelling of the interconnector limits is implemented.

NEMMCO agrees with Snowy Hydro Trading that solving each region individually by fixing the interconnector flows would not capture changes to the interconnector limits. Similarly, NEMMCO believes that using the historical interconnector limits will also fail to capture the changes to the interconnector limits. Further, NEMMCO does not consider that reduction in interconnector limits due to network outages is appropriate as these usually occur randomly or are scheduled for times of low impact on the system.

Therefore, NEMMCO believes that the interconnector limits used to calculate forward-looking loss factors need to be independent of network outages and generation dispatch, and include relevant future augmentations.

### 7.22 Should units that run infrequently be given a time weighted MLF?

View of Interested Party

Hazelwood Power believes that using time weighted loss factors would be an unnecessary departure from the specified aim of approximating nodal pricing. Hazelwood Power also considers that weighting by volume and price would place an undue reliance on the highly uncertain forecasts of market price.

NRG Flinders considers that the use of connection point load (volume) weighting appears to be the most appropriate and Code compliant.

NEMMCO Consideration

NEMMCO agrees that the loss factors should be volume weighted and would only be used time weighting as a last resort when the forecast generation for a unit is zero for every trading interval.

### 7.23 Should MNSPs have separate MLFs for each flow direction?

View of Interested Party

Hazelwood Power considers that each connection point of an MNSP should have separate loss factors for supplying into and drawing from the network at that connection point.

NEMMCO Consideration

The question of whether an MNSP should have separate loss factors for each power flow direction is outside the scope of the methodology for calculating forward-looking loss factors.

NEMMCO agrees that providing a separate loss factor for each direction of flow would provide a closer approximation to nodal pricing. Equally using multiple static loss factors for scheduled loads, generation and MNSPs is a form of dynamic intra-regional loss factor. Dynamic loss factors were specifically removed from the RIEMNS Stage 1 Code changes following the NECA consultation.

### 7.24 Should pump-storage schemes have separate MLFs for each flow direction?

View of Interested Party

Hazelwood Power considers that pump storage schemes should have separate loss factors for pumping and generating.

In contrast, Snowy Hydro Trading considers that it is not appropriate to have separate loss factors for pump and generator operation. They argue that

pumping load is registered as station auxiliary energy, and that generation and pumping are not always performed in response to the pool price.

NEMMCO Consideration

NEMMCO agrees that providing a separate loss factor for pumping and generation would provide a closer approximation to nodal pricing. However, this is a form of dynamic intra-regional loss factor.

### 7.25 Should different participants at the same connection point have different MLFs?

View of Interested Party

Hazelwood Power believe that multiple participants at the same connection point should have separate loss factors in order to achieve the best approximation to nodal pricing. NRG Flinders agrees but considers that it may be worthwhile to clarify the application of this approach.

NEMMCO Consideration

NEMMCO agrees that giving different participants at the same bus different intra-regional loss factors produces an outcome that is closer to nodal pricing and this would generally lead to better market efficiency.

However, loss factors also lead to perverse outcomes such as two otherwise identical embedded customers supplied from the same physical transmission busbar with different transmission loss factors because they were supplied by different DNSPs.

Therefore, for simplicity, NEMMCO will continue with the present arrangements.

### 7.26 Is the statistical information provided for the inter-regional MLF equations sufficient?

View of Interested Party

Delta Electricity believes that NEMMCO should use the adjusted $R^2$, instead of the $R^2$, when testing the inter-regional loss factor equation. Further, they believe that NEMMCO should also publish the F and T statistics.

NEMMCO Consideration

The conventional definition of adjusted $R^2$, denoted $\overline{R}^2$, can be calculated from the $R^2$ using the following formula[11],

$$1-\overline{R}^2 = \frac{n-1}{n-k-1}(1-R^2)$$

where n is the number of observations in the regression and k is the number of independent variables. In the case of the inter-regional MLF equations k is

[11] "Introduction to Econometrics", G.S. Maddala, second edition, Macmillan, 1992.

equal to 2 or 3, while n is equal to 17520 (or 17568 for leap years). Therefore, there is no material difference between the $R^2$ and the adjusted $R^2$.

NEMMCO does publish the standard error values for the regression coefficients and of the y estimate. For a large sample size the standard error values for the regression coefficients are equal to the T statistics. NEMMCO has not published the F statistics because it would not provide much more statistical information than that already supplied.

### 7.27 Should loss factors apply from 1 October each year?

View of Interested Party

Delta Electricity, Ergon Energy, Hazelwood Power, Hydro Tasmania and Snowy Hydro Trading generally support a change so that loss factors apply for the year starting 1 October. They believe that this would result in more accurate loss factors because the load forecasts would be more up to date. Hazelwood Power, Hydro Tasmania and Snowy Hydro Trading believe that a change to the year in which loss factors apply should be aligned with the implementation of any changes to the region boundaries. VENCorp support a more detailed investigation into the issue.

NRG Flinders and Yallourn Energy consider that there are benefits in aligning loss factors with the financial year. Yallourn Energy believes that other mechanisms should be used to address the accuracy of the load forecasts.

TransGrid believes that there would be far reaching implication for the whole NEM if loss factors applied from 1 October but would like to avoid any duplication of efforts.

Powerlink Queensland consider that there is considerable effort in producing a load forecast and Powerlink considers the costs associated with producing a second forecast each year would be greater than the benefits arising from the use of a second forecast for the production of loss factors. On balance Powerlink considers it more appropriate for the load forecast cycle to be post winter with the forecast produced by end December each year. This will allow it to be used for the annual planning review instead of a forecast that is 12 months old.

NEMMCO Consideration

NEMMCO is bound to develop a methodology that is consistent with the loss factors being applied for the financial year.

NEMMCO is aware of the benefits of improving the loss factor accuracy and considers that further investigation of the change may be warranted.

### 7.28 Is the NEMMCO MLF calculation process sufficiently transparent?

View of Interested Party

Yallourn Energy believe that participants must have access to sufficient input/output data from the load flow analysis to enable their own assessment and verification of outcomes.

NEMMCO Consideration

Loss factors are calculated from the settlements data used in the NEMMO settlements process. This data is confidential and is not available to be released to third parties.

NEMMCO is prepared to allow the calculation of loss factors to be audited at the request of a specific participant. The auditing cost should be born by the participants requesting the audit.

NEMMCO will seek to have, and fund, an audit conducted on the first set of loss factors calculated under the new methodology.